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ENVIRONMENT POLICY AND PUBLIC HEALTH

Dr. Krishnappa Venkatesharaju
Kul Bhushan Anand

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CHAPTER 1

CLEAN AIR ACT AND THE NATIONAL ENVIRONMENTAL POLICY ACT

Dr. Krishnappa Venkatesharaju, Assistant Professor
Department of Environmental Science and Engineering, Presidency University, Bangalore, India
Email Id-venkateshraju.k@presidencyuniversity.in

ABSTRACT:

The Clean Air Act is the main tool used by the EPA to control possible emissions that could have an impact on air quality. The EPA controls the pollutants by creating standards for allowed levels that are based on human health, the environment, and/or science. In this chapter author is discusses the national ambient air quality standards.

KEYWORDS:

Amendments, Act, Environment, Policy, Pollution.

INTRODUCTION

The fundamental statute that guides American environmental policy is the Clean Air Act. Starting with the U.S. version in the 1950s, this statute has undergone various revisions. Investigation by the Public Health Service of the air pollution incident in Donora, Pennsylvania. According to this analysis, industrial air pollutants from cold air inversions were very toxic, causing several dozen fatalities that might have been prevented. Although the majority of the fatalities were cardiopulmonary among the elderly, U.S. PHS investigators linked mortality to air pollution both temporally and etiologically. The first air pollution legislation sponsored research largely for medical studies, but they progressively gave way to federal regulatory initiatives that included a special kind of federalism whereby the states were required to implement the federal restrictions in a relatively cooperative manner. The federal government's constitutional authority to control interstate trade granted it that authority, which has been routinely affirmed in court following industry appeal [1], [2].

Air Quality Act

The Donora and the London fogs

In response to public demand to reduce smog and air pollution in general, Congress approved the historic Clean Air Act in 1970. Before it was put into effect, pollution caused a number of significant disastrous events in the globe. Particularly, cold air inversions that enhanced atmospheric sulfur dioxide, SO2, and particle matter were to blame for the London Fog event in 1952, which resulted in the deaths of thousands of individuals from cardiovascular and pulmonary issues. This disaster was preceded by the 1948 Donora, Pennsylvania, air pollution episode, which saw high levels of sulfur dioxide, a temperature inversion, and foggy weather. Twenty people died as a result of cardiac and respiratory disease, and about half of the town's 12,000 residents complained of coughing, respiratory tract irritation, chest pain, headaches, nausea, and vomiting. Based on eyewitness testimony, Berton Rouech'e described the incident as follows: The weather was raw, overcast, and dead still, and it kept that way while the fog accumulated throughout that

day and the next. By Thursday, it had become an immobile clump of smoke after adhering firmly. The mills were disappeared, except for the stacks, by the time it was able to see across the street that afternoon. The air started to smell and nearly taste vile. It had a sulfide odor, a sweet-sour smell. Everyone who was out that day made comments about it, but none seemed really concerned. The scratchy gas sulfur dioxide, which is released when coal burns and ore melts, is a typical side effect of any persistent fog in Donora. Simply said, it seemed more piercing this time.

Policy Reactions to Air Pollution Early on: The Air Pollution Control Act, the first piece of legislation aiming at reducing air pollution, was enacted in 1955. That was the first time that air pollution at its source had been addressed by federal legislation. The United States received a grant of $5 million per year for five years for research. Health Service Public. While the legislation accomplished nothing to stop air pollution, it did inform the government that it was an issue at the federal level. It recognized the threats to the public's health and welfare, livestock, agriculture, and property degradation and reserved for Congress the authority to address this expanding issue. The measure, which was proposed by California's senators and representatives in the house, was followed by other unsuccessful efforts. As long as air pollution was seen as a local issue, the federal government refrained from interfering with state sovereignty. As a consequence, the first APCA's scope and impact were very limited.

The amendments to the First Clean Air Act: Congress created the Clean Air Act of 1963 three years after the APCA, with the goal of lowering air pollution by establishing criteria for stationary sources including steel mills and power plants. Mobile sources of air pollution, which had grown to be the main source of many harmful pollutants, were not considered. The government was required to establish timeframes for businesses to adhere to these requirements when they were established. The Clean Air Act had amendments in 1965, 1966, 1967, and 1969. These amendments gave the Secretary of Health, Education, and Welfare the authority to establish air quality control regions, set air quality standards and compliance deadlines for stationary source emissions, set standards for auto emissions, expand local air pollution control programs, and authorize research on low-emission fuels and vehicles [3], [4].

The CAA encouraged federalism by giving the states obligations and financial support to carry out its provisions. The federal government was crucial in the execution and harmonization of the CAA since air pollutants crossed state lines. Also, the CAA promoted public health with guidelines for air pollutants that were focused on health. As there were secondary criteria to save farmland, forests, monuments, visibility, and water bodies from the harmful impacts of air pollution, it also promoted public welfare. The interstate commerce clause's regional and national context allowed the U.S. Supreme Court to uphold the federal government's right to regulate air pollution.

By 1970, Congress had once again addressed matters covered by the CAA. The Environmental Protection Agency was formed by executive order by President Richard Nixon in 1970. Notwithstanding the fact that significant legislative precedents had been established, the current statute and changes were judged insufficient. The Clean Air Act of 1970, technically another amendment, was a significant reform and imposed considerably higher criteria. It also expanded funding for research on air pollution, created new main and secondary standards for ambient air quality, and new federal and state-enforced emission limits on fixed and mobile sources. The 1970 amendments created a program to demand the best available control technology for large new sources of air pollution, requiring a 90% decrease in emissions from new cars by 1975, and established a program to regulate air toxics. The timeframes established were quickly found to be unduly aggressive. It would be very difficult for the car industry to meet these criteria in such a

short amount of time due to severe economic constraints and apparently insurmountable technical obstacles. The 1977 CAA amendments were a response of these problems, and they changed the car emission regulations, extended the deadlines for meeting the air quality criteria, and included the program for the prevention of significant deterioration.

The act, according to Sen. Edmund Muskie, put public health above technology and economic concerns: "The primary responsibility of Congress is not to make technological or economic judgments or even to be constrained by what seems to be technologically or economically feasible. Establishing what is necessary in the public interest to safeguard people's health is our obligation. This might imply that individuals and businesses will be required to do tasks that now appear unattainable. Yet these difficulties must be overcome if health is to be preserved.

This was a consensus position at the time, and Republicans supported the legislation despite its demands on business. Sen. Winston Prouty, for example, said of the 1970 amendments, "For the first time, air quality standards will take precedence over objections of economic impracticality and technical impossibilities." During the 1980s, Congress did not amend the Clean Air Act, in part because President Ronald Reagan's administration prioritized economic objectives over environmental objectives. The federal government decided to update the CAA once again in 1990, after a protracted period of dormancy, in response to escalating environmental concerns. The 1990 Clean Air Act focused on five key areas: It reduced exposure to six so-called criterion pollutants: lead, particulate matter less than 10 microns in size, ozone, nitrogen dioxide, and sulfur dioxide. It restricted the sources of and exposure hazards to the 188 listed hazardous air contaminants. It stopped the air quality in wilderness regions and national parks from significantly deteriorating. It managed the acid rain. It reduced the usage of substances that reduce the O3 layer in the stratosphere.

The 1990 CAA amendments also contained provisions for categorizing nonattainment locales or locations where ambient air quality in the surrounding region is below criteria or when air pollution levels consistently exceed national ambient air quality limits. The CAA updated enforcement provisions, including the ability for EPA to impose administrative penalties, tightened auto and other mobile source emissions standards, required reformulated and alternative fuels in the most polluted areas, established a new software of technology-based standards, and required a state-run permit program for the operation of major sources of air pollutants.

DISCUSSION

National Ambient Air Quality Standards

National Ambient Air Quality Standards for contaminants deemed hazardous to the environment and public health were established in Title 1 of the CAA 1970 amendments. These contaminants included hydrocarbons, oxidants, Pb, NO2, SO2, total suspended particles (in 1987 and PM2.5 in 1997), NO2, NO, and SO2. The NAAQS were created with a sufficient margin of safety to preserve the public's health and welfare. Every five years, the EPA must examine the scientific evidence that underpins the standards and, if required, amend them in accordance with the CAA. The five-year review has presented the EPA with a growing number of challenges. A criterion document that summarizes the study and its implications for regulation using a variety of standards is created by the Office of Research Development. The EPA staff is used by the Office of Air Quality Planning and Standards to compile a staff paper that lists all the health-related research publications that are pertinent to the standard-setting process. They often exceed 2,000 and produce a lengthy staff document. The staff paper is a document that evaluates the implications of

the data in the criterion document for standard establishment and offers staff suggestions for NAAQS decision-making [5]–[7].

The National Institute for Environmental Sciences was given permission to study air pollution by the 1970 CAA amendments, which included toxicity, air pollution measurement and characterisation, animal studies, clinical and translational investigations, and epidemiological studies. Moreover, the EPA has provided funding for studies on air pollution via its Science to Achieve Results award program and institutions like its Particulate Matter Center grants. At the Boston-based Health Impact Institute, the EPA also collaborates financially with businesses interested in reducing air pollution. Prior to publishing as HEI publications, the findings and final reports are reviewed by both a review committee and a research committee at HEI. These funding sources provide air pollution specialists the tools they need to carry out studies that support the regulatory framework's underlying science. Via graduate programs and postdoctoral fellowships, these funds help scientists by providing financial support, building a team of specialists, and training the next generation of scientists.

The establishment and enforcement of regulations are left to the discretion of the federal regulatory authorities. The process of developing standards has slowed down over the last eight years, and the NAAQS have been working under court orders for most of that time after environmental groups sued the EPA for missing deadlines or failing to regulate. Congress may raise or decrease appropriations, or the presidential budget may reduce or eliminate budget items to limit agency activity. The regulatory justification used to avoid regulation is more intriguing. After losing a case challenging this interpretation at the Supreme Court, the EPA under George W. Bush determined that CO2 was not covered by the CAA and chose to issue a long Advanced Notice of Proposed Rule-Making in an effort to justify not regulating. It made it clear that the CAA was the incorrect legal framework for this. It made use of the CAA NAAQS, which required regulation of any emitter of more than 250 tons of main pollutants. As most structures would have to conform with this inter- pretation, every conservative group would be condemning the growth of large government. But, the agency may adopt a focused strategy and concentrate, for instance, on coal-fired power stations, where there would be a significant benefit at a low cost. There are several entrance points into the regulatory process for individuals or groups to voice their opinions on proposed rules, present information at CASAC meetings, or even petition the administrator directly. The best way to carry out these initiatives is via reputable groups like the American Lung Association or American Thoracic Society.

Scientific Advisory Committee for Clean Air

The staff paper and the criterion document are both reviewed and critiqued by the Clean Air Scientific Advisory Committee. Before establishing a range of criteria for the EPA administrator to take into consideration, the CASAC gathers public testimony about these documents, analyzes its results, and consults the main literature. The EPA administrator is in charge of deciding whether to follow or reject their suggestions. A physician, a person with knowledge of air pollution monitoring, and a representative from the state air pollution bureaus are required members of the CASAC. The EPA is required by Executive Order 12866 to create regulatory effect evaluations. Costs and technical viability cannot be taken into account while establishing NAAQS, but they may be when devising control techniques. The Office of Management and Budget must examine the regulatory effect evaluations that the EPA has prepared.

Proposals for State Implementation

Although the CAA gives the EPA the authority to set NAAQS, the states are in charge of creating the processes necessary to meet and maintain the requirements. To make sure they adhere to legal requirements, the states adopt plans known as State Implementation Plans and submit them to the EPA. SIPs use emissions inventories and computer models to forecast the likelihood of air quality violations. Plans for monitoring air pollution levels must be developed by the states; the EPA may help pay for these plans. The state may be forced to impose new limitations on current sources if the SIP reveals that criteria might be breached. State building permits are required for proposed new and modified sources, and the applicant must demonstrate that expected emissions won't go above permissible limits. State SIPs must be submitted to EPA three years after the final NAAQS rule designations are put into effect. These SIPs must describe how regions will be brought into attainment. The SIPs are evaluated by EPA to see whether they are enough to satisfy legal obligations and fulfill the criteria.

If states don't comply with NAAQS regulations, the federal government takes a variety of steps to ensure compliance. Secondly, emissions from new or modified sources in nonattainment regions must also be offset by decreases in emissions from existing sources. Second, in states where the SIP is insufficient, the EPA may impose a 2-to-1 emissions offset within eighteen months for the construction of new polluting sources and may restrict the majority of federal highway funding six months thereafter. If the state does not provide or execute a sufficient SIP, a Federal Implementation Plan may finally be imposed. This extra prohibition on air quality funding is discretionary.

Transportation SIPs

In non-attainment regions, it is necessary to demonstrate compliance with transportation plans and SIPs at least every three years. Plans for nonattainment must include instructions for implementing all practical preventative actions. The SIP may designate HOV lanes on roads to promote carpooling or SIPs may enhance the frequency of vehicle inspections to monitor air pollution, for example, are examples of control technology recommendations. To limit CO, VOCs, NOx, and O3, Title II on mobile sources specifies how to establish emissions regulations for automobiles, trucks, off-road vehicles, lawnmowers, chainsaws, construction equipment, locomotives, and marine engines. The hydrocarbon and NOx auto-mobile standards were both cut by 40% and 50%, respectively, by the 1990 CAA revisions. The EPA mandated a 90% decrease in PM10 by 2007 and NOx by 2010 for heavy-duty vehicles in 2001. Ninety-seven sites were deemed to be in nonattainment for ozone, with only Los Angeles being classified as "Extreme," and targets were established for achieving a one-hour level of 0.12 ppm by 2010. The 0.08 threshold for ozone over eight hours, the amended standard of 0.075, and the EPA administrator's impending assessment of this level have all updated these objectives. Also, there have been various revisions to the specifications for gasoline composition. At first, methyl tert-butyl ether was preferred, but this additive's ability to pollute ground water led to its replacement with ethanol, a renewable fuel. In 1990, lead was eliminated from gasoline, and by 2004, sulfur content had been further controlled by more than 90%. California is allowed to create its own automobile requirements as long as they are at least as strict as federal standards, according to Section 209 of the CAA. Other states may adopt California's harsher regulations according to Section 177; New York, Maine, Massachusetts, and Vermont have already done so.

Conditions for Permits

The CAA was amended in 1990 to include Title V, which mandated that states implement a thorough permit scheme for the operation of sources generating air pollutants. In non-attainment zones, the permit requirements may also apply to sources of VOCs that emit as little as 10 tons per year. Sources subject to the permit requirements typically include those that emit 100 tons per year or more of any regulated pollutant. To pay for the per-mits and associated air pollution management initiatives, states levy yearly levies. The permit specifies the types of air pollutants that a source may release in what amounts. A source must create a compliance strategy and confirm compliance as part of the permit application process. The CAA is enforced by regional and municipal authorities. Most permits are issued by them, and they also oversee compliance and carry out most inspections. The CAA also allows for citizen lawsuits to be filed against people and companies that are accused of breaking emissions standards or permit requirements. In situations when the administrator has neglected to take a step that is required under the CAA, claims against EPA may also be made. The EPA has the power to impose administrative fines, prosecute offenders for felonies rather than misdemeanors in particular circumstances, and grant $10k to sources of information that result in CAA convictions.

Hazardous Air Pollutants

The 1990 amendments' Section 112 created a program to safeguard the environment and public health against hazardous air pollution. This provision mandated the EPA set Maximum Achievable Control Technology requirements for 188 pollutants and list the different types of sources that must comply with rules. The second critical component instructed EPA to establish health-based criteria to deal with circumstances where a substantial residual risk of harmful health consequences persisted after MACT installation. Finally, EPA was required to set guidelines for stationary "area sources," which were in charge of 90% of hazardous air pollutant emissions. Last but not least, EPA was mandated to create a Chemical Safety and Hazard Investigation Board to look into mishaps involving the discharge of dangerous materials. Owners and operators were required to create risk management plans that included hazard evaluations, release prevention strategies, and reaction plans.

The 3.7 metric tons of air toxics were released in the United States during 1993, with 41% coming from mobile sources, 35% from regional sources, and 24% from local stationary sources. EPA has taken into consideration twenty-one mobile source air toxics, taking into account the health and risk information, as well as the degree of human exposure and toxicity. They include acetaldehyde, benzene, formaldehyde, 1,3-Butadiene, acrolein, polycyclic aromatic hydro- carbons, diesel, arsenic, chromite, dioxin/furan, ethyl benzene, n-hexane, lead, manganese, mercury, MTBE, naphthalene, nickel, styrene, toluene, and xylene. The EPA's inspector general published a scathing report in 2010 due to the HAPS program's lack of funding and the lack of resources it had to implement a HAPS regulation program. The Inspector General Act of 1978 gives the executive branch control over how well federal agencies are carrying out their legal obligations under congressionally enacted law.

Brand-New Performance Standards for Sources

According to Section 111 of the CAA, the EPA must create nationally consistent, technology-based criteria for various types of new industrial facilities in order to deter polluting companies from settling in states or localities with lenient regulations. Since it was unclear what constituted a modification as opposed to ordinary maintenance of a facility, the guidelines also established the

new source review to apply to changes made to already-existing facilities. NSR was waived for "routine maintenance" up to a maximum of 20% of the facility's value. Particularly for nonattainment zones, NSR was to apply.

Protection Against Serious Deterioration

The Prevention of Substantial Deterioration program embodies the idea that even though NAAQS will not be broken, places whose air quality is greater than that needed by NAAQS should be protected against major additional air pollution. Wilderness areas and national parks are under the classification of Class I areas, where extremely minimal amounts of new pollutants are permitted. Class III locations are planned for development but are not expected to go above the NAAQS. Class II areas are all attainment regions. Ozone, NOx, and PM, sometimes known as regional haze, are the main factors affecting visibility, particularly in the Grand Canyon and Great Smoky Mountains national parks. The Grand Canyon Visibility Transport Committee was created by the 1990 CAA amendments and is made up of the governors of each state in the affected area, an EPA designee, and a representation from each national park or wilderness area in the area. The changes specifically stipulate that governments must impose the best retrofit technique on any current sources of emissions that reduce visibility. The Regional Haze Regulation, which the EPA published in 1999, created a 65-year program to restore 156 national parks and wilderness areas to their original visibility conditions.

Interstate Clean Air Quality Regulation

By concentrating on the twenty-eight states and the District of Columbia that contributed to downwind states' nonattainment of these NAAQS, EPA proposed the Clean Air Interstate Quality Rule in 2004 with the goal of reducing the interstate transmission of fine PM and ozone. For the substances SO2 and NOx, which are responsible for creating PM and ozone, the EPA suggested a model cap and trade regime. These initiatives were directed at power plants that will be reduced gradually between 2010 and 2015. Due to regional contributions from sources far from these places, EPA monitoring revealed that several counties in the eastern United States were in violation of the yearly PM2.5 and ozone standards. By 2010, the EPA recommended a regional SO2 emissions restriction of 3.9 million tons, along with a NOx emissions cap of 1.6 million tons. By 2015, the ceiling would be increased to 2.7 million tons for SO2 and 1.3 million tons for NOx. This regulation was invalidated by the U.S. in 2008.

Court of Appeals for Washington, D.C. Circuit because it believed that the rule's reliance on regional limitations rather than a state-by-state approach was fundamentally flawed. The court revived the regulation at the end of 2008 following pressure from environmentalists, the EPA, certain utilities, and state air regulators, with the understanding that it would be changed to address the court's concerns. The EPA published the transportation rule in 2010 with the intention of reducing emissions from power plants in 31 eastern states and the District of Columbia. According to the EPA, the regulation would cost $2.8 billion to execute and bring about benefits of $120-$290 billion, mostly in the form of better respiratory health. By preventing 14,000 to 36,000 premature deaths, 21,000 cases of acute bronchitis, 23,000 nonfatal heart attacks, 26,000 hospital and ER visits, 1.9 million days missed at work or school, 240,000 cases of aggravated asthma, and the worsening of 440,000 upper and lower respiratory symptoms, the rule would improve public health when fully implemented in 2014. By 2014, the transportation regulation would cut NOx and SO2 emissions by 52% and 71%, respectively, above 2005 levels. On July 7, 2011, the Cross-State Air Pollution Regulation became official [8].

Act establishing national environmental policy

The National Environmental Policy Act was the second important statute resulting from the environmental movement of the 1960s and 1970s, in addition to the Clean Air Act. In her book Silent Spring, Rachel Carson discussed the effects of pesticides like DDT on the ecosystem, including how they weaken bald eagle eggs and prevent chicks from hatching. In the US, bald eagles became scarce, and other songbirds faced danger. Several years later, the Rachel Carson Great Room was given the name of the EPA's primary conference space. On April 22, 1970, Senator Gaylord Nelson launched the Earth Day festivities by addressing the impending environmental concerns and catastrophes. The following objectives of the National Environmental Policy Act, which was passed into law in 1969: establishing a national strategy to promote productive and joyful harmony between people and their environment to encourage actions that will stop or reverse environmental and biosphere harm and improve human health and wellbeing. To deepen knowledge of ecological systems and natural resources crucial to the country, and in order to create a Council on Environmental Quality

The environmental impact statement was created by NEPA, and it requires the responsible official to report on the environmental impact of the proposed action, any adverse environmental effects that cannot be avoided, alternatives to the proposed action, and the connection between local short-term human environmental use and long-term productivity, as well as any irreversible resource commitments. This marked a significant shift in how environmental impact was viewed in cost-benefit analyses of governmental initiatives. In order to apparently coordinate environmental measures across federal departments, it established a federal Council on Environmental Quality. A yearly report, requirements for the EIS, and coordination of federal environmental initiatives were all tasks assigned to the CEQ. With the Republican takeover of Congress in 1997, Newt Gingrich arranged the adoption of the Federal Reports Sunset statute, which put a stop to the yearly report, which was a remarkable compilation of environmental data and initiatives. After 1997, there were no more yearly reports on the environmental authorities' activities. An environmental evaluation rather than a comprehensive EIS might be released if the government action was not significant. There were 542 EISs in 2006, with the U.S. At 144, the Forest Service has the most; logging and roadwork are likely the blame. US was one of the others. Army Corps of Engineers has 56, followed by Federal Energy Regulatory Committee (32), Bureau of Land Management (42), National Park Service (34), and Federal Highway Administration (66).

Health impact assessments (HIAs) offer great potential for promoting health by encouraging decisions that protect and enhance health and health equity. HIAs are a natural extension of the EIS and are used to examine the effects that a policy, program, or project may have on the health of a population. Large transportation projects may take into account accident prevention or the health implications of air pollution, but they often overlook how road design affects physical activity and obesity. So, a bicycle lane may be thought of. Educational HIAs could encourage students to walk to school and steer clear of places with a lot of noise or air pollution. When redesigning their environmental impact statement (EIS) for the Northeast National Petroleum Reserve in Alaska, the Bureau of Land Management took Native populations' well-being into account. They also withdrew some land from leasing for oil and gas development and put in place new pollution monitoring controls. Local and state governments also employ HIAs to promote proactive decision-making and planning to enhance public health [9], [10].

CONCLUSION

The landmark environmental legislation that concentrates Americans' attention on the environment is the Clean Air Act. It offers ozone and particle matter regulations that are based on research. States carry out these laws and put policies into place to reduce pollution from stationary sources, such power plants and transportation sources. The Environmental Protection Agency has put in place specific programs for diesel engines, achieving zero new source pollution, stopping the degradation of the air in pristine places, and integrating numerous contaminants. The Clean Air Act NAAQS for fine particle and ozone, according to EPA Administrator Lisa Jackson, averted more than 160,000 instances of premature death, 130,000 heart attacks, 13 million missed workdays, and 1.7 million asthma episodes in 2010 alone. The National Environmental Policy Act focuses on land and water, where federal government actions must take into account any negative environmental implications before beginning such activities.

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CHAPTER 2

A BRIEF DISCUSSION ON PARTICULATE MATTER

Ms. Meenakshi Jhanwar, Assistant Professor
Department of Environmental Science, Presidency University, Bangalore, India
Email Id-meenakshi@presidencyuniversity.in

ABSTRACT:

The combination of solid and liquid droplets in the air known as particulate matter may come from either natural or man-made sources. Particles come from a variety of sources, including sea spray, plant pollen, and crustal or surface particles that are carried by the wind. Anthropogenic sources include combustion-related elements such as vehicle engines, industrial power plants, industries, refineries, agricultural sources, forest fires, and/or secondary sources such as aerosol condensation. In this chapter author is discusses the effect of air-pollution control on death rates in Dublin.

KEYWORDS:

Deposition, Environment, Health, Pollution, particles.

INTRODUCTION

The size of the particles is significant since exposure is influenced by particle size. In general, particles larger than 10 microns are not respirable. The lung's alveolar passages may be reached by coarse particles (10 to 2.5 microns), known as "fine particulate," and ultrafine particles (0.1 microns or less), known as "ultrafine particles," which can reach the distal lung and have an affinity for absorption. The three levels of defense that particles that enter the airways must pass through to be stopped by the respiratory system's defenses against inhalable particles may be grouped together. Impaction, sedimentation, and diffusional deposition of particles suspended in the inspired air as it travels through the nose, nasopharynx, pharynx, and larynx as well as the conducting airways, or the tracheobronchial tree, serve as the lower respiratory tract's first line of defense. The buildup of particles along the airways inhibits their entry into the more delicate gas-exchanging organs, such as the respiratory bronchioles, alveolar ducts, and peripheral lung alveoli.

The fluids that cover the surfaces of the airways and gas exchange structures, as well as the clearing processes that physically remove particles from their surfaces, serve as the second line of defense. The fluids of the respiratory tract operate as a physical barrier to prevent particles on airway surfaces from coming into touch with the bronchial and alveolar epithelia; they may also act as a chemical buffer if they contain compounds that have detoxifying and bactericidal properties. Moreover, a viscoelastic fluid is formed by the secretions that cover the ciliated epithelia of the conducting air passageways of the upper and lower airways. The less viscous sol layer's cilia beat, escorting any particles still on the more viscous gel layer to the larynx, where they are either eaten and expelled via the gastrointestinal system or expectorated. Resident alveolar macrophages, the third line of defense, scavenge particles from the alveolar surfaces, digest them, and/or remove them through the mucociliary escalator [1], [2].

Particles may enter the respiratory system by a number of different processes, including impaction, gravitational sedimentation, Brownian diffusion, and interception. In airway bifurcations,

deposition by impaction happens when a particle fails to turn into either of the daughter branches due to its velocity and the aerodynamic forces applied to it by the stream of air in which it is transported. The settling of particles onto airway surfaces caused by gravity is known as gravitational sedimentation. The random thermal effects that result in sedimentation and impaction are more significant for particles smaller than 2.5 microns, while the gravitational influences that generate these processes are less significant.

The gas molecules in the air surrounding them were being buffeted kinetically. In contrast to deposition by impaction, which rises with the branching angle regardless of airway length, sedimentation increases with airway length. Long fibers from combustion processes, those created by the coagulation of smaller particles from the nucleation and Aitken modes, or those formed incidentally in atmospheric interactions all cause interference when they enter the lower respiratory tract like a spear. The majority of the vapors in the nucleation mode are associated with combustion and condense into Aitken mode particles. The coarse mode generally provides the greatest mass and comprises particles with a diameter of 2 to 100 mm. The largest surface area is seen in the accumulation phase, when particles have diameters between 0.1 and 1.0 mm. The coarse and accumulation modes nearly totally confine the PM material. The most particles are found in the ultrafine zone, which has particles with diameters less than 0.1 mm. Nevertheless, the ultrafine mode typically adds very little mass to PM.

Moreover, there may be noticeable concentration disparities between urban and rural areas. Recently, yearly average PM2.5 concentrations in the United States have varied from 4 to 28 mg/m3. With the exception of California, urban PM concentrations in the United States are typically greater in the east than the west. Only the northeast region's yearly PM2.5 concentration did not fall during that little time span, whereas urban concentrations fell by 10% and rural ones by 20% countrywide.

Impacts on Health

The number of fatalities caused by air pollution incidents around the middle of the 20th century varied from a few extra deaths to thousands, greatly dependent on the size of the population exposed. The most well-known of these occurrences was the London Fog of 1952, which resulted in an estimated 3,500 more fatalities during a few days and perhaps thousands more in the following weeks. Even though there were many other pollutants in London during this fog, it is probable that particle air pollution was substantially to blame for the extra mortality. These incidents show that exposure to urban air pollution may, in rare circumstances, result in mortality.

DISCUSSION

Increased PM concentrations and higher cardiopulmonary mortality have been linked, according to several research. They discovered that mortality went up a little bit for every 10 mg/m3 rise in PM10. Despite the modest impact of PM rises, if seen over a large population, the public health impact might be significant. As a result, rising ambient PM concentrations pose a considerable danger to human mortality. Similar studies have shown other health risks linked to elevated PM, such as an increased risk of heart disease and lung cancer. C. started the American Cancer Society Air Pollution Study. Based on a cohort of 1.2 million people recruited in the autumn of 19821, Arden Pope and colleagues found that a subset of 552,138 adults who resided in 151 US urban regions could be linked to data on air pollution gathered by the Environmental Protection Agency. Using multivariate analysis that controlled for smoking, education, and other risk variables up to 1989, the associations between sulfate and particulate matter air pollution and all-cause, lung

cancer, and cardiopulmonary mortality were investigated in this subgroup. The most contaminated towns had a 15%–17% higher death rate from air pollution than the least polluted ones. As this cohort was followed up on until 1998, when 22.5% of the cohort passed away, PM2.5 data were gathered and mortality risk ratios were calculated using a Cox proportional hazard regression model. Significant mortality associations were found for ischemic heart disease, dysrhythmias, heart failure, and cardiac arrest, as well as pneumonia and influenza in non-smokers, for every 10 mg/m3 increase in PM2.5.2 Each 10 mg/m3 elevation in fine particulate air pollution was associated with an increased risk of all-cause, cardiopulmonary, and lung cancer mortality, respectively. Pope and colleagues collected information on life expectancy, socioeconomic status, and demographic characteristics for 51 U.S. metropolitan areas with matching data on fine particulate air pollution for the late 1970s and early 1980s and the late 1990s and early 2000s. They discovered that a reduction of 10 mg/m3 in PM2.5 was linked to an estimated increase in mean life expectancy of 0.61 0.20 years. Up to 15% of the total gain in life expectancy in the studied locations was attributed to lower air pollution.

Researchers at the Harvard School of Public Health developed a longitudinal research on the health impacts of air pollution in six cities at the same time the American Cancer Society cohort was being put together. The Harvard Six Cities Study was a sixteen-year prospective cohort study that began in the 1970s and included 8,111 people from the northeastern and midwestern regions of the United States. The research found a significant correlation between PM2.5 and lung cancer, cardiopulmonary diseases, and overall mortality.5 There was a 26% difference in total mortality between the most and least polluted cities. The increased mortality rate ratios of 1.27 for lung cancer and 1.28 for cardiovascular fatalities were confirmed after an eight-year extended follow-up, and the findings revealed that the mortality effect was not cumulative and that reducing air pollution had a positive impact on public health. Compared to lung cancer, this was more obvious in cardiopulmonary mortality.

Following the completion of these studies, Jonathan Samet, M.D., and colleagues published the National Morbidity and Mortality Air Pollution Study, in which they evaluated the effects of five major outdoor air pollutants on daily mortality rates in 20 U.S. metropolitan areas from 1987 to 19947. These pollutants included PM10, ozone, sulfur dioxide, carbon monoxide, and nitrogen dioxide. For every 10 mg/m3 rise in PM10, they discovered a negligible 0.5% increase in all-cause mortality. As changes were made to the statistical modeling, this little gain was eventually reduced lower to 0.2%. Both a generalized additive model using the S-plus GAM function and a generalized linear model utilizing natural cubic splines were used to evaluate the data. Every 10 mg/m3 rise in PM10, the estimated impact on overall mortality from nonexternal causes was 0.41% higher with the original technique, 0.27% higher with the stricter criteria, and 0.21% higher with GLM.

In the Northeast, there was a higher chance of dying from cardiovascular and respiratory diseases. Overall mortality increased by 0.41% for every 10 ppb of seasonal ozone. No significant correlations with CO, SO2, or NO2 were found. According to 799 monitoring stations, PM decreased by 20% throughout these years. In linear regression models, significant socioeconomic variables had no impact on the relationship between PM10 concentrations and the probability of dying. A short-term increase per 10 mg/m3 PM2.5 was found for hospitalizations for stroke, ischemic heart disease, heart rhythm problems, heart failure, exacerbations of chronic obstructive pulmonary disease, and respiratory tract infections, but not for injuries. These NMMAPS data were then correlated to Medicare hospitalizations for 1999 through 2002 for 204 U.S. urban counties

with 11.5 million Medicare enrollees living an average of 5.9 miles from a PM2.5 monitor. Eastern counties in the US, particularly those in the Northeast, South, and Midwest, tend to have greater cardiovascular risks. It is likely due to power plant emissions in the East and transportation in California that there is a higher sulfate concentration of PM in the East than nitrate in California. It is hypothesized that PM2.5 triggers inflammatory reactions in the lower respiratory tract, resulting in the production of cytokines that have both local and systemic effects. Particulate matter weakens the effectiveness of the lung's defensive systems, increases inflammation, and aggravates underlying lung illness.

The study Air Pollution and Health: A European Approach found epidemiological evidence that short-term exposure to PM and ozone had an impact on daily hospital admissions and ER visits for asthma and COPD in eight cities. In the United States, Moolgavkar used data for Los Angeles County, California, for 1987-1995 and discovered that PM2.5 was significantly associated with risk for hospital admissions for cardiovascular disease in people ages 65 and older.

Studies on air pollution have been supported by the California Air Resources Board in order to provide information on the particulars of California's smog and create a ratio that can be used to support spending and emission-reduction plans. Children who resided closest to freeways had lower attainment of FEV1 than kids who lived at least 1,500 meters away from one. In analyses of those who had left the Los Angeles area, those who moved to a less polluted area had less loss of pulmonary function.15 Since traffic is a major source of pollutants, many studies have attempted to identify negative health effects among people exposed to traffic. Living within 75 meters of a major road increased asthma risk with an odds ratio of 1.29, prevalent asthma, and wheeze; background rates were observed 150-200 meters from a major road. Environmental scientists in the Netherlands looked into a random sample of 5,000 participants in a national diet and cancer study starting in 1986. They used the addresses of the participants' homes to plot the distance from a major road using Cox's proportional hazard models, and the study was followed up until 1994.

After accounting for age, sex, education, employment, active and passive smoking, and residing near a major road, the relative risk for cardiopulmonary death was 1.95, and the all-cause mortality rate was 1.41. Asthmatics should be more cautious about exposure from the environment, particularly black smoke from diesel engines. Sixty asthmatics were enrolled in a randomized crossover study by McCreanor et al. that compared walking for two hours in pleasant Hyde Park versus two hours on polluted Oxford Street.17 After walking on Oxford Street, their FEV1 decreased by 6.1% and their forced vital capacity decreased; moderate asthmatics experienced greater decreases. Myeloperoxidase, an inflammatory mediator, was measured in sputum after the walk and was found to be 24.5 ng/ml after walking on Oxford Street as opposed to 4.2 ng/ml after walking in Hyde Park. These associations only trended toward significance for PM2.5, but they were significant for ultrafine particles, elemental carbon, and NO2. Microscopic carbonaceous particles inside alveolar macrophages were discovered to correspond with greater PM10 exposure and decreased FEV1 in a significant investigation of children exposed to traffic with assessments of lung function and in-duced sputum. For instance, a 17% drop in FEV1 predicted was linked to each 1.0 mm2 rise in carbon in the alveolar macrophage18.

Studies on air pollution interventions have shown improvements in health outcomes and a decrease in air pollutant levels. There was a thirteen-month worker strike at the nearby steel factory in Utah Valley in 1987. Total mortality decreased by 3.2%, while PM10 reduced by around 15 mg/m3. Acute bronchitis and asthma attacks in preschool-aged children decreased by 50% after the strike as compared to before. After switching from oil to bituminous coal for household space and water

heating in the 1980s, Dublin, Ireland, experienced worsening air quality.20 Periods of high air pollution were 2.8 Mean percentage changes in FEV1 and FVC during and after exposure on Oxford Street and in Hyde Park. The forced vital capacity and forced expiratory volume in 1 second percentage increases from baseline values are shown for all study participants, those with mild asthma, and those with intermediate asthma. For the difference in results between the Oxford Street and Hyde Park exposures, an asterisk denotes p 0.05. I bars show the 95% CI.

Controlling air pollution's impact on Dublin, Ireland's mortality rates: a case study. Studies conducted in vitro show that when exposed to PM, macrophages or healthy human bronchial epithelial cells produce inflammatory cytokines and exhibit stimulation of the transcription factor NF-kB. Immature dendritic cells express CCR6, which is the ligand for macrophage inflammatory protein-3a, which is released when PM2.5 stimulates normal human bronchial epithelial cells.23 Theoretically, recruitment of immature dendritic cells to the airway where PM deposits can result in their maturation via GM-CSF, which is also released. The normal interaction between human bronchial epithelial cells and dendritic cells caused by diesel exhaust particulate releases a third factor, thymic stromal lymphopoietic factor, which attracts and activates Th2 lymphocytes that release the IL-4, IL-5, and IL-13 cytokines that cause asthma exacerbation.

Particulate matter and Cardiovascular Disease

How can cardiovascular diseases result from PM2.5? Anthony Seaton, M.D., proposed in 1995 that fine particles induced alveolitis with release of cytokines capable of exacerbating lung disease and increasing blood coagulability.25 In rabbits, phagocytosis of PM2.5 by alveolar macrophages releases cytokines that stimulate the release of neutrophils and monocytes from the bone marrow.26,27 Particulate matter may result in a type of systemic inflammatory response syndrome that activates. Using transgenic mice lacking ApoE, atherosclerosis and vascular inflammation developed on high-fat chow with exposure to PM2.5 for six hours per day, five days a week, for six months as demonstrated by increased thoracic and abdominal plaque: PM2.5 41.5% versus air 26.2% or normal chow PM2.5 19.2% versus 13.2%.29 Rats breathing PM2.5 for five hours have increased reactive oxidant species and antioxidant enzymes in their lung tissues species, and the aortic arch had more lipids. These mice may be more susceptible to the development of atherosclerotic plaques as a result of ultrafine particles.

It has become more difficult to conduct human clinical and epidemiological research of air pollution and cardiac disease. In a German panel study of 57 male patients with coronary heart disease, increases in PM10 and PM2.5 particles were significantly correlated with increases in C-reactive protein, a marker of systemic inflammation.32 Peters and colleagues investigated whether exposure to air pollution while snarled in traffic would increase the risk of myocardial infarction.33 They gathered case histories of 691 subjects who had heart attacks in Ge. They discovered that exposure to traffic in a car, on a bus, or while riding a bicycle at least an hour before having a heart attack tripled the likelihood of having one. They conducted comprehensive correlations with gaseous air pollutants and PM10, however these connections were not significant after thorough analysis. exposure to traffic over time within 100 meters of a residence

In a case-control analysis of the Worcester, Massachusetts, Heart Attack Study34, which included 5,049 verified cases between 1995 and 2003 and population controls chosen from Massachusetts resident lists, the proximity to a road was evaluated. They discovered a 5% increase in the likelihood of an acute myocardial infarction next to a busy road using logistic regression. Correlations were found for housing, employment, and air pollution characteristics in a cohort of

3,239 non-smoking people tracked in California for 22 years.35 Only females exhibited significant relationships between coronary heart disease and PM2.5, raising relative risk to 1.42. In a two-pollutant scenario, ozone caused the relative risk to rise to 2.00. From 1994 to 1998, the Women's Health Initiative of the National Institutes of Health recruited 65,893 postmenopausal women from 36 U.S. metropolitan regions who had never had cardiovascular disease and followed them for an average of six years. A total of 1,816 women had one or more fatal or nonfatal cardiovascular events, including myocardial infarction, stroke, death from coronary or cerebral vascular disease, coronary revascularization, or both. A 24% increase in the likelihood of a cardiovascular event and a 76% increase in the chance of dying from cardiovascular disease were linked to each 10 mg/m3 of PM2.5 exposure. The variation in exposure was more pronounced within cities than across them [3], [4].

In a controlled, double-blind, randomized, crossover study, 20 men who had previous heart attacks but were now stable were exposed to diluted diesel exhaust in filtered air for one hour while participating in moderate exercise.37 All patients had exercise-induced ST-segment depression, but the ischemic burden increased more during exposure to diesel exhaust. Exposure to diesel exhaust decreased the acute release of endothelium plasminogen activator but did not worsen pre-existing vasomotor dysfunction. Diesel particulate worsened electrocardiographic indications as compared to filtered air. The carotid artery intima-media thickness in 798 individuals from vitamin E and B atherosclerosis intervention studies was measured by ultrasonography as a further indicator of atherosclerosis linked to air pollution38. Their residence regions were geocoded to yearly PM2.5 values. Carotid intima-media thickness rose by 5.9% with a cross-sectional exposure contrast of 10 mg/m3 PM2.5. The highest correlation between PM2.5 and carotid intima/media thickness was 15.7% in women over 60. Those who lack the gene glutathione S-transferase M1, which codes for an enzyme that scavenges oxygen-free radicals, have an increased sensitivity to inhaled particulate matter as demonstrated by greater changes in heart rate variability, which suggests that there may be a genetic predisposition to exposure to air pollution. Studying the short-term impact of PM and other ambient pollutants on arrhythmias in a demographic subset that may be particularly sensitive has included patients with automated implanted cardioverter defibrillators. AICDs save records of past arrhythmias, which may be accessed later to assess the connection between arrhythmia initiation and PM concentration. Research from Boston presented the first concrete evidence that transient elevations in PM concentrations were related to arrhythmias.

Current research has also looked at relationships with pregnancy outcomes. Just a few of them have concentrated on the PM's recent relationships. Associations between short-term increases in PM concentrations and infant mortality, particularly respiratory mortality and death from sudden infant death syndrome, have been reported, just as they have in time-series studies of total and more specific causes of mortality.41 Recently, PM10 averaged over the previous six weeks, or at a few specific days before delivery, has been associated with preterm birth in a time-series study.42 A New Jersey Department of Health statewide study also found this association.

gleton births from 1999 to 2003 with gestational ages of 37 to 42 completed weeks and birth weights greater than 500 grams with air pollution data from such a monitoring station within 10 km of residence for PM2.5, NO2, CO, and SO2.43 There were significantly higher risks for gestational ages that were too small and first and third trimester PM2.5 exposure, as well as for gestational ages that were too small and first, second, and third trimester NO2 concentrations. This shows that after accounting for established risk factors, traffic has a negative impact on the

outcome of delivery [5]. There are at least two time-series studies that suggest crustal origin PM may not be a cause of mortality. High PM concentrations caused by windy circumstances that cause crustal PM to be suspended in the air were not linked to mortality in Spokane, Washington,44 or Salt Lake City, Utah,45 although PM on other days did.

Instead of concentrating on the effects of individual PM components, it may be possible to identify particularly toxic forms of PM by concentrating on the effects of particles emitted from particular sources.46 Factor analysis approaches have been used in a few health studies to try and divide daily PM concentrations into their relative source contributions. data coming from the U.S. The effects of different sources of ambient PM on daily mortality were estimated using data from the Six Cities Study, which included measurements of elemental chemical species of fine PM. Of all the sources, PM from motor vehicle exhaust was more consistently linked to daily mortality than PM from coal combustion. Mortality was not linked to severe PM. It is probable that PM size, regardless of chemical content, influences toxicity. In epidemiological research, PM has traditionally been categorized by size into total suspended particles and its inhalable fraction, which has been further separated into coarse, and fine fractions. This is partially owing to the usage of PM data from monitoring networks used for regulatory purposes [6]–[8].

CONCLUSION

It has been noted that the laws addressing air pollution are rather rigorous and well-written. It includes the scientific facets of controlling air pollution via State and Central body operations. We can breathe the oxygen in our atmosphere, which also contains carbon dioxide that plants need to survive. The atmosphere, however, does much more than just provide living things access to air. The temperature of Earth is also regulated by the atmosphere. An Act to Establish Boards for the Purposes of Preventing, Controlling, and Abating Air Pollution, Assigning Powers and Responsibilities to Such Boards for the Purposes of Carrying Out the Aforesaid Purposes, and Other Matters Connected.

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CHAPTER 3

RESPIRATORY EFFECTS OF CONCENTRATED AMBIENT PARTICLES

Dr. Krishnappa Venkatesharaju, Assistant Professor
Department of Environmental Science and Engineering, Presidency University, Bangalore, India
Email Id-venkateshraju.k@presidencyuniversity.in

ABSTRACT:

In order to maintain normal lung function, ambient ultrafine particles trapped in the walls of airway bronchioles caused persistent airflow restriction and fibrogenic small airway remodeling. These findings point to negative consequences of repeated exposures to ambient particle air pollution. In this chapter author is discusses the ozone layer health effect.

KEYWORDS:

Environment, Health, Policy, Particles, Respiratory.

INTRODUCTION

In these studies, healthy participants had a mild increase in bronchoalveolar lavage neutrophils at 18 hours after CAPs exposure compared to filtered air. Concentrated ambient particle exposures in asthmatic and healthy individuals have shown that there are no changes in spirometry or respiratory symptoms at particle concentrations up to 311 mg/m3.48,49. In one investigation, elderly people with and without COPD exposed to CAPs and NO2 did not have any significant changes in their spirometry or induced sputum cell counts. Nevertheless, reductions in arterial saturation and maximum mid-expiratory flow connected to CAPs exposure were seen, indicating an impact on small airways. Surprisingly, the healthy people had a bigger impact. Reduced numbers of columnar epithelial cells were seen in the induced sputum of asthmatics, young, healthy individuals, and elderly participants with and without COPD after CAPs exposure in comparison to filtered air, indicating a possible influence on bronchial epithelial cells [1]–[3].

In controlled exposure trials with healthy and asthmatic volunteers, diesel exhaust increased sputum neutrophil counts as well as bronchial tissue mast cell, neutrophil, and lymphocyte counts. It also increased patients' airway resistance. Moreover, exposure to diesel particulates enhances the expression of the adhesion molecules ICAM-1 and VCAM-1, IL-6, and IL-8. With high-level exposures and nasal instillations in humans, researchers have shown that DE can enhance later allergic effects. More recent studies suggest that the diesel particle is what causes allergic sensitization.52 This has been hypothesized to be a potential cause of greater allergic sensitization and prevalence of allergic disorders.

Air Pollution and Public Policy

The EPA has identified six criterion pollutants: lead, sulfur dioxide, nitrogen oxides, particulate matter, and ozone. Among them, PM is distinct in that it is not a particular chemical substance or element. An indication, an average period, a form, and a level are all components of each NAAQS. Indicator TSP was replaced in 1987 by PM10. In 1997, PM2.5 was included as an indicator. A 24-hour average as well as a yearly average are included in PM averaging periods. Forms of the requirements are related to the precise facts that the NAAQS uses to determine area attainment.

Different NAAQS are established to safeguard the welfare of the population, which includes affects on visibility and flora. The main and secondary PM NAAQS have been the same since 1987. It is required that the NAAQS be reviewed every five years. The 24-hour and yearly standards for PM10 were maintained at values of 150 mg/m3 and 50 mg/m3, respectively, at the time the most recent EPA PM assessment was completed in 1997. At that time, concentrations for the initial 24-hour and yearly levels of PM2.5 were established at 65 mg/m3 and 15 mg/m3, respectively. It became crucial that the next assessment would advise lowering these thresholds since a plethora of scientific health data had collected since that time showing that impacts might occur far lower than those concentrations. With 24-hour and annual PM10 values of 50 and 20 mg/m3, respectively, and an annual PM2.5 concentration of 12 mg/m3, the State of California Air Resources Board authorized new ambient air quality guidelines in 2005. These limits were far stricter than those of the EPA. In 2005, the European Union proposed that the 24-hour and annual PM10 limit values be reached at 50 and 40 mg/m3, respectively, with a further suggested decrease in the yearly level to 20 mg/m3 by 2010.

The American Trucking Association and the D.C. government have sued EPA over the 1997 PM regulations. The new public health air quality criteria for PM were declared illegal and an inappropriate transfer of legislative power to the EPA by the Circuit Court of Appeals, according to a split ruling. EPA challenged the judge's ruling all the way to the United States. High Court. The Supreme Court maintained the EPA's jurisdiction to establish national air quality rules that shield millions of people from the damaging impacts of air pollution in a historic decision in February 2001. The Supreme Court also reaffirmed that the Clean Air Act forbids the EPA from taking costs into account when establishing national ambient air quality standards, instead requiring the agency to set those standards at levels required to safeguard the public's health with a sufficient margin of safety and to prevent harm to the general welfare. This decision was significant for the interpretation of the constitutional justification for the EPA's implementation of clean air standards to safeguard the general public's health [4], [5].

The EPA staff paper suggested the administrator take two options into consideration: either an annual PM2.5 standard at the current level of 15 mg/m3, together with a revised 24-hour PM2.5 standard in the range of 35-25 mg/m3, or an annual standard of 14-12 mg/m3, together with a revised 24-hour PM2.5 standard to provide supplemental protection against episodic local-ized or seasonal peaks, in the range of 40 to 35 mg/m3. The administrator should raise the 24-hour standard from 65 to 35 mg/m3 and the annual standard from 15 mg/m3 to a range of 13-14 mg/m3, according to the Clean Air Scientific Advisory Committee's evaluation of the EPA's criteria document for PM2.5, which took into account health effects, exposure trends, and policy considerations. Nevertheless, the CASAC's suggestions were not all agreed upon. The American

Thoracic Society's Environmental Health Policy Committee collaborated with the American Lung Association to recommend lowering the annual standard to 12 mg/m3.55 and the 24-hour standard to 25 mg/m3. To achieve these levels, the ATS wrote a letter to the administrator and obtained co-sponsorship from other professional societies, including that of the American College of Cardiology, the American Academy of Pediatrics, and the American Association of Cardiac The suggestion for the ATS recommended levels was presented by the American Medical Association House of Delegates and approved. Separately, other medical associations such as the American College of Chest Physicians, the American College of Preventive Medicine, and the American Public Health Association advocated lowering the requirement. The ATS then verbally supported reducing the criterion during a phone conversation during the CASAC public hearing. The ATS

organized academic pulmonologists who spoke at the hearings so that each one would have a public record of support. The EPA sponsored public hearings at several locations around the nation. Finally, the EPA administrator granted an in-person interview to the ATS and ALA to present their data and interpretations. They passionately argued that there was a scientific consensus supporting a lowering of the standard during a personal meeting with Administrator Steven Johnson and his advisors in the Rachel Carson Great Room.55 The EPA did not heed the CASAC's recommendations by maintaining the annual standard, but it did lower the 24-hour standard to 35 mg/m3. PM10 continued to be restricted. The American Farm Bureau promptly filed a lawsuit against the EPA on behalf of the industry, claiming that farms should only have a coarse requirement of PM10-2.5 that was also nontoxic and that farms were being subjected to double regulation of PM2.5 due to overlapping PM10 and PM2.5 criteria. On the opposing side, thirteen states, the District of Columbia, the American Library Association, Environmental Defense, and the National Parks Conservation Council all joined with briefs arguing that the EPA had illegally used uncertainty to get out from under the scientific consensus that called for a more protective standard. The EPA will combine the criterion document and staff paper into an Advanced Notice of Public Rulemaking and Integrated Scientific Assessment in the future.

DISCUSSION

Ozone is created when interactions between nitrogen oxides and volatile organic compounds are catalyzed by UV radiation from sunshine. Each VOC has a varied ozone production capacity. For instance, one kilogram of formaldehyde creates twice as much ozone as one kilogram of ethane. Ozone concentrations are often maximum on warm, bright, windless days. Ozone concentration rises during the morning and/or afternoon rush hour and then drops overnight. Vehicles, industrial processes particularly those in the chemical and petroleum sectors, and any usage of paints, varnishes, and solvents are some of the sources of VOCs. Other notable sources of VOCs are gas stations, pesticide use, dry cleaning, fuel combustion, and open burning. Ozone is a potent oxidant that irritates the respiratory system in both adults and children. It causes coughing, wheezing, chest discomfort when breathing deeply, and shortness of breath.

Ozone levels have decreased by 21% since 1980 as a result of joint efforts by the Environmental Protection Agency, state and municipal governments, and other organizations to enhance air quality. On the effects of O3 on respiratory symptoms, respiratory function, and airway inflammation in humans, particularly on transitory responses to acute exposure, a sizable and mostly consistent body of research has collected. Additional lung function responses to acute and subacute exposure have been investigated, mostly in animals, and include alterations in lung cell secretions, mucociliary and early alveolar zone particle clearance, functional responses in macrophages and epithelial cells. Using "subchronic" and "chronic" animal exposure methods, structural alterations in the more proximal gas exchange area and the smaller conductive airways have been linked. Chronic impacts may be caused by accumulated harm or by adverse reactions to repeated daily or intermittent exposure [6], [7].

Impacts on Health

Pulmonary Activity

During forced expiratory movements, O3 inhalation results in concentration-dependent mean decreases in exhaled volume and flow rate. In a study of 846 urban children with asthma, Mortimer et al.3 demonstrated that the greatest effect on peak expiratory flow rate occurred with a two-day lag, with an even greater effect for a five-day distributed lag. David Bates, M.D., demonstrated

that subjects exposed to ambient O3 levels while exercising also displayed pulmonary function changes. They gathered information from eight U.S.

This functional adaptation to exposure vanishes about a week after exposure stops. It is also well known that repeated daily one- or two-hour exposures, at a level that produces a functional response with a single exposure, result in an enhanced response on day two, diminishing responses on days three and four, and virtually no response by day five. Multiday exposures also reduced inflammation, as measured by polymorphonuclear cells, fibronectin, and IL-4 in lavage fluid.6 For repeated 6.6 hour per day exposures to 120 ppb O3, the first day is when the peak functional response occurs, with successively weaker responses on the second, third, and fourth days of exposure. Nevertheless, there were prolonged alterations in small airway function and response to methacholine challenge peaked on the second day and remained increased for the whole five days of exposure. O3 may further enhance reactivity in asthmatic individuals. An major health consequence is the ongoing alterations in small airway function and airway responsiveness.

During a two-month period in the late winter and early spring, Kinney and colleagues studied 154 Tennessee schoolchildren by measuring lung function as many as six times. Child-specific regressions of lung function versus maximum 1-hour O3 concentration the day before indicated significant associations. The significantly high response coefficients may be caused by potentiation by other pollutants or by a poor degree of seasonal adaptation since it is possible to anticipate that school-aged children would have relatively low activity levels. Aerosol acidity is remarkable in Kingston-Harriman, Tennessee, due to its comparatively high concentrations. Peak expiratory flow rates decreased along with ambient O3 concentrations in a study of kids with moderate to severe asthma at a summer camp in the Connecticut River Valley9. Asthmatic children had low levels of physical activity, which resulted in reduced O3 intake and low reserve functional capacity. These functional declines raise serious health concerns.

Field investigations of functional reactions of adults participating in outdoor recreational activities in the presence of various O3 levels have also been carried out. Spektor et al.10 measured the respiratory function of 30 young people before and after they exercised outdoors for roughly a half-hour each day in a place with regional summer haze but no nearby point sources. In controlled chamber exposure tests, the magnitudes of the functional declines per unit of ambient O3 concentration were comparable to those seen in volunteers exposed while engaging in strenuous exercise for one or two hours. Competent cyclists in the Netherlands11 and hikers on Mount Washington, New Hampshire, both reported functional declines in proportion to ambient O3 concentrations.12 The hikers on Mount Washington with a history of asthma or wheezing had four times greater responses to O3, PM2.5, and aerosol acidity than the others.

With O3 averaging 4.0 ppb, PM2.5 averaging 10 mg/m3, and acidity averaging 0.3 mg/m3, the average pollutant levels were very low. Ozone exposure was associated with decreased evening peak expiratory flow rates when measured twice a day over two weeks in the summer, with a five-day cumulative lag exposure having the greatest effect in 473 nonsmoking women in Virginia.13 The morning peak expiratory flow rate reductions were associated with O3 mean of 54 ppb and a maximum of 84 ppb.14 The morning peak expiratory flow rate reductions were associated with O3 mean of 84 ppb. During a period of six weeks, mail carriers had twice-daily PEFR measurements. The nighttime PEFR decrease was correlated with 8-hour O3 levels with a lag of 0–2 days while controlling for PM, temperature, humidity, sex, age, and illness status.

Inflammation

Adult participants were exposed to 120 ppb O3 for 6.6 hours in a chamber during a research conducted by Folinsbee and colleagues. The investigators found that the pulmonary function decrements increased after each hour of exposure, reaching average values of about 400 ml for forced vital capacity and about 540 ml for forced expiratory volume in one second by the end of the day. Moderate exercise was performed for 50 minutes every hour for 3 hours in the morning and again in the afternoon. There were no residual function decreases the next day, indicating that the effects were temporary. After 6.6 hours of exposure to 120 ppb, the decreases in FEV1 were 13% on average. Follow-up investigations comprised 6.6-hour exposures at 80, 100, and 120 ppb doses. The results at 120 ppb supported the earlier findings, although those at 80 and 100 ppb revealed less significant alterations that, nonetheless, similarly become steadily more pronounced with exposure time17. For exposure at 120 ppb for 6.6 hours, McDonnell et al. modeled the data from 68 healthy nonsmoking people evaluated using this protocol at the EPA Chapel Hill, North Carolina, laboratory and found that 46% would have a FEV1 decrease of less than 10%. The decline in pulmonary function with increased O3 exposures.

Reactivity and inflammation in the airways

Ozone is an irritating gas that enhances the responsiveness of the airways to inhaled methacholine, a measure of airway reactivity. Not all participants exhibit airway hyperreactivity, and those with asthma and allergies may be especially vulnerable. Bronchial hyperreactivity may be raised by ozone's interactions with particles and other gaseous contaminants. Horstman and colleagues'18 follow-up experiments on healthy volunteers exposed for 6.6 hours to concentrations of 80, 100, and 120 ppb revealed 56, 89, and 121% increases in methacholine reactivity, respectively. 19 Jorres et al.20 exposed twenty-four subjects with mild stable allergic asthma, twelve subjects with allergic rhinitis without asthma, and ten healthy control subjects to 250 ppb O3 or filtered air for three hours with intermittent exposure.

The low dose of O3 increased bronchial responsiveness to allergen, reducing by almost two-thirds the amount of allergen required to produce a 15% decline in FEV1. As compared to filtered air, the methacholine or allergen dosage after O3 increased by more than double in the asthmatic patients, whose FEV1 fell by 13%. When O3 and filtered air were followed by allergen inhalation in the rhinitis-prone patients, respectively, mean FEV1 fell by 7.8% and 1.3%. A bronchoalveolar lavage was performed three hours after Seltzer and colleagues exposed 10 healthy subjects to ozone or air at 0.4 or 0.6 ppm. Ozone exposure increased bronchial hyper-reactivity, methacholine responsiveness, neutrophils, and prostaglandins in the BAL, and responses were greater with the higher dose of ozone [8], [9]. In order to study ozone-induced inflammation in the lower airways directly, the EPA established a Health Effects Research Laboratory at their Research Triangle Park, North Carolina, facility.22 They showed an exposure-response relationship at three levels of exposure while also demonstrating inter-individual variation.

Eleven healthy people were initially exposed to 0.4 ppm O3 for two hours while exercising, and then they underwent BAL the following day. Eight-fold more neutrophils were present, and biochemical alterations in the BAL fluid included increases in prostaglandins, fibronectin, and neutrophil elastase. They also included a nasal lavage and noted an increase in neutrophils immediately after the NL and also the next day at the time of the BAL.23 Next was indeed a lowering of the O3 dose to 0.10 or 0.08 ppm O3, with exercise for a longer time period of 6.6 hours followed by BAL the next day.24 Two very different exposure levels caused inflammation

inside the lower respiratory tract with increased neutrophils, prostaglandins, fibronectin, interleukin-6, and decreased alveolar phagocytosis. These studies were confirmed by Aris and colleagues at the University of California-San Francisco, where 14 volunteers were exposed to 0.20 ppm O3 for 4 hours while exercising and having a BAL examination of the proximal airway to determine how irritating O3 gas was. They discovered increases in neutrophils as well as the same biochemical parameters, such as interleukin-8, a chemotactic protein for neutrophils. Moreover, mucosal biopsies were performed in order to demonstrate the neutrophil infiltration after O3 exposure in comparison to filtered air using histology. The progression of O3-related side effects upon exposure.

FEV1 decreased immediately after exposure to 0.3 ppm for 1 hour on three different days, whereas the proximal airway neutrophilia peaked at 6 hours and persisted until the next day.26 Kinney and colleagues reported on fifteen U.S. BAL fluids in the summer contained increased amounts of lactic dehydrogenase, IL-8, and prostaglandin E2, according to research done by the Coast Guard on joggers on Governor's Island in New York Harbor. Five asthmatics and five control subjects exposed to 0.20 ppm O3 in chamber studies had no change in FEV1 but developed significant increases in next day BALs of neutrophils from 1% to 12%, IL-6, and IL-8. This suggests that asthmatics may be particularly sensitive to the irritant properties of inhaling O3 for 6 hours and performing exercise. Much inter-individual heterogeneity existed in these chamber trials, and methacholine tests for bronchial hyperreactivity were unable to identify individuals who would respond to O3. There was no additional effect from allergen exposure on pulmonary function, BAL neutrophils, or cytokines in a study of fourteen asthmatics exposed to O3 at 0.20 ppm for 1 hour to exercise, which is a negative study. However, a subgroup of nine people were more sensitive to allergen exposure and had more neutrophilia.29 A meta-analysis from twenty-one publications and demonstrates a linear relationship between neutrophils at 6-hour or 18-hour.

Regarding pulmonary function, methacholine reactivity, or neutrophil recruitment, two weeks of pretreatment with 800 mg twice daily of inhaled budesonide did not offer any protection against inhaled O3. Samet et al.32 investigated the pulmonary effects of O3 on healthy adults with and without dietary antioxidant supplementation and discovered that the antioxidants reduced the O3-induced functional decrements but did not affect its effect on increasing neutrophils and IL-6 in BAL fluid. As measured by proliferating cell nuclear antigen, rats exposed to a single dose of O3 had increased proliferation of bronchial and alveolar epithelial cells. Short-term, one-hour exposures of alveolar macrophages to 0.4 ppm O3 throughout vitro increased release of inflammatory cytokines IL-1b, IL-6, IL-8, and TNF-a approximately fourfold over control. Matrix metalloproteinases were shown to have a function in O3-mediated lung damage using transgenic mutant mice exposed to O3 in chamber studies, with MMP-9 having a protective effect but MMP-7 not.34 Corticosteroids decreased this from 19.2% to 10.9% and reduced the neutrophil influx. O3 exposure to transgenic mice missing these genes also revealed that the transcription factor NF-kB, the tumor necrosis factor-a receptor, and the signaling routes to the nucleus were all necessary for the inflammatory effects of O3.

Populations Exposed to Ozone in Ambient Air: Epidemiological Studies

Because the population is also exposed to other pollutants in the ambient air that might affect the observed responses or to other environmental challenges that might produce comparable effects, such as environmental tobacco smoke, other pollutants in indoor air, and allergens found in both indoor and outdoor air, observational studies of the influence of O3 on human health are frequently difficult to interpret.

A new diagnosis of asthma was sought among 3,535 children without a history of the condition in twelve communities over the course of a five-year longitudinal study in the Children's Health Study from Southern California.38 Six communities had increased O3 concentration, and 265 children reported a new diagnosis of asthma over the course of the study. The relative risk—the risk of an event related to exposure of developing asthma in children participating in three or more sports was linked to a greater prevalence of asthma in regions of high O3 but not in areas of low O3 in six communities with high O3 concentration. Team sports had the same impact even when they were exposed to contaminants besides oxygen. Due to central air conditioning, children inside the school are only exposed to 15% of the O3 concentrations outside, but when they play outside, they are subjected to daily peak O3 exposures. Further research on gene-environment interactions was pursued in this carefully monitored cohort of children and their exposure to air pollutants.

Airway oxidative stress is a cardinal feature, and antioxidant enzymes exist to counteract effects of reactive oxidant species. School absences for respiratory tract illnesses increased 63% in association with a 0.02 ppm increase in O3. Heme oxygenase, superoxide dismutases, and catalase are antioxidant enzymes; they contain functional polymorphisms that may increase the risk of developing asthma. 576 Hispanic and 1,125 non-Hispanic children from the Southern California Children's Study were eligible for this research, and 1,690 of them had newly developed asthma. Non-Hispanic whites with heme oxygenase short alleles had a lower chance of developing asthma, but Hispanic children with the Catalase-262 T gene had a higher risk. There is a 2.7-fold increase in mortality for people over 65 per 10 ppb O3, a 2.8-fold increase for black people compared to non-black people, a 1.9 increase for women over 60 compared to men, a 1.7-fold increase for atrial fibrillation per 10 ppb increase in O3, and an increased risk of reduced FEV1 with O3 exposure with obesity, according to other susceptibility studies.

Children who play outside have been particularly at risk from ambient ozone, especially in the summer when school is out, ozone levels are at their highest, and traffic is at its highest. For every interquartile-range increase in same-day 24-hour O3, wheeze increased 37% in Virginia, where 691 infants participated in a time-series study over the summer of 1995.41 Among infants of asthmatic mothers, same-day 24-hour O3 increased the likelihood of respiratory symptoms to 59% and of difficulty breathing to 83%. Mortimer and colleagues followed a cohort of 846 inner-city asthmatic children, noting that those with low birth weight had increased respiratory symptoms and a greater decline in morning percentage peak expiratory flow rate in relation to O3.42 Pediatric emergency room visits during the summers of 1993–1995 in Atlanta were correlated by zip code to O3 and PM10 with more than 6,000 asthmatics. There was a linear correlation of O3 and PM10 with pedi- atric emergency room visits, and there was also When the Summer Olympics were held in Atlanta in 1996, the city redirected traffic.

Friedman et al. conducted an ecological study comparing the seventeen days of the games to the four-week periods before and after for children's acute care.44 Using several databases, including the Georgia Medicaid claims file, asthma acute care events decreased by more than 40% during the games, and peak daily O3 concentrations decreased by 28% while traffic decreased by 23%. A 30% increase in chest tightness was linked to a 50 ppb rise in 1 hr O3.45 O3 >0.063 ppm for an 8-hour peak on the same day in an epidemiologic study of 271 asthmatic children aged 12 or younger attending a summer camp in southern New England. Shortness of breath and prolonged coughing were similarly linked to one-day delays. Just the half of the sample that used maintenance medication found these statistics to be noteworthy. The greatest level of same-day O3 was connected to more frequent usage of bronchodilators. PM2.5 was not linked to bronchodilator

usage or respiratory symptoms. Consequently, the group may be divided into two degrees of air pollution O3 susceptibility based on the severity of asthma. In Detroit, a two-year longitudinal study of 86 inner city schoolchildren revealed startling 8-hour peak O3 levels.

The majority of Atlanta's hospitals' emergency departments participated in the Study of Particles and Health in Atlanta 1993-2000, in which 11% of 4.5 million ER visits were due to respiratory causes.47 PM10, O3, NO2, and CO were each individually associated with 1%-3% increases in upper respiratory infection. The subgroup of asthmatic children on corticosteroids had significant associations with both O3 and PM and reduced FEV1.46 With O3, the risk ratios were highest at lags of one and two days, and they were highest for delays of five to eight days for visits for asthma. In the summer, O3 and PM2.5 had greater correlations with asthma. The California Air Resources Board examined hospitalizations for asthma in children between the ages of zero and nineteen between 1983 and 2000, and discovered a correlation between home air pollution levels and quarterly asthma hospital discharges.

Increasing ambient O3 causes decreased lung function and increased respiratory symptoms, including an aggravation of asthma, particularly in children. Burnett et al.49 demonstrated that the impact was highest at a one- or two-day lag but biggest of all for a dispersed lag over four days in an investigation of respiratory hospital admissions in fourteen Canadian cities. They used daily time-series to account for the effects of the day of the week, season, and weather while analyzing hospital admissions in Toronto from 1980 to 1994 for acute respiratory admissions in children under the age of two. A 5-day moving average was related with a 35% increase in daily admissions for respiratory illnesses.

highest O3 concentration of 0.045 ppm per hour every day from May to August. An independent impact of 9.61% of all pollutants combined was shown to be associated with neonatal respiratory morbidity in eleven Canadian cities.50 Modifying variables, such as ambient temperature, aeroallergens, and other co-pollutants, might also influence this connection. Ozone air pollution may contribute to certain hospital admissions and ER visits for respiratory conditions throughout the summer. From these investigations, it has been shown that O3 may be responsible with one to three more summertime respiratory hospital admissions per 100 ppb O3, per million people. In Vancouver, Canada, where the 24-hour average O3 concentration was just 13 ppb, Yang et al.51's recent research found a strong connection between O3 respiratory hospital admissions for elderly patients and children under the age of three [10], [11].

Daily measurements of temperature, PM10, and gaseous pollutants were compared to concurrent data on hospital admissions for people over 65 in a Denver epidemiological study conducted between 1993 and 1997.52 The results suggested that O3 was linked to an increased risk of hospitalization for acute myocardial infarction, coronary atherosclerosis, and pulmonary heart disease. Respiratory hospital admissions, ozone, and PM10 data were compiled during the years 1986 to 1999 in a cross-over study of 36 U.S. cities. The two-day cumulative impact of a 5 ppb rise in O3 during the warm season was 0.27% more hospitalizations for COPD and 0.41% more for pneumonia. With a 10 mg/m3 rise in PM10 over the same time period, there were increases in COPD of 1.47% and pneumonia of 0.84%.

CONCLUSION

Particulate matter smaller than 2.5 microns has been shown to be hazardous to human cells and is capable of penetrating deeply into the lungs. Increased hospitalizations and cardiopulmonary mortality have been shown in epidemiologic research. Regulations have proved to be difficult since

there are so many sources, particularly stationary and trans- port sources like coal-fired power plants. In addition to performing gas exchange, endogenous and foreign agent metabolism, and disease and chemical harm protection, the respiratory system also carries out a variety of other tasks. Its anatomical structure and many cells with specific roles make it well adapted to do these tasks.

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CHAPTER 4

A STUDY ON OZONE STANDARD

Ms. Meenakshi Jhanwar, Assistant Professor
Department of Environmental Science, Presidency University, Bangalore, India
Email Id-meenakshi@presidencyuniversity.in

ABSTRACT:

The current main and secondary standards are 0.070 parts per million (ppm), which is the fourth-highest daily maximum 8-hour concentration, averaged over three consecutive years. They were set from the preceding year. In this chapter author is discusses about the acid rain.

KEYWORDS:

Acid, Environment, Ozone, Policy, Pollution.

INTRODUCTION

Data from prior time-series mortality studies that had not accounted for ambient temperature were examined by Thurston and Ito54. A RR 14 1.036 per 100 ppb rise in daily 1-hr maximum O3 was obtained from the combined study. Nevertheless, a combined estimate of RR 14 1.056 per 100 ppb was produced by the subgroup of research that specifically stated the nonlinear nature of the temperature-mortality connection. This shows that the pre-mature mortality effects of O3 air pollution have been underestimated in previous time-series research employing linear temperature-mortality parameters. Weather control is a specific issue for O3 investigations since high O3 days are often quite warm. In a study of more than one million deaths in fourteen U.S. cities, Schwartz used a case-crossover methodology and matched a day by temperature with the date of death with O3 as the independent variable.55 He discovered that when matching on temperature, there was an association of 0.23% with a 10 ppb increase in maximum hourly O3 concentrations.

The result was limited to the summer season, unaffected by PM, and equivalent in size to seasonal matching when temperature was controlled for by regression splines. O3 epidemiology study findings on increased mortality are significant since mortality dominates cost-benefit calculations when creating a health standard. The Atmospheric Information Retrieval System data on ambient O3 from 95 U.S. communities were used by the National Mortality and Morbidity Air Pollution Study to correlate with daily mortality data.56 A positive association was found in all but two communities, and a statistically significant association was shown for seven communities and for the 95 as a whole.57 The 95-community effect was strongest on the same day, and highly significant for o. Estimates of the short-term impacts of O3 on mortality at the national and community levels were unaffected by the addition of PM10 or PM2.5 in time-series models [1]–[3].

The EPA hired three separate scientific teams to do meta-analyses of various teams' methods for examining O3 exposures and mortality. In all three investigations, Bayesian hierarchical models were used, and it was discovered that PM interaction with O3 was typically insignificant. Ito and coworkers used data from fourteen U.S. cities, thirteen Canadian cities, and twenty-one European cities (excluding NMMAPS) and discovered a combined estimate of 0.39% per 10 ppb increase in

1-hour daily maximum O3.58 Even though air conditioning was not common during this time in Europe, the prevalence of air conditioning in North America lessened the exposure-mortality association. In their meta-analysis, Bell et al. used NMMAPS to combine data from 39 time-series studies with 144 effect estimates with lags, age groups, cause-specific mortality, and concentration metrics.59 They found that a 10 ppb increase in daily O3 at lags of 0 or 1 day was linked to an increase in total mortality of 0.87%, with higher rates for cardiovascular and respiratory mortality. Since weather influences were more aggressively adjusted for, the NMMAPS estimate was consistently higher. Seven of the 71 time-series studies on O3 that Levy et al. examined

Total mortality was shown to have risen by 0.41% per 10 ppb O3.60 The largest O3 mortality connections were seen in Brisbane, Australia, and Mexico City. These cities do not have any seasonal impacts. There was a relationship between O3 and mortality only in the summer, with a mean increase in overall mortality of 0.33%, cardiovascular mortality of 0.45%, and respiratory mortality of 1.13% per 5 ppb O3 (according to a recent analysis of European data). To see if O3 exposure only moves mortality toward otherwise susceptible elderly with chronic cardiopulmonary disease, mortality during the months of June through August was correlated to various lags in a study of 48 U.S. cities between 1989 and 2000.62 The authors found a 0.3% increase in total mortality for a 10 ppb increase in 8-hour O3 at lag 0 during the summer. The link between ozone and daily fatalities wasn't caused by a short-term mortality bias. The public health effect of risk estimates based on a single day of O3 exposure is more likely to be underestimated than overestimated.

In two-pollutant models, PM2.5 was associated with the risk of death from cardiovascular causes, so even though ozone was associated with the risk of death from respiratory causes. This was evaluated from eighteen years of follow-up with the American Cancer Society II cohort correlated to air pollution data from ninety-six metropolitan statistical areas in the United States. An increase in ozone concentration of 10 ppb was calculated to be related with an increase in the relative risk of mortality from respiratory causes of 1.040, or nearly 2.9%.

Oxides of Nitrogen

Controls for the O3 standard must take into account nitrogen dioxide since it is a crucial NAAQS-regulated contaminant and helps create oxygen. Due to the presence of other gases, such as nitric oxide, nitrous oxide, nitrogen peroxide, and nitrogen trioxide, nitrogen dioxide is often referred to as NOx. Inner-city vehicle and truck traffic, electrical utilities, refineries, and gas-fired indoor ranges are a few sources. In the United States, the average maximum hourly concentrations were about 30 ppb with peaks to 200 ppb, particularly along high-traffic roadways. Yearly average outdoor concentrations declined by 41% from 1980 to 2006. In 1971, a nuclear average standard of 53 ppb was established.

These irritating gases are comparable to ozone. Increased non-specific airway hyper-responsiveness was shown in chamber investigations of healthy volunteers exposed to NO2 levels of 7,500 ppb for 1-2 hours.64 Asthmatics who were exposed to levels as low as 300 ppb for 30–60 minutes while exercising had decreased pulmonary function. Patients with COPD exhibit higher airway resistance at 1,600 ppb during exercise. In certain homes in the Harvard Six Cities Study, indoor exposure to NO2 from gas stoves has been linked to an increase in respiratory infections in children under 2 years old. The pulmonary function was same, although

As compared to houses with electric stoves, wheezing and shortness of breath were more common. Children with asthma in Tucson, Arizona, had substantial reductions in peak flow as a result of gas

stoves. Epidemiology studies connected NO2 within the current standard to decreased lung function, increased asthma symptoms, and an increase in emergency hospital visits.65,66,67,68 Clinical studies showed increased airway responsiveness to allergen challenge in patients with asthma.68 In January 2009 the EP issued a recommendation to increase the EP's recommended indoor NO2 limit to 15 ppb. The 1-hour standard would take the shape of the 98th percentile of the yearly range of daily maximum 1-hour average concentrations, averaged over three years.

The Ozone Standard in NAAQS

More people are impacted by the ozone standard than any other air quality standard. Ozone nonattainment regions are where 156 million Americans, or about half the country's population, reside. In 1979, a U.S. NAAQS of 120 ppb for O3 using a 1-hour average period was set, which cannot be exceeded more than twice annually. It was mostly predicated on the assumption that afternoon peaks in ambient exposure would be rather acute. It has been shown that ambient O3 concentrations in New Jersey often experience wide daytime peaks maximum 8-hour averages are quite similar to peak 1-hour values at 90%. Ozone guidelines of 1 hour are thus irrelevant since exposure lasts 6–8 hours. The EPA administrator issued a new O3 NAAQS in 1997 with a 0.08 ppm 8-hour average concentration level that could only be exceeded three times annually [4]–[6].

The American Trucking Association sued EPA before it could publish the 1997 O3 regulation, claiming that EPA should have taken economic considerations into account while establishing the updated threshold. 2002 saw the U.S. The Supreme Court unanimously rejected that claim, with Justice Antonin Scalia writing the opinion, "Were it not for the hundreds of pages of briefing respondents have submitted on the issue, one would have thought it fairly clear that this text does not permit the EPA to consider costs in setting the standards." Executive Order 12866, however, mandates that agencies conduct cost-benefit analyses prior to the publication of regulations. The White House Office of Management and Budget is in charge of enforcing these provisions, and within OMB, the Office of Information and Regulations is in charge of determining whether regulations are likely to have "an annual effect on the economy of $100 million or more" or "adversely affect in a material way the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities."

A regulatory effect analysis is the ultimate result of the evaluation that the agencies issue. A net benefit calculation—the difference between expected costs and benefits is the result of the RIA. All agency evaluations, including the RIA itself, include various degrees of significant assumptions and uncertainties. It was exceedingly challenging to financially account for repeated exposures on health outcomes and to account for future technology advancement in the O3 NAAQS. A statistical life saved in the year 2020 resulted in a $6.6 million benefit to society, according to the O3 RIA's benefits assessment. According to the NMMAPS study's predictions, a standard of 0.070 in 2020 will result in decreased exposure saving between 670 and 4,300 lives, with a net benefit range of negative $17 to $16 billion. The scientifically supported link between ground-level ozone exposure and premature death has often been questioned by OIRA in OMB. These are political factors influenced by the president-elect and the policies and goals of his or her political party. A recess appointment gets around the Senate's confirmation procedure that applies to presidential nominations to OMB and OIRA. If there is no causal link between O3 and a health result, the OIRA required EPA to add; OIRA might expand the bottom limit of the benefits range for any regulation option.

The RIA might thus be used as evidence against a stricter standard by those who oppose regulation, the White House, and business lobbyists. The National Association of Manufacturers, for instance, said after the publication of the O3 RIA, "If we're going to go ahead with something so incredibly costly, we believe we need greater clarity." Cost-benefit analysis ought to be a relatively modest element in the evaluation of public health legislation. OIRA has the authority to modify proposed rulemaking and alter the scientific focus, which has the unfortunate effect of raising costs. This gives industry a means of undermining support for the improved health outcomes that Congress had in mind when establishing the Clean Air Act and overseeing EPA. The National Academy of Sciences 69 concluded that there was good evidence linking O3 exposure to mortality after reviewing the available scientific data and risk estimations. The NAS is regarded as a nonpartisan source of scientific interpretation knowledge. The investigation came to the conclusion that secondary pollutants or the confounding effects of temperature were not to blame for the O3-related fatalities.

Each year from 2000 to 2002, 36% to 57% of ozone sensors did not fulfill the criteria. The present level of 0.08 ppm should be lowered, according to a staff document published by the EPA on January 30, 1997. A level of 0.084 was nevertheless considered to be within conformity with this requirement. They suggested that the limit be determined by the EPA administrator between 0.80 and 0.060 ppm. The World Health Organization, Canada, and the United Kingdom all utilize 0.060, whereas the body of research on ozone's health consequences as a whole "clearly calls into question the appropriateness of the present threshold." 0.050 ppm is the target. The ozone secondary standard, which was similar to the main standard from 1997, was also evaluated by the EPA. Crop yields and tree development are both impacted by ozone, and exposure causes cumulative harm over the course of the growing season. The standard should be updated to include a new seasonal average that would add up hourly ozone exposures for the 12-hour daily daylight window [7], [8].

After examining 2,000 pages of data, the ozone subcommittee of the Clean Air Scientific Advisory Committee unanimously recommended that EPA establish the main 8-hour limit in 2006 at a level between 0.070 and 0.060 ppm and that a secondary standard have an upper maximum of 15 ppm-hours. The EPA suggested tightening the limit to 0.070-0.075 on June 20, 2007, but left open the option of maintaining the present level of 0.085 or reducing it to 0.060. The EPA allowed for written comments, public hearings, and discussions with the EPA administrator before publishing the final rule. In a letter to the EPA administrator, the ATS Environmental Health Policy Committee recommended a threshold of 0.060 ppm for the 8-hour limit, indicating that the data was "compelling" and that there was no room for disagreement or question among respiratory experts. Broad coalitions of industry organizations developed to oppose the tougher requirement, arguing that the research was too ambiguous and that the present standard hadn't had enough time to take effect. The amount of background ground-level ozone, according to them, was 0.040 ppm, which was greater than EPA's projections.

The NAM, oil industry stakeholders, and representatives of agriculture and the White House OMB gathered to go through the final ozone ideas. According to the American Corn Growers, "raising the main and secondary standard will push a number of rural areas out of attainment for the first time ever." The National Association of Manufacturers organized a backlash against the new regulations and made public a letter signed by 11 governors objecting to the EPA rule that was being proposed. The California Air Resources Board established a state limit of 0.070 ppm, but this was only valid if it was approved by the EPA. California is home to 8 of the top 10 ozone-producing counties in the nation, with San Bernardino County ranking first. An advocacy

organization called Clean Air Watch said that it was seeing a true business campaign to prevent the EPA from establishing stricter ozone limits.

Steven Johnson, the administrator of the EPA, agreed to meet with the chief executive officer and one other representative from other environmental organizations. The American Lung Association, the American Thoracic Society, the American Academy of Pediatrics, the American Public Health Association, Environmental Defense, and the Natural Resources Defense Council were among the eleven organizations represented at the conference. The likely mortality consequences of ozone were used by environmental and health organizations to refute industrial claims that the health effects of ozone were reversible. The ALA said, "Premature death is not a reversible health impact." Administrator Johnson of the EPA asked for details on a chamber research, one asthma study, and background ozone levels. Schildcrout et al. analyzed criterion pollutants on daily symptoms and rescue inhalers among 990 kids in eight North American cities during 1993 and 1995 for their research on asthma.

Since it found no significant effect of ozone on the worsening of asthma in the children in eight cities during the year-long study of five of the NAAQS criteria pollutants, opponents of a stronger ozone standard apparently used this in meetings with the EPA. They discovered that lags in CO and NO2 were positively associated with both measures of asthma exacerbation. The authors noted that this "result" was "not surprising" and listed twelve other studies to support their claim that ozone had previously been shown to be harmful to asthmatic youngsters. The research may have been underpowered to detect any effects of ozone because on average, only twelve children were monitored on any given day, making it difficult to capture the effects of O3. This is a fair explanation provided by the authors for the anomaly. The Adams chamber study, which involved 30 healthy young adults who were exposed to oxygen for 6.6 hours while engaging in moderate exercise, was the other study that the EPA administrator reviewed.

Consistent with earlier research, Adams reported statistically significant effects of oxygen on FEV1 and respiratory symptom responses at 0.08 ppm. Adams72 observed a significant O3 impact only on a total symp- tom score for the triangular 0.060 ppm O3 procedure after 6.6 hours of exposure when the O3 concentration was below 0.08 ppm. The author did a two-way analysis of variance with repeated measurements that was not significant when compared to filtered air with the primary goal of examining the pattern of responses at each hourly time interval. The author minimized type I errors while doing repeated comparisons by using a conservative test, the Scheff'e post hoc test; nevertheless, this approach may raise type II error for the straightforward assessment of pre- to post-exposure effects of O3 vs filtered air on FEV1. In contrast, EPA staff's evaluation of pre- to post- exposure effects found that there was a lack of an overlap in the range of re- sponses at 0.060 ppm O3 versus filtered air at t-test was statistically significant different from filtered air. The paired t-test has been the commonly used statistical test used by investigators of chamber studies comparing short or long exposure to filtered air for a group of individuals. After carefully examining this variation, the CASAC O3 panel recommended using the paired t-test strategy as the optimal technique for comparing the pre- and post-exposure lung function responses.

FEV1 and symptom recovery rates were shown to be correlated with total O3 dosage, according to Adams71,72, who modeled pulmonary function response data from investigations that included 2-hour and 6.6-hour exposures as well as the recovery periods that followed. In 2009, Schelegle and colleagues replicated the Adams trial with 31 healthy people who underwent five 6.6-hour chamber exposures with mean O3 values of 60, 70, 80, and 87 ppb. After exposure to mean concentrations of 70, 80, and 87 ppb, the number of emergency room visits, nonfatal heart attacks,

and premature deaths were assessed, and there were statistically significant decreases in FEV1 and increases in the overall subjective symptom ratings. According to EPA's RIA, the benefits outweighed the standards' implementation costs, which ranged from $7.6 billion to $8.5 billion. According to the EPA, states and local governments have three years to comply with the new standard and twenty years to do so. As of 2020, according to the EPA, the new limit will save more than 260 premature deaths, 890 heart attacks, and 200,000 missed school days annually. The EPA examined the health advantages of meeting the 8-hour requirement that was in force in 2000, 2001, and 2002. Reductions in included in the average of the health effects across the three years were

800 untimely deaths, 4,500 hospital and emergency department admissions, 900,000 missed school days, and more than 1 million minor restricted activity days are associated with costs of $5.7 billion.75 The assumption of a true background level of O3 of 40 ppm was pushed by industry because it would reduce impacts by 30% to 60%. On May 27, 2008, the revised ozone level was contested in federal district court as being too lenient by five environmental organizations, fourteen states, and two cities, with industrial interests moving to have the threshold loosened. The Obama EPA informed the court in September 2009 that they will review the Bush-imposed ozone NAAQS, in part because the Bush administration had rejected the CASAC's proposal for an even stricter limit than 75 ppb.

DISCUSSION

A colorless, highly soluble, and reactive gas, sulfur dioxide. Electric power stations are responsible for around 65% of the SO2 that is discharged into the atmosphere, with 35% coming from sources related to metalworking, industry, and fuel combustion. Water or water vapor may dissolve SO2 to generate a number of acidic sulfates. In North America, SO2 concentrations as 1-hour averages are 0.2-0.3 ppm due to point sources from smoke stacks from industrial and electric power plants dispersing the gas in a 20 km radius. Between 1983 and 2002, the outdoor ambient SO2 concentration declined by 54%, mostly as a consequence of lower emissions from factories and power plants. From 31,161,000 tons in 1970 to 18,867,000 tons in 1999, emissions have decreased, mostly as a result of flue gas desulfurization caused by the addition of calcium oxide, which combines with SO2 to produce calcium sulfite. After the 2007 rules for diesel trucks, stricter regulatory limitations on the quantity of sulfur in fuels will further decrease annual SO2. Kerosene-burning indoor space heaters are a cause of SO2 indoor air pollution. As opposed to ozone, particulate matter, and hazardous air pollutants, ambient SO2 levels have been decreasing, therefore there has been less focus on SO2 regulation for health impacts [9]–[11].

A mixture of combustion-related gases in the atmosphere, such as SO2 from power plants and industrial facilities, and nitrogen oxides from power plants, automobiles, and other combustion sources, cause "nucleation," or the formation of fine and ultrafine particles in ambient air. Both sulfate-containing PM and acidic aerosols have significant effects on health and ecology. In the northeastern United States, a significant portion of PM exposure is caused by secondary production of PM, with SO2 and nitrous oxide as the main acknowledged precursors. Industrial ultrafine particles and SO2 may combine to generate bigger fine particles. Just 2% of SO2 can get through the glottis and is either scrubbed or absorbed in the nasal turbinates. While exercising while mouth breathing, this increases because SO2 may be absorbed in the aqueous lining of the respiratory epithelium and enter the lower respiratory tract, where its irritating qualities can lead to bronchoconstriction and airway inflammation.

A combination of wet and dry deposition from the atmosphere that contains greater than usual levels of nitric and sulfuric acids is what is often referred to as "acid rain." Acid rain precursors, or chemical forerunners, are produced by both natural and artificial sources, notably sulfur dioxide and nitrogen oxide emissions from the burning of fossil fuels. Natural sources include volcanoes and decaying vegetation. Around two-thirds of the SO2 and one-quarter of the NOx emissions in the US are caused by the burning of coal and other fossil fuels in the production of electricity. When these gases interact with water, oxygen, and other substances in the atmosphere to generate different acidic compounds, it results in acid rain. The outcome is a moderate mixture of nitric acid and sulfuric acid. Prevalent winds carry sulfur dioxide and nitrogen oxides over state and international boundaries, often across hundreds of miles, when they are emitted from power plants and other sources. Infrastructure, marine life, and plants may all be harmed by acid rain.

Health Consequences of SO2

Many studies have shown a connection between SO2 exposure and an increase in overall mortality as well as death from lung cancer. The National Mortality and Morbidity Air Pollution Study also examined SO2 and found no significant associations with total mortality.3 An international study of pulp and paper workers with 40,704 SO2-exposed workers found no significant associations between total mortality. For instance, the study of the American Cancer Society cohort that reported the link between mortality and criteria air pollutants found that the relative risk of all-cause mortality from sulfate exposure was 1.25 and was higher at the county level with an RR of 1.5. It was hypothesized that weighted cumulative SO2 exposure and lung cancer mortality had a favorable association. They demonstrate that exposure to SO2 increases mortality.

At 10 ppm, SO2 is a respiratory irritant that may cause coughing, dyspnea, eye and throat irritation, and reflex bronchial constriction. All power plants and motor vehicles in Hong Kong were required to use fuel oil with a sulfur content of no more than 0.5% by weight as of July 1990.5 Over the following 12 months, there was a decline in seasonal deaths, which was followed by a peak in the cool season death rate between months thirteen and twenty-four, before returning to the expected pattern during years 3-5. The average yearly trend for fatalities from all causes, respiratory 3.9%, and cardiovascular 2.0%, all decreased. For females and men, respectively, the average increase in life expectancy per year of exposure to the lower pollutant concentration was twenty days and forty-one days. Children's symptoms of chronic bronchitis and bronchial hyperresponsiveness decreased two years following the intervention. Respirable particles decreased during two years whereas SO2 decreased by 45% over five years.

Daily mortality was examined in a district of Chongqing, China, from January through December 1995, looking for associations with daily ambient sulfur dioxide and fine particles.7 Particulate matter smaller than 2.5 mm in diameter was monitored for seven months, while SO2 was monitored for the entire year. The researchers discovered links between daily ambient SO2 concentrations and death from cardiovascular and respiratory diseases. For instance, a 100 mg/m3 rise in daily SO2 concentrations resulted in a 1.20 relative risk for cardio-vascular death, with a three-day maximum latency. When PM2.5 was taken into account, the SO2 relationship remained strong. There were no links found between the daily ambient PM2.5 concentration and any cause of death. The lack of measurements for carbon monoxide, ozone, or nitrogen dioxide was a flaw in this research. With a population of 30 million, Chongqing is one of China's biggest cities. It utilizes high-sulfur coal for electricity, with sulfur levels ranging from 4% to 12%.

PM10 variations. Only for PM10 did study participants over 65 years old have substantial daily cardiovascular hospitalizations. According to this research, SO2 pollution has a role in precipitating ischemic cardiac episodes. Sulfur dioxide concentrations were related to asthma hospitalizations in girls and CO exposure and asthma hospitalizations in boys, according to a study done in Toronto on 7,319 admissions for asthma in children aged 6 to 12 years between 1981 and 1993. Nitrogen dioxide was positively related to asthma admissions in both sexes. Boys' CO and NO2 lag times were two to three days, whereas females' SO2 and NO2 lag times were six to seven days. Once PM was taken into account, these effects persisted. Pollution measurements at the time included total suspended particles, total suspended particulates that are smaller than 100 m, SO2, and total sulfates. Ware et al. reviewed data from the Harvard Six Cities Project. All three pollutants were significantly linked to cough in preadolescent children. TSP was linked to bronchitis and lower respiratory illnesses.

In South Korea, Lee et al. assessed the connections between low birth weight and air pollution.11 Low birth weight tended to rise with CO exposure between months 2 and 5 of pregnancy, PM10 exposure between months 2 and 4, and SO2 and NO2 exposure between months 3 and 5. In Taiwan, 92,288 full-term babies were evaluated in relation to SO2 exposure in the first trimester as part of a retrospective cohort research. In comparison to exposures to SO2 less than 0.007 ppm, higher exposure levels, beyond 0.011 ppm, were linked with a 26% increased risk for low birth weight in term pregnancies12. No other air pollutants were related with any appreciable enhanced risk.

Research involving normal participants exposed to SO2 in human exposure chambers reveal effects at 1-2 ppm, including lower forced expiratory volume in 1 second and respiratory symptoms, while asthmatics demonstrate bronchoconstriction at 0.5 to 0.1 ppm. There was no evidence of an alteration in antimicrobial defense and there was no association between sulfuric acid aerosol exposure and an inflammatory response as measured by bronchoalveolar lavage in healthy non-smoking volunteers.13 Carlisle and Sharp reviewed the relationship between athletic activity and the risks of exposure to outdoor ambient air pollution, particularly carbon monoxide, nitrogen oxides, ozone, PM, volatile organic compounds, and sulfur dioxide,14 and concluded that "athletic exercise increases the risks of exposure During only 5 minutes of exposure, airway resistance may rise by up to 100% in those with asthma who are exercising while inhaling 0.5 ppm of SO2. One of the causes for exercise-induced airway constriction in patients with asthma may be SO2. In a recent survey of Olympic winter athletes, the overall incidence of exercise-induced bronchospasm was reported to be 23%.14 Forty-seven asthmatic subjects between the ages of 18 and 39 were tested for SO2 sensitivity by being exposed to the gas for 10 minutes while engaging in moderate exercise.15 Of these subjects, 25 (or 53%) experienced a decrease in FEV1 of at least 8%. In this group, asthma severity did not predict SO2 reactivity. Sulfur dioxide and acidic aerosol exposures modify mucociliary clearance, according to studies on both people and animals. The ability of the ciliated epithelium and the mucous layer that covers it to function properly is necessary for the removal of inhaled particles from the airways. Nasal mucous flow rates were reduced by resting exposure to sulfur dioxide at values as low as 1.0 ppm.

Twenty-two healthy nonsmokers were exposed to 8 ppm SO2 for 20 minutes, including mild activity during the last 15 minutes of exposure, in order to assess the effects of sulfur dioxide exposure in humans16. There were only slight impairments in lung function and mild upper-airway symptoms during exposure. After exposure, the airways were reddened during bronchoscopy, and the amount of macrophages, lymphocytes, and mast cells in the bronchoalveolar lavage fluid had

increased. According to these results, healthy persons who are exposed to high amounts of SO2 have inflammation in their distal airways.

When combined with other pollutants, SO2 exposure may intensify the effects of allergen exposure in asthmatics. Thirteen mildly atopic asthmatic individuals17 were exposed to either air or a combination of 0.4 ppm NO2 and 0.2 ppm SO2 for six hours. Three different exposures to the mixture of gases were given to the subjects, and each exposure was followed by an allergy challenge either right away, 24 hours later, or 48 hours later. At all post-exposure time periods, the researchers discovered that exposure to NO2 and SO2 reduced the amount of allergen needed to cause a 20% decline in FEV1. These results showed that when NO2 and SO2 exposure maxima occur together, asthmatics may be more susceptible to allergens. The impact peaked 24 hours after exposure to these air pollutants and continued for a duration of 24-48 hours [12], [13].

CONCLUSION

This ozone layer plays a crucial role in maintaining life on Earth by absorbing a large portion of the sun's ultraviolet radiation and shielding all creatures living at the surface of the planet from this radiation. Ozone is an irritating gas that is created when NOx and volatile organic compounds are exposed to sunlight, peaking throughout the day. Increases in mortality, modifications to pulmonary function and lung inflammation, as well as negative impacts on asthmatic children, are among the negative health consequences observed. Ozone regulation calls for an 8-hour standard that safeguards those who are vulnerable. The requirement is not being met by about half of the counties in the United States, which calls for significant improvements in traffic and stationary sources like refineries.

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CHAPTER 5

HEALTH POLICY: NATIONAL AMBIENT AIR QUALITY STANDARDS

Dr. Krishnappa Venkatesharaju, Assistant Professor
Department of Environmental Science and Engineering, Presidency University, Bangalore, India
Email Id-venkateshraju.k@presidencyuniversity.in

ABSTRACT:

Pollutant concentrations in the air are referred to as ambient air quality criteria, or standards, and usually apply to outdoor air. The standards are set out for a number of reasons, including planning and other objectives, as well as the protection of human health, buildings, crops, plants, and ecosystems. In this chapter author is discusses the environmental effects of acid rain and deposition.

KEYWORDS:

Air, Environment, Health, Pollution, Policy.

INTRODUCTION

There are basically two U.S. NAAQS for ozone. The air pollution control district's short-term threshold is 0.14 ppm, and it cannot be exceeded more than once a year. According to the long-term norm, the yearly arithmetic mean cannot be higher than 0.03 ppm. These regulations do not cover exposures to SO2 for extremely brief periods of time. It is generally known that even short SO2 exposures during exercise, like 15 or 20 minutes, may significantly decrease lung function in those who have asthma. As a result, the UK has set a 15-minute threshold for outdoor SO2 exposure of 0.1 ppm. The principal NAAQS for sulfur dioxide were reinforced by the Environmental Protection Agency on June 2, 2010, when a new 1-hour limit at a level of 75 parts per billion was established. The two principal limits that were in place 140 ppb assessed over 24 hours and 30 ppb evaluated over a whole year were cancelled by the EPA because they did not provide any more public health protection than the current 75 ppb threshold for one hour.

The updated threshold, according to the EPA, will result in health benefits of between $13 billion and $33 billion, including a decrease in hospital admissions, ER visits, sick days missed at work, and occurrences of exacerbated asthma and chronic bronchitis. The advantages include avoiding between 2,300 and 5,900 premature deaths as well as 54,000 asthma episodes annually. To completely adopt the new standard, it would cost around $1.5 billion in 2020. The EPA has established minimal standards that tell states where they must install SO2 monitors; around 163 SO2 monitoring stations would be necessary statewide. The American Petroleum Institute proposed a 400 ppb threshold for one hour, claiming that the EPA's epidemiological research was contradictory and inadequate and that harmful effects were also reversible and transitory, like a number of other stimuli [1]–[3].

Acid Mist

One of the few ecological challenges that has attracted the attention of scientists, legislators, law-makers, business, and the general public is acid rain, which is caused by emissions of sulfur and nitrogen oxides. Almost a century ago, the idea of acid rain first appeared in literature. The acidic

nature of rainwater collected and analyzed from England was mentioned by an English chemist in a publication from 1872 titled "Air and Rain: The Beginnings of Chemical Climatol- ogy."18 However, it wasn't until the late 1960s and early 1970s that this environmental issue was brought to the attention of scientists and the general public, particularly in North America and Western Europe. Throughout the following two decades, research on and interest in acid rain increased exponentially. Our knowledge of the atmospheric chemistry, deposition patterns, and biological and environmental impacts of acidic deposition has greatly increased throughout this period of acid rain study.

Geographic and political borders are crossed by acid rain, making its environmental, economic, political, and legal repercussions very complicated and sometimes perplexing. When rain, snow, sleet, or hail becomes extremely acidic owing to human activity, particularly the combustion of fossil fuels, it is referred to as acid rain. Gaseous sulfur oxides and nitrogen oxides, which are released during the combustion of coal, oil, and other organic materials as well as during smelting processes, are what cause acid rain.19 These primary pollutants are then further oxidized and hydrolyzed in the atmosphere to produce secondary pollutants, such as the potent mineral acids sulfuric and nitric.

Sulfur oxides are produced naturally by volcanic eruptions and sea spray. The major source of SO2 in the atmosphere is the combustion of fossil fuels in various regions of the globe. In fact, it is believed that human activity is to blame for more than 90% of the sulfur released into the atmosphere in the eastern United States. Three-fourths of the sulfur dioxides created by humans in 1970 came from the burning of fuel, including electricity generated by utilities predominantly in the mid-western United States, particularly in the valleys of the Ohio and Tennessee rivers. Around one-fourth came from industrial operations, such as those in the chemical and petroleum sectors, but by 2002, fuel combustion had replaced industrial activities as the main source of SO2, which had decreased to 9%. Recently, oxygen isotope fingerprinting localized anthropogenically established SO4 pollutant in fine particulate from ship smoke, observing that 4% to 25% of annual fine particulate may originate from sulfate particles from ships burning 2.4% sulfur-containing bunker oil.

This source of pollution is thought to be responsible for 60,000 cardiopulmonary and lung cancer deaths, mostly in ports in Europe and Asia. California and the European Union are requiring 0.1% sulfur marine diesel. The other significant precursor to acid rain is nitrogen oxides. While fossil fuels typically contain far lower amounts of nitrogen than of sulfur, thermal processes that occur when combustion temperatures are elevated sufficiently to oxidize ambient N2 or the oxidation of nitrogenous compounds in fuel result in nitrogen oxide emissions. As a result, atmospheric nitrogen is often a significant source of nitrogen for NOx emissions. The resultant NOx may either be further oxidized, often by interacting with hydroxyl radicals, and hydrolyzed to nitrate and nitric acid, or it can be deposited on surfaces as NO2.

A solution's acid-base condition is determined by all of its chemical constituents, not only the hydrogen ions, sulfates, nitrates, and chlorides. The entire ionic composition of precipitation, which in turn is a consequence of its sulfur and nitrogen content as well as other elements that are released into the atmosphere, react, and then are delivered to the Earth's surface as precipitation, determines the pH of precipitation. In reality, several of these substances play a crucial role in balancing the acidity of rain. For instance, reduced nitrogenous substances that are produced as a consequence of both industrial and agricultural processes, such as ammonia and ammonium, often react with NO3 to form NH4NO3 or sulfate to form 2SO4 and are transported over vast distances.

Base cations are the calcium, sodium, potassium, and magnesium that are present in the atmosphere and are often caused by human emissions, sea spray, the suspension of dirt and dust particles, and a number of other factors. They have the ability to balance precipitation's acidity.

Both sulfur and nitrogen oxides have the potential to travel great distances in the atmosphere as main or secondary pollutants. In order to lower local, ground-level concentrations of particle air pollutants, increasing the height of chimneys and smokestacks was a traditional remedy to local air pollution issues in urban and industrialized regions. One effect of this control method was to inject air pollutants, particularly gases, into the atmosphere at a higher altitude, which caused them to travel further downwind. Since around 1950, the average height of chimneys and smokestacks in the United States drastically increased: in the 1970s, more than 400 smokestacks higher than 60 m were erected, and many of them were expanded to heights of more than 300 m. Hence, local air pollution concerns became widespread air pollution issues. One of the most divisive and politically troublesome parts of the acid deposition debate resulted from this reality. In other words, toxins produced in one location may be dumped in another that is quite far away, leaving the receivers with little options. Moreover, it was challenging to identify and quantify the many sources of the contaminants [4]–[6].

Although rain and snow may account for a large portion of the total deposition to a variety of eco-systems, research conducted since the 1970s at sites like the Hubbard Brook Experi- mental Forest in New Hampshire, which has the longest continuous record of precipitation chemistry in North America, has shown that in some regions, dry deposition and/or cloud, fog, or rime ice deposition can contribute roughly one-third to two-thirds of the total depositional load.23,24,25 For Dry deposition may contribute, on average, 50% of the total deposition of sulfur and nitrogen at certain locations in other regions of North America. In the northeastern United States, cloud or fog water contributes between 50% and 80% of the total sulfur and nitrogen deposited in many coastal or high-elevation locales. The frequency and volume of rain and snow, the presence of cloud cover, the quality and design of impaction surfaces, elevation, and wind speeds are only a few of the variables that affect each of these processes' respective contributions.

In order to test this assumption, a team of scientists collected rainwater from some of the most remote places on Earth in the early 1980s and measured its chemistry.27,28,29 They reasoned that, in the absence of relevant historical data, the rainwater from these places was likely to be as representative of "preindustrial" rain as possible. In fact, their findings indicated that the chemical concentrations from these locations were among the lowest in the entire world. They also suggested that the background rain pH is likely between 5.1 and 5.3 as opposed to 5.6, which is roughly 10 times less acidic and less concentrated in sulfate and nitrate than the average annual rain collected from the northeastern United States. A mixture of various cations and anions in solution and natural releases of S and N from sources such as volcanoes, lightning, wildfires, and stratospheric transport was assumed to be the cause of the increased acidity. They discovered that precipitation from distant locations was far more likely than that from eastern North America to be dominated by naturally occurring organic acids, such as formic and acetic acids. As a result, it has been shown that preindustrial rain is quite different from postindustrial rain, and it is obvious that human activity has caused acid deposition.

During the 1950s, there has been an upward trend of acid rain in the United States, with the northeastern part of the country seeing the most of the rise and the Midwest becoming more acidic. While historically, precipitation events have been observed with pHs far lower than this, in 2011 the average pH of rain in North America, Europe, and other regions of the globe is between 4 and

5. The relative quantities of sulfuric and nitric acid in rainwater have been affected by shifting patterns in NOx and SO2 emissions; for example, the ratio of sulfur to nitrogen in rain has changed from 2:1 in 1980 to 1:1 in 2000.

There are monitoring programs available that are intended to gauge and tabulate different types of atmospheric deposition. The majority of these projects were launched in North America in the late 1970s, and up until the previous ten years, they exclusively included rain monitoring. These wet deposition-monitoring networks have as one of its objectives to collect enough information to quantify the deposition of contaminants and nutrients across vast geographic areas. As a consequence, data that depict the spatial distribution of ion deposition in precipitation are now available. These numbers demonstrate that there are regional differences in the moist deposition of certain pollutants and nutrients in the United States. For instance, sulfate and nitrate deposition rates are much greater in the majority of the eastern than the western United States. The closeness to the sources, the prevalent wind direction, and the volume of precipitation deposited all contribute to this pattern.

Another kind of moist deposition is cloud water. We do know that cloud water samples taken from remote locations in North America show similar geographic patterns to rain water and are frequently several times more acidic and more concentrated in other ions than rain water taken at the same time from those same locations, despite the fact that continuous records for cloud water deposition are quite rare. Moreover, rainfall from distant parts of the planet has an acidity that is around 40 times greater than that of typical cloud water from the northeastern United States. Regional cloud events that are very acidic have been detected, and cloud water pHs often fall in the range of 3.19. Cloud water occurrences have occurred in conjunction with other air pollutants like ozone that have high amounts.

Now, the National Atmospheric Deposition Program includes about 250 EPA wet deposition monitoring stations and about 80 air chemistry monitoring locations where dry deposition is anticipated. In an attempt to provide data on total deposition across a large geographic area, several of the wet and dry monitoring stations have been co-located. Although the data are somewhat spatially constrained, they have been used to model total deposition over the northeastern United States, showing a difference in the form and species of deposition by region as well as generally higher total deposition in the northeastern United States compared to the western United States.

DISCUSSION

Environmental Effects of Acid Rain and Deposition

Tens of thousands of lakes and streams in North America and Europe are more acidic than they were just a few decades ago as a result of acid deposition. These freshwaters are all in sensitive areas with hard bedrock, thin acid soils, and little acid-neutralizing capacity, and their acidification has resulted in losses of fish and other aquatic organisms. The evidence demonstrating taht acid deposition has a negative impact on freshwater ecosystems is mounting. Analyses of historical changes in the alkalinity of lakes in the Adirondack Mountain area of New York state revealed extremely substantial acidification of a large number of those lakes during the last few decades, for instance. In the previous 50 to 60 years, 274 lakes were analyzed, and it was found that 80 percent of them were more acidic. These changes were attributable to acid deposition and could not be explained by other variables such changes in land use. The Department of Environmental Conservation has discovered that more than half of the lakes and ponds in the Adirondacks have endangered fish populations, and more than 200 lakes are completely fishless.

Indeed, fish, zooplankton, and benthic species have been demonstrably impacted by the acidity of surface water caused by acid rain36. The chemical components that consistently seem to affect freshwater creatures as a consequence of acid deposition include monomeric aluminum, calcium, and hydrogen. Acidification has an impact on fish and invertebrates, largely via physiologic disruptions. There have been reports of direct effects on gills and ion regulatory abnormalities in waters with mobile, monomeric aluminum species present. In addition, liming of acidic lakes has not been able to restore lakes' fish and biota due to the complexity of the chemistry accompanying the acidification process. Spring shock is a condition where acid stored in melting snow causes rapid decreases in pH values, which is dangerous to fish populations. As a result of the acid mobilizing mercury ions, their conversion to methyl mercury, and bioamplification in the food chain, fish caught in acidic waters in New York, Canada, and Sweden had greater mercury levels than fish caught in alkaline waters in the same countries [7], [8].

Long-lived species like trees and extremely diverse systems like soils are also at risk from acidification. The impact of acidification may be challenging to assess in the context of other concurrent pressures, such as illness, ozone, and drought, but is especially challenging when effects demonstrate considerable temporal delays. It has been more challenging to prove cause and effect for terrestrial ecosystems than for aquatic ecosystems as a result of acid deposition. Although nitrogen saturation, a condition in which the nitrogen inputs to an ecosystem exceed the capacity of the system to "use" the nitrogen, is being documented, it includes soil acidification and effects on plant and ecosystem productivity. Recent data suggest a link between atmospheric deposition and leaching of calcium from red spruce needles and sugar maple decline throughout parts of the northeastern United States.

It takes hundreds to thousands of years for soil to form. Such ions as aluminum, calcium, magnesium, potassium, and sodium often dominate the exchange sites on negatively charged clay particles in soils. These cations have been shown to be displaced by excess hydrogen ions from acidic deposition, and as a result, they are later eliminated from the soil through leaching40. This displacement signifies a change in the nutrient and acid-base status of the soils, as calcium, for instance, is a crucial plant nutrient that is typically absorbed by plant roots from the soil. In contrast to rain at pH 5.6, rain at pH 4.6 may have an impact on soils. Common alumina minerals, for instance, are largely insoluble at pH 5.6 but extremely soluble at pH 4.6 in fact, 1,000 times more soluble. At these lower pHs, there is an increase in the leaching of aluminum from soil, and dissolved aluminum is harmful to organisms. Moreover, an accumulation of aluminum in the soil may be harmful and have an impact on the biogeochemical processes of plants.

Acid deposition has a significant impact on some soils in areas with high acid deposition, as we now know. Forest decline is defined as a quantifiable decline in the health of a forest ecosystem, which is characterized by unexpected changes in tree growth, reproduction, and death. This phenomenon has been observed in many industrialized regions of the world. Forest trees are dying, generally unwell, or developing poorly when acid rain is a problem. Many terrestrial ecosystems, if not most, are likely to be stressed simultaneously by acid rain, acid cloud or fog water, ozone, toxic metals, the global climate, hydrocarbons, disease, exotic pests, and even land use changes. This condition has become widespread in Europe and parts of North America. There have been theories put up as to why forests are declining, including the interactions between different contaminants and other pressures. The fact that it may take years before stress-related symptoms manifest themselves as harm to trees or forests further complicates matters. It is obvious that air

pollution may stress forest ecosystems, even if these interactions are undoubtedly complicated and it is difficult, if not impossible, to ascribe precise cause and effect.

The Environment and Acid Rain

In order to combat acid rain, the 1990 CAA amendments recommended reducing sulfur dioxide emissions by 50% by the year 2000, compared to 1980 levels; however, actual reductions were closer to 40%. The reductions made use of the "cap and trade" mechanism, which was intended to accomplish environmental goals while giving impacted companies a broad range of options. This program was the first to establish a national pollution limit and to provide power plants the option of meeting their commitments by decreasing their emissions or by buying emission "allowances" from other sources that cut emissions above and beyond their legal requirements. The initiative mandated the installation of continuous emissions-monitoring devices at every impacted source in order to precisely quantify emissions. Each quarter, the EPA was obliged to receive hourly statistics. Further guarantee of ongoing high-quality emissions data was given by an improved auditing system that was introduced in 2002.

Wet and dry deposition as well as water quality are monitored nationwide by environmental monitoring networks including the National Atmospheric Deposition Program and the Clean Air Status and Trends network. By the year 2000, it was predicted that sulfur dioxide emissions would be around 10 million tons lower than they were in 1980, with non-point utility sources, miscellaneous categories, and other sources making up the majority of the difference. Utility SO2 emissions decreased from 17.3 million tons in 1980 to 10.6 million tons in 2001. Due to the capacity of the sources to get bank funds, the objective of 8.9 million tons of SO2 by 2000 was exceeded each year. The cost savings compared to the 1990 projections was 75%. The actual market price for SO2 permits as of January 2003 was $150 per ton, compared to the predicted range of $579 to $1,935 per ton. According to a 2003 Office of Management and Budget study, the Acid Rain Program generated the largest quantified benefits for human health of any major federal regulatory program implemented in the previous ten years, totaling more than $70 billion annually, with benefits outpacing costs by more than 40:1.

Certain power plants were subject to a Phase I limit from 1995 to 2000, while all point sources were subject to a Phase II cap starting in 2001. Power plants had banked more than 10 million tons of SO2 emission permits by the time Phase II started, mostly via collecting flue gases. They intended to use the savings to offset the effects of Phase II's stricter limit, which had a total EPA emission allowance of 9.5 million tons annually. The EPA keeps track of who owns each and every existing SO2 allowance using an allowance tracking system. By transitioning from eastern coal to low-sulfur coal from Wyoming, Montana, North Dakota, and the Mountain West, it will be simple to meet the criteria of the CAA amendments. Plants may add flue gas scrubbers, which are more efficient while costing less, to further decrease pollution.

In the transition between emission and deposition, pollutants often travel across great distances and undergo chemical changes. What is the link between lower emissions of main pollutants that cause acid deposition and higher chemical concentrations and deposition of those components in rain? is a logical issue that has been posed. Data from Hubbard Brook Experimental Forest's long-term precipitation chemistry record suggest that decreases in SO2 emissions in the United States are reflected in both sulfur concentration and deposition in rainwater, indicating that the amount of sulfur deposited to ecosystems is closely related to the reduction in emissions.19 Similarly, after leaded gasoline was banned in the eastern United States, there was a steep and significant decrease

in lead concentration. Notwithstanding the complex chemical and transport mechanisms involved between emission and deposition, these are convincing instances of how a decrease in source leads in reducing deposition.

While emissions were addressed by the CAA amendments, it remained unclear if this restriction would be sufficient to save ecosystems. If the objective is to lessen acid rain and its impacts, emissions may need to be decreased even more. Sulfur emissions were reduced more than nitrogen emissions with the 1990 CAA amendments. Nitric acid inputs in atmospheric deposition are virtually as significant as sulfuric acid additions at HBEF in 2011, as was previously mentioned. When research at HBEF first started in the early 1960s, acidic sulfate made up around 70% of the total anion charge of the precipitation, whereas acidic nitrate made up 15%–20%. Nitric acid is expected to be the predominant acid in precipitation at HBEF by 2012 due to decreasing SO2 emissions, which have lowered SO42's relative contribution and raised NO3's.

Since 2003, a number of competing legislation have been submitted in the Senate's Committee on Environment and Public Works, but none of them were able to garner support under the George W. Bush administration. The Clean Skies Act of 2003 was the name of the Bush measure. It was a required program that would decrease and limit SO2, NOx, and mercury emissions from the production of electric power to a level that was almost 70% below that of the year 2000. The NOx and SO2 standards of Clear Skies would apply to all fossil fuel-fired power generators larger than 25 megawatts, whereas the mercury rules would only apply to the subset of coal-fired units. There would be a 73% decrease in SO2 from 11.2 million tons in 2000 to 4.5 million tons in 2010 and 3 million tons in 2018. NOx emissions would be reduced by 67%, from 5.1 million tons in 2000 to 2.1 million tons in 2008 and 1.7 million tons in 2018.

In the eastern part of the nation, NOx regulations would have been stricter, with 31 states permitted 1.58 million tons in 2008 and 1.16 million tons in 2018. There would be a 69% decrease in mercury from 48 tons to 26 tons in 2010 and 15 tons in 2018. In 2020, Clear Skies would provide $110 billion in benefits for human health, outweighing its expenses of $6.3 billion. By 2020, EPA predicted that Clear Skies will save 14,000 premature deaths, 30,000 emergency department visits, and 12.5 million days of respiratory symptoms annually. Sens. Robert Stafford and Bernard Sanders of Vermont introduced the competing Clean Power Act in 2007, and it had much stricter reductions: from 2010 to 2012, 2.25 million tons of SO2, 1.51 million tons of NOx; from 2013 to every year after that, 1.3 million tons of SO2 and 900,000 tons of NOx; and only 5 tons of mercury to be emitted by 2012. As part of a multipollutant strategy, this measure also set CO2 emission limits. None of these measures were presented to the Senate's Environment and Public Works Committee for consideration.

Under President Barack Obama, the EPA started preparing a more aggressive regulation strategy for the NAAQS mandated secondary requirements of SO2 and NOx to combat acid rain. In order to prevent aquatic habitats from being acidified by emissions deposition on water, the EPA and the National Park Service collaborated to develop a joint secondary standard to reduce NOx and SOx emissions. According to the EPA's first policy assessment, SOx and NOx molecules in the atmosphere go through a complicated mix of reactions to create different acidic chemicals that influence ecosystem exposure and ecosystem structure and function, including declines in fish species richness. According to the EPA's integrated scientific assessment, both contaminants and the byproducts of their deposition have an effect on ecosystems. According to the policy evaluation, the current regulations need to take into account the months to years-long exposure period during which deposition-related consequences take place. The National Park System

supported the EPA's plan to assess an ecosystem's acidification risk using an Atmospheric Acidification Potential Index. Area-specific features including deposition, background acid neutralizing capability, and other factors that affect sensitivity would be included in the AAPI [9]–[11].

CONCLUSION

The health risks of ambient air pollution are real. It is a worldwide issue since research suggests that harmful effects may still occur even at low levels of air pollution, making it impossible to define threshold values for traditional air pollutants using the data at hand. Due to its irritation of the respiratory tract, SO2 has negative health consequences that influence mortality as well as morbidity. Asthmatics and those with chronic cardiac disorders are particularly vulnerable to these effects. These adverse outcomes will be decreased by the new lower standard of 75 ppb over 1 hour. Ecosystems in the eastern United States and Western Europe are negatively impacted by acid rain, which is caused when SO2 and NOx mix. Despite "cap and trade's" enormous success in lowering acid rain, further work using a two-pollutant model must be done to undo decades' worth of acidification.

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CHAPTER 6

ENVIRONMENTAL TOBACCO SMOKE

Ms. Meenakshi Jhanwar, Assistant Professor
Department of Environmental Science, Presidency University, Bangalore, India
Email Id-meenakshi@presidencyuniversity.in

ABSTRACT:

Period Five Through poisonous emissions and greenhouse gases, tobacco smoke has an effect on persons who smoke, those around, and the environment. Tobacco smoke generates hundreds of metric tons of greenhouse gases, other poisons, and chemicals that cause cancer in a single year. In this chapter author is discusses the tobacco smoke and disease.

KEYWORDS:

Disease, Environment, Health, Smoke, Tobacco.

INTRODUCTION

The use of tobacco products, including cigarettes, is a worldwide issue, but it is also one of the most easily avoidable causes of early mortality in our society. Smoking causes 443,000 fatalities per year and $193 billion in economic costs connected to health. Lung cancer, ischemic heart disease, and chronic obstructive pulmonary disease are the three main adult illnesses and killers. Smoking cigarettes is a significant risk factor for cancers of the lungs, larynx, oral cavity, pharynx, and esophagus, and it is responsible for 30% of all cancer-related fatalities in the United States. Moreover, smoking cigarettes has a direct causative link to malignancies of the bladder, pancreatic, uterine cervix, kidney, stoma, and acute myeloid leukemia. On general, men who smoke lose 13.2 years off their life expectancy, whereas women who smoke lose 14.5 years. In the United States, the prevalence of adult cigarette smoking decreased from 42.0% in 1965 to 19.9% in 2007, with a greater percentage among men than among women.

Nonetheless, the number of Americans who smoke has started to increase once again, reaching 20.6 percent in 2008. As the Mormon Church forbids tobacco use, the prevalence of smoking cigarettes ranges from a high of 31% in Kentucky to a low of 13% in Utah. Serious diseases brought on by tobacco affect 8.6 million individuals. People with co-occurring mental and drug use problems smoke around 44% of all cigarettes in the United States. Smoking-related fatalities were estimated to have killed 4.83 million people worldwide in 2000, and by 2020, this number might reach 10 million. 250 million women and one billion men smoke worldwide, with 70% of males in China smoking. The national public health goal of 12% prevalence cigarette smoking by 2010 has not been met; subgroups with a prevalence of 12% include women of Hispanic and Asian descent, men and women with graduate degrees, and men and women over the age of 65 [1]–[3].

History of Illness and Smoking

In 1939, Drs. While presenting a case series of lung cancer, Alton Ochsner and Michael Debakey identified smoking as the primary cause. Before them, the first director of the Bellevue Chest Service, Dr. James Alexander Miller, presented a case series in which he claimed that bronchial irritation was the root cause of lung cancer. He did not relate it to smoking cigarettes. Ernest

Wynder demonstrated in 1953 that when cigarette smoke condensate was administered to mice with shaved skin, it resulted in tumors. Doll and Hill1 began their groundbreaking case-control study of lung cancer with equal weight given to smoking and air pollution as potential causes of the disease. Raymond Pearl showed that heavy smokers of white males had a life expectancy that was roughly 10 years shorter after age 30 than non-smokers. This finding was published in 1938. For intermediate smokers, longevity was similarly decreased. After that, Pearl's discovery was regularly and easily supported by cohort studies of smokers. The early case-control studies of lung cancer3,4 and cohort studies like the Framingham study,5, the British Physician's Study,6, and the studies started by the American Cancer Society,7 are just a few of the significant investigations into the link between smoking and disease. In the UK, the 1962 report of the Royal College of Physicians8, concluded that smoking was a cause of lung cancer and bronchitis and a contributing factor to coronary heart disease. In the United States, the 1964 study of the Advisory Committee towards the Surgeon General came to the conclusion that smoking caused chronic bronchitis and lung cancer in men.9 Later findings have led to an ever-growing list of illnesses that smoking causes.

DISCUSSION

Tobacco smoke in a burning cigarette is produced by the burning of complex organic materials, such as tobacco, additives, and paper, at a high temperature of about 1000°C.9 The resulting smoke, consisting of numerous gases also and particles, includes myriad toxic components that can cause injury through in-flammation and irritation, asphyxiation, carcinogenesis, and other mechanisms. Active smokers breathe mainstream smoke, which is the smoke pulled straight through the cigarette's end. Con- centrations of tobacco smoke components in ETS are far below the levels of MS inhaled by the active smoker, but there are qualitative similarities between ETS and MS. Passive smokers inhale smoke that is frequently referred to as environ- mental tobacco smoke (ETS), which is composed of a mixture of mostly sidestream smoke given off by the smoldering cigarette and some exhaled MS. It is known that cigarette smoke contains over 4,000 different chemicals. Particularly for compounds containing nitrogen, several of the components are more concentrated in SS than in MS.

Smoking harms almost all of the human body's organs, has been linked to at least fifteen different malignancies, and is responsible for around 30% of cancer-related fatalities. The risks for several illnesses associated with smoking are dramatically increased in adult smokers. The American Cancer Society's Cancer Prevention Studies I and II, each involving about one million people, were used to calculate relative risks for dying from major smoking-related diseases and overall mortality.10 The wide range of relative risk values reflects the relative potency of smoking as a cause of the various diseases as well as the relative potency of other causal factors. For the main chronic diseases linked to smoking, the effect on disease risk typically doesn't become apparent until after a long latent period, which represents the amount of time required for the injury to be severe enough to result in disease and for the underlying process to be fully developed, such as the conversion of a normal cell to a malignant cell. For instance, the risk of lung cancer increases after around 20 years of continuous smoking [4]–[6].

The relative risk values often increase with markers of exposure to tobacco smoke, such as the quantity and frequency of cigarettes smoked, and decrease following a successful quit. Smoking may harm a person's ability to reproduce. Birth weight is often reduced by 200 grams in pregnant women who smoke. The quantity of smoking has an impact on how much is reduced. Most of the weight loss may be prevented if a smoker stops doing so by the third trimester. Additionally,

smoking raises the quantity of abnormal sperm in men, which can result in infertility, birth defects, or other issues.13 Smoking also raises rates of spontaneous abortion, placenta previa, and perinatal mortality, and it is now thought that smoking during pregnancy is a cause of sudden infant death syndrome. For several forms of juvenile cancer and congenital abnormalities, there is more tenuous evidence that maternal smoking may raise the incidence of the disease.13,14

Additionally, smoking can lead to cardiovascular conditions such as cerebral vascular disease, abdominal aortic aneurysm, atherosclerotic vascular disease, and coronary heart disease.15 These conditions are all characterized by the narrowing of the coronary arteries, which are the blood vessels that carry blood to the heart. The majority of myocardial infarction instances are caused by blood clots or thrombi blocking the constricted coronary arteries. Smoking is not only a cause of atherosclerosis, which increases blood clotting risk while also narrowing coronary arteries. Smokers have a greater incidence of carotid artery thickening than non-smokers, according to studies utilizing Doppler ultrasonography to scan the artery. Smoking induces stroke via comparable pathways as those that cause myocardial infarction. The risk of developing cardiovascular illnesses rises with daily cigarette use and smoking duration. Quitting smoking lowers the chance of developing cardiovascular illnesses. The risk of coronary heart disease often decreases quickly right once after quitting. The risk is roughly cut in half after one year after quitting compared to someone who is still smoking, and after five to 10 years, it is equivalent to someone who has never smoked. Smoking cigarettes with less tar and nicotine has not been demonstrated to increase risk of cardiovascular illnesses.

Inflammation of the lungs is another condition brought on by smoking, in addition to heart problems. Smoking triggers the production of enzymes that may damage the lungs' fragile alveoli and the migration of inflammatory cells into the lungs. Smoking increases inflammation and decreases the effectiveness of the body's anti-inflammatory defenses. The underlying cause of COPD is unchecked inflammation that has been present for a long period of time. In 10%–15% of smokers, this illness progresses over time.16,17 Important epidemiologic information comes from studies on the level of lung function in smokers and nonsmokers, as well as the evolution of lung function over time. The studies demonstrate that smokers have a lower level of lung function on average than non-smokers, and that the level of lung function in smokers diminishes as the number of cigarettes smoked per day rises. Cohort studies have also shown an increase in mortality from COPD in smokers.

As compared to non-smokers over time, smokers often have a quicker deterioration in lung function. After successfully stopping, the rate of decrease for smokers returns to that of nonsmokers. Regrettably, much of the harm done before withdrawal is irreparable. Smokers have almost 10 times the mortality rate for COPD compared to nonsmokers. There is no concrete proof that smoking cigarettes with high tar and nicotine content increases the chance of developing this condition. The relationship between respiratory health and health status and smoking is the subject of much epidemiologic research. The four primary respiratory symptoms cough, sputum production, wheeze, and dyspnea are more common after smoking. Among smokers compared to non-smokers, symptom rates are much greater, and the frequency of symptoms tends to rise with daily cigarette use. The Surgeon Generals' reports have often discussed these correlations and assigned a causal explanation to the link between smoking and cough and phlegm.

Impact of Passive Smoking on Health

There is little historical evidence linking passive smoking to health. The 1960s saw the publication of some of the first epidemiological research on the relationship between secondhand smoke or environmental tobacco smoke and health. The first studies looked at lung function and respiratory symptoms in kids, and the 1972 Surgeon General report was the first to bring attention to passive smoking.18,19 Hirayama and colleagues found that among nonsmokers in 91,549 married women, age-adjusted lung cancer mortality rates were lowest for wives of nonsmokers, intermediate for wives of light or ex-smokers, and highest for wives of smokers.

est for wives of heavy smokers. Another study from two Athens hospitals of lung cancer cases and controls found a risk of lung cancer 2.4 times higher for wives of men who started smoking less than a pack per day and 3.4 times higher for wives of heavy smokers, compared to the wives of nonsmokers. By 1986, the data supported the idea that passive smoking was a cause of lung cancer in nonsmokers. In a review, the International Agency for Research on Cancer, the U.S., supported this decision. Surgeon General of the U.S. A substantial body of evidence has decided to continue to identify new diseases and other negative effects of passive smoking, including an increased risk for coronary heart disease. Estimates are as high as 53,000 ETS- related deaths per year from heart disease, according to studies.19,23,24,25 A meta-analysis of all available studies came to the conclusion that there was an increased risk of lung cancer associated with environmental cigarette smoke [7].

Children and newborns are particularly affected negatively by ETS exposure. These include deteriorated respiratory health, including a higher risk of middle ear illness, persistent respiratory symptoms, and asthma, as well as a slower pace of lung function development throughout childhood. The NHANES III data was used to correlate children's serum cotinine levels with a variety of cognitive and academic abilities, reporting a significant negative linear correlation between cognitive abilities but instead exposure to ETS.31 There is more limited evidence suggesting that maternal ETS exposure reduces birth weight and that parental smoking has a negative impact on a child's development and behavior.

Lung cancer, ischemic heart disease, and coronary heart disease have all been causally linked to adult exposure to ETS.35,36 In a 1997 meta-analysis, Law et al. calculated that the extra risk from ETS exposure was 30% at age 65. Pell and colleagues investigated acute coronary syndrome admissions to nine Scotland hospitals for the ten months before to and during the smoking ban. They found a 17% decrease compared to 4% in England, which was operating under no such regulation at the time. Once this smoke-free law went into effect, there were fewer hospital admissions for acute coronary syndrome, with nonsmokers accounting for 67% of the decline. Low levels of inflammation are among the systemic consequences of smoking; C reactive protein levels may be raised for up to 10 years after quitting and are linked to an increased risk of atherosclerosis and coronary heart disease39.

The SAPALDIA study in Switzerland used questionnaires prospectively in 4,197 never-smoking adults and discovered passive smoking to be associated with wheezing. Negative studies include Enstrom's study of the American Cancer Society cohort covering thirty-nine years in California, which found no effect for secondhand smoke on risk of spousal lung cancer, coronary heart disease, and COPD mor- tality. However, this study had been criticized for misclassifying smoke effects. Once smoking was outlawed in bars, the same findings were replicated in Dublin, where PM2.5

levels fell by 83% and bartenders' respiratory symptoms and pulmonary function significantly improved.

The U.S. is one of many panels. National Research Council, the U.S. Lung cancer is caused by secondhand smoking, according to the findings of the Surgeon General and the Environmental Protection Agency47,48. The International Agency for Research on Cancer conducted the most current assessment. It completed meta-analyses in which the relative risk estimates from the many research were combined, compiling more than fifty papers on the relationship between involuntary smoking and the risk of lung cancer in non-smokers. The IARC monograph came to the conclusion that there is a strong and persistent link between secondhand smoke exposure and lung cancer risk in spouses of smokers, with the extra risk being roughly 20% in women and 30% in men. Secondhand smoke exposure at work raised nonsmokers' chance of developing lung cancer by 12% to 19%. IARC came to the conclusion that forced smoking causes lung cancer in people.

Epidemiology of Lung Cancer

With more than 200,000 new cases and 160,000 fatalities each year, lung cancer is the most frequent kind of cancer mortality in the US. Lung cancer is thought to be responsible for roughly 1.2 million deaths each year globally. In communities where smoking has been prevalent for a long time, smoking is responsible for around 90% of occurrences of lung cancer. The length of smoking is the biggest risk factor for lung cancer among smokers, while the amount of cigarettes smoked also raises the risk. Lung cancer is brought on by smoking in both men and women. Smoking cessation at any age prevents the lung cancer risk from rising higher as a result of continuing smoking. In contrast to never smokers, ex-smokers continue to have a higher risk of developing lung cancer years after quitting. 5.5 shows how smoking has affected lung cancer in the United States throughout the 20th century. Lung cancer and cigarette smoking were uncommon in the early 20th century. Due to enormous cigarette manufacture, increasing promotion, and widespread cigarette usage by military troops during World War I, smoking surged throughout the 20th century, first among men and then, after a 20-to-30-year lag, among women. Throughout the 1950s and 1960s, cigarette smoking reached its height. As a flood of research demonstrating its harms appeared and the first Surgeon General's report was published in 1964, smoking started to fall. Men's mortality from lung cancer follows the smoking prevalence curve by around 30 years and started to decline in the middle of the 1990s. In 1988, lung cancer surpassed breast cancer as the leading cause of cancer-related mortality among women in the United States [8]–[10].

Cancer-causing Agents in Tobacco Smoke

Comparable to the present sales-weighted average nicotine delivery of around 0.8 mg/cigarette, the range of total carcinogen exposure in smokers is about 1.4-2.2 mg/cigarette. The lowest concentrations of some of the greatest carcinogens, such polycyclic aromatic hydrocarbons, N-nitrosamines, and aromatic amines, are found whereas the highest concentrations of some of the lesser carcinogens are found. N-nitrosamines are a large class of carcinogens with demonstrated activity including at least thirty animal species. PAH are incomplete combustion products that were initially identified as carcinogenic constituents of coal tar. They occur as mixtures in tars, soots, broiled foods, automobile engine exhaust, and other materials generated by incomplete combustion. Both PAH and N-nitrosamines are well supported as important etiological factors in lung cancer. Tobacco smoke fractions richer in PAH are hazardous because they are potent, locally acting carcinogens. The TP53 tumor suppressor gene has mutations that are similar to those produced in vitro by PAH diol epoxide metabolites and in cell culture by Benzopyrene. PAH-DNA

adducts have been found in the human lung. Persistent DNA adducts can cause miscod-ing during replication when DNA polymerase enzymes process them incorrectly. There is considerable specificity in the relationship between specific DNA adducts caused by G to T and G to A mutations are often seen.

Mutations have been regularly seen in the TP53 tumor suppressor gene in a variety of cigarette smoke-induced malignancies and in the K-ras oncogene in smokers with lung cancer. Animal studies have conclusively shown that mutations in these genes have a cancer-causing effect. While acrolein may also result in p53 adducts in lung cancer hot spots and is far more prevalent in cigarette smoke than PAH, the K-ras and TP53 mutations seen in lung cancer in smokers seem to represent DNA damage by metabolically activated PAH. In addition, lung cancer has been connected to a variety of cytogenetic alterations, and exposure to tobacco smoke has been directly linked to chromosomal damage throughout the aerodigestive tract. By a convoluted series of signal transduction channels, gene abnormalities may result in the loss of normal cellular growth control mechanisms, which in turn leads to cancerous cellular proliferation.

The TP53 tumor suppressor gene is the most frequently mutated gene found in human cancers. Of the tobacco-related cancers, lung cancer has the largest database, with mutations in the TP53 gene found in about 70% of tumors. In smokers, the mutations are concentrated in the central region of the gene, which is the DNA binding region that is crucial for its function. Smokers have mutations in this region's hotspots, such as codons 157, 176, 248, and 249, which serve as a distinctive hallmark. In vitro activation of PAH causes DNA adducts on the same codons in lung fibroblasts or epithelial cells.

Quitting smoking

Mark Twain once said, "Stopping smoking is simple. It was noted in 2008 that social networks amplify smoking cessation, with one's spouse, sibling, friend, or coworker, in order of importance, influencing a smoker's likelihood of quitting smoking, and that smokers over time are increasingly marginalized socially55. The Lung Health Study was a randomized clinical trial of smoking cessation and inhaled bronchodilator therapy in smokers 35 to 60 years of age who were in good health but had a history of The hazard ratio for usual care was lower in the intervention group at 14.5 years of follow-up, and the changes in mortality rates were highest for lung cancer and cardiovascular disease.

Treatment for tobacco dependence with nicotine gum and patches may increase sustained quit rates above 15%, which is the typical success rate for those trying to quit "cold turkey." Nicotine is the addictive substance in tobacco, and cigarette manufacturers are highly skilled at blending tobacco blends to achieve maximum nicotine delivery via the cigarette. The half-life of nicotine is only approximately 20 minutes, thus smoking another cigarette is necessary to maintain blood levels nicotine at levels high enough to avoid withdrawal symptoms. Smoking delivers nicotine directly to the brain and blood, where nicotinic acetylcholine receptors are essential for the development of dependency. The reward area of the brain has the largest concentrations of these receptors, the a4b2. Varenicline, a plant alkaloid called cytisine, is a competitor for this receptor that doesn't or only partly activates it. This medicine has a greater sustained quit rate when compared to bupropion or nicotine replacement therapy in clinical studies.

Policy Limitations on Smoking and Tobacco Use

More than 20 states have laws that prohibit smoking in public places, most notably in bars, restaurants, and workplaces.60 Minnesota started this trend in 1975 by passing a law requiring nonsmoking zones in public places, but it wasn't until 2008 that smoking was outlawed completely. The attorneys general case against U.S. tobacco companies to recover tobacco-related medical expenditures is the main state-level smoking policy. The AGs sought a $368.5 billion settlement by 46 states, but this was bargained down to around $206 billion to be paid over 25 years. The cigarette advertising was regulated by this master settlement agreement. Regrettably, the majority of governments only allocate a tiny fraction of their budgets to initiatives targeted at helping older smokers stop and preventing youth from starting to smoke. States are advised to give one-fifth of the funds they get for anti-tobacco initiatives, according to the Centers for Disease Control and Prevention. To pay for the anti-tobacco programs required under the master settlement agreement, tobacco companies raised the price of cigarettes by 45 cents per pack, which is likely to have caused a 4%–5% decrease in demand. New York City expanded its tobacco program in 2002 by passing the New York City Smoke-Free Air Act, which increased taxes on tobacco products. A smoking pub in New York had PM2.5 levels 50 times greater than the Holland Tunnel entrance, while a non-smoking bar had levels equivalent to Central Park's Great Lawn, as an illustration of the effects of such prohibitions. There were started aggressive anti-tobacco advertising campaigns in print and broadcast media. When free nicotine replacement was made available, the smoking rate decreased by 3% or by 200,000 smokers over the course of two years. The Smoke-Free Air Act saw an increase in support from 52% in 1999 to 73% in 2002.

Since the tobacco industry hid the fact that nicotine was addictive and manipulated the nicotine market to increase addiction, the Food and Drug Administration had been prevented from regulating nicotine as a drug for many years. President Bill Clinton said in 1995 that FDA studies confirmed the conclusion that nicotine in cigarettes and smokeless tobacco products is a medicine and that these items are, in accordance with the act, drug delivery systems. In spite of his unsuccessful attempts to regulate nicotine, FDA Commissioner David Kessler was able to obtain a large number of private documents created by the tobacco industry to thwart FDA regulatory efforts.64 These documents revealed that the tobacco companies had been manipulating the amount of nicotine in cigarettes. FDA regulation of tobacco would result in health benefits of $28–$43 billion compared to expenditures of $180 million, plus operation costs of $149–$185 million year. FDA v. Brown and Williamson Tobacco Inc., a case from 2000, involved the U.S. The Supreme Court found 5-4 that Congress never meant to grant the FDA regulatory jurisdiction over tobacco since a distinct regulatory framework for tobacco had been formed outside of the agency. Moreover, the Court's majority upheld the freedom of expression of businesses.

In order to protect the public's health, Congress created the Family Smoking Prevention and Tobacco Control Act, which gave the FDA broad authority to regulate the manufacture of tobacco products as well as their sale, distribution, and promotion.65 Tobacco manufacturers were required to provide lists of their ingredients, which the FDA could regulate or ban if it determined that they were harmful. Fruit, spice, and other flavors that appeal to children would be prohibited, and the terms light, mild, and low would be regulated. Menthol wouldn't be prohibited, but it may be restricted if it's shown to be dangerous. The smaller tobacco businesses opposed this law even if Philip Morris supported it since it restricted the operations of their rivals while strengthening Philip Morris's lead or dominating position. 30th of July 2008, the U.S. The House approved this measure by a vote of 326 to 102.

August 2006 saw U.S. District Court Judge Gladys Kessler gave her opinion on the US case brought by the Department of Justice against the tobacco firms in an effort to recoup expenses for smoking-related illnesses in government-funded health programs. With the following statement: "The evidence in this case plainly demonstrates that Defendants have not stopped participating in unlawful activities," she concluded that the big cigarette firms had broken civil racketeering statutes. They continue to deceive consumers in order to increase Defendant's profits by enticing new smokers while discouraging current smokers from quitting, maintaining the industry, according to the plaintiff. She claimed that this case involved a business that thrives and makes money from the sale of a highly addictive substance that causes diseases that result in a staggering number of deaths each year, untold suffering and financial loss, and a significant burden on society. These details have been known to defendants for at least fifty years or more. They have continuously, repeatedly, and with great ability and sophistication denied these facts to the general public, the government, and the public health community in spite of this information. For the most part, defendants sold and promoted their dangerous products with fervor and deceit, with a single-minded concentration on their financial success and without consideration for the human tragedy or societal expenses that success exacted.

Public health organizations requested $130 billion to support initiatives to help people stop smoking, but the U.S. In 2005, the Justice Department cut this to $10 billion, and the U.S. The Circuit Court of Appeals disallowed any kind of compensation. Instead, it was declared in the Final Judgment and Remedies Order that tobacco companies would no longer be allowed to engage in racketeering or make false, misleading, or deceptive claims about the dangers of smoking. It forbade words as well. including low-tar, light, ultra-light, mild, or natural, mandated corrective statements about the health risks of smoking and secondhand smoke, as well as their deceptive practices, through newspaper and television advertising, their websites, and as part of their cigarette packaging, and required tobacco companies to submit marketing data to the government every year. ETS was classified as a Class A human lung carcinogen by the EPA in 1992. The Occupational Safety and Health Administration published a proposed regulation on indoor air quality in 1994 that would significantly reduce the amount of tobacco smoke that nonsmokers were exposed to at work.

Today's Global Smoke

Over the globe, 17% of teenagers between the ages of 13 and 15 reported using tobacco in 2008. Every day, between 82,000 and 99,000 youngsters, approximately half of whom reside in Asia, begin smoking. More than $1.26 billion is spent on tobacco by young people. 67% of the time, minors may purchase cigarettes illegally, and 88% of the time, they do so from vending machines. Also, a lot of kids use smokeless tobacco products like chewing tobacco and snuff. As many as 1 in 4 of the 6 million Americans who use smokeless tobacco are under the age of 19. Because just half of high school smokers say that consuming more than one pack per day poses a severe health risk, it is crucial to educate kids about tobacco use. More than 90% of children aged 6 are aware that Joe Camel smokes, and 46% of children aged 8 to 13 encounter cigarette advertisements on billboards.

Nowadays, smoking is prevalent in 70% of developing nations. In China, India, and Indonesia, about half of the world's 1.3 billion smokers reside. Twenty percent of the 6 trillion cigarettes smoked worldwide annually are produced by US tobacco corporations. Indeed, American tobacco corporations grew their exports by 260% despite the fact that municipal, state, and federal anti-tobacco regulations have lowered smoking by 20% since 1998. The Doggett Amendment,

approved by Congress in 1997, forbade the use of public funds from the Departments of Commerce, Justice, and State to encourage the sale or export of tobacco abroad or to work for the lifting of any nondiscriminatory foreign nation limitations on tobacco marketing. The Clinton administration finally issued an order to U.S. embassies to enforce the legislation at the beginning of 1998 after much delay. While a start in the right direction, this weak amendment is revocable every year, does not apply to all federal agencies, and places compliance responsibilities in the hands of organizations that have a history of being indifferent to or hostile to public health issues.

All nations may control tobacco using the international legal framework provided by the Framework Convention on Tobacco Control. In 2003, it was approved by the World Health Assembly in Geneva. This pact was negotiated during the course of two U.S. administrations, each of which had radically different opinions on the tobacco business. The George W. Bush government rejected obligatory taxes as well as eleven other proposals. The pact was signed in 2004 by the United States, however it has not yet been sent to the Senate for approval. All countries are required to abide by the treaty's prohibition on tobacco advertising, promotion, and sponsorship.67 The treaty also calls for the implementation of tobacco control measures, such as the use of large, graphic health warnings, restrictions on the use of terms like "light" and "low-tar," as well as bans on or restrictions on tobacco marketing. The pact has received ratification from 132 countries. In high-income countries, a 10% price rise results in a 4% decrease in consumption, whereas an 8% decrease occurs in developing nations. Moreover, taxes provide income that may be used toward tobacco prevention and cessation initiatives. Taxes should make up between two-thirds and four-fifths of the retail price of cigarettes, according to the World Bank's proposal [11]–[13].

CONCLUSION

Cigarette smoking is a serious public health issue that leads to cardiovascular disorders, malignancies of the lung and other organs, and chronic lung ailments. The Family Smoking Prevention and Tobacco Control Act, which President Obama signed into law on June 22, 2009, gives the Food and Drug Administration the power to control the production, distribution, and sale of tobacco products in order to safeguard the general public's health. Three key provisions of the law were implemented by the FDA's Center for Tobacco Products by June 2010: the youth access and advertising rule, first proposed in 1996 and limiting how the tobacco industry could indeed advertise and sell cigarettes and smokeless tobacco products, new warning labels that must take up 20% of both the packages and advertisements for all smokeless tobacco products, and tobacco companies will no longer be allowed to call their products "light" or "low.

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CHAPTER 7

A STUDY ON CHILDREN'S ENVIRONMENTAL HEALTH

Dr. Krishnappa Venkatesharaju, Assistant Professor
Department of Environmental Science and Engineering, Presidency University, Bangalore, India
Email Id-venkateshraju.k@presidencyuniversity.in

ABSTRACT:

The area of public health known as "environmental health" is concerned with how people and their environment interact, as well as how to encourage safe and healthy communities. Any approach that addresses all aspects of public health must include environmental health. In this chapter author is discusses the outdoor air pollution. In recent years, public concern about environmental health risks to children has grown, drawing the attention of scientists, lawmakers, regulators, and public health authorities. The question is whether young children, babies, and fetuses are at an elevated risk for health problems from environmental chemicals because they are more susceptible to such substances and/or because they are exposed to them at larger relative levels than adults.

KEYWORDS:

Air, Children, Environment, Health, Pollution.

INTRODUCTION

In terms of public health, this is a real worry. We must ascertain if this worry is scientifically true since as a community and as people, we put considerable emphasis on ensuring a safe environment for children. When doctors noticed severe lead poisoning in kids who were chewing paint off crib railings, walls, and verandas at homes, the vulnerability of children to environmental chemicals was first discovered at the beginning of the twentieth century.1,2 Despite the National Lead Company's admission that lead was toxic, a policy debate would continue for more than 50 years before the U.S. The Consumer Product Safety Commission banned lead paint in 1977, and the Environmental Protection Agency announced a phase-out of lead in gasoline from 1975 to 1986.3 Policy delays protecting children from other environmental chemicals have followed a similar pattern, with a presumption of safety placed on chemicals and the burden of proof falling on scientists, families, and children before regulations are put into place to limit children's exposure. This article's first part gives an outline of the physiological and other factors that contribute to children's special sensitivity to environmental toxins. The broad foundation for how chemicals are regulated, evaluated for their potential to be dangerous to children, and particular policy changes for pollutants including mercury, lead, and outdoor air pollutants are presented in the following sections. The promise offered by the National Children's Study to develop proactive policies on behalf of children to reduce the health impacts of environmental risks is discussed in the last part [1]–[3].

Particularly Vulnerable Children

The 1993 National Academy of Sciences study "Pesticides in the Diets of Infants and Children" best captures the scientific foundation for children's particular sensitivity to environmental chemicals. Children have disproportionately high exposures to environmental toxins, which is one

major factor in their high susceptibility. Children consume more water, food, and air per pound of body weight than adults do, which causes them to absorb proportionally more of the poisons found in these sources into their systems. The exposure of young children is increased by their typical activities, such as playing near to the ground and engaging in hand-to-mouth play, which physicians refer to as "normal oral exploration behavior." Children do not metabolize, detoxify, or excrete many toxins in the same manner that adults do, which allows the chemicals to remain in children's bloodstreams for a longer period of time and do more harm. This is another factor contributing to children's high vulnerability to chemical toxins.

Children's quick growth and development both of which are very complicated developmental processes is a third factor. Last but not least, children have a longer lifespan than the majority of adults, giving them greater opportunity to acquire chronic illnesses that may be brought on by early environmental exposures. The disorders of most present concern are chronic diseases of environmental origin, which have grown pandemic in American children during the last thirty years. They consist of: Since 1980, the prevalence of asthma has more than doubled, and it is now the main reason for pediatric hospitalization and school absences birth defects, which are currently the main reason why babies die, Autism, dyslexia, mental retardation, and attention deficit/hyperactivity disorder are among the neurodevelopmental problems that afflict 5%–10% of the 4 million newborns born in the United States each year.

DISCUSSION

During the 1970s, incidence rates of leukemia, brain cancer in children, and testicular cancer in adolescents have grown despite lowering death rates8,9,10. These chronic illnesses have increased concurrently with the extensive use of chemicals in the environment. Currently, there are more than 80,000 synthetic chemicals, the majority of which have only been produced since the 1950s11. These compounds include synthetic hormones, flame retardants, motor fuels, construction materials, antibiotics, and polymers. The 2,800 synthetic chemicals that are produced in quantities of one million tons or more annually put children in particular danger of exposure.12 These high-production-volume chemicals are the synthetic materials that are dispersed most widely in the environment—in the air, food, and water, as well as in consumer goods in homes, schools, and communities. Most People have detectable quantities of certain HPV compounds in their body, according to recent national studies [4]–[6]. There is mounting evidence that many chronic illnesses are linked to common chemical exposures in infancy. Secondhand smoke, mold and mites, cockroach droppings, animal dander, and some pesticides have all been shown to be indoor asthma triggers.14,15 Ambient pollutants, such as airborne fine particulates, ozone, oxides of nitrogen, and diesel exhaust, have also been shown to increase the incidence of asthma and to trigger asthmatic attacks. Ionizing radiation, benzene, 1,3-butadiene, and pesticides.

In the United States, the elimination of lead from gasoline led to reductions in exposure which resulted in IQs among preschool-aged children in the 1990s that were 2.2-4.7 points higher than they would have been if some these children had a distribution of blood lead levels found among children in the 1970s. Local policy can also significantly affect childhood disease and disability. Significant reductions in ambient ozone and the number of asthma acute care visits were linked to the city of Atlanta's restrictions on vehicle traffic during the 1996 Olympic Games

The Case of Mercury

Mercury is employed in a variety of scientific research projects, amalgam dental repair materials, and illumination. Both natural and artificial sources have the potential to release mercury into the

environment. Even at low quantities, continuous exposure to mercury vapor may have harmful consequences on employees, including tremors, cognitive impairment, and sleep disruption. It has been shown that acute mercury vapor exposure has substantial effects on the central nervous system, including psychotic episodes marked by delirium and hallucinations. The environmental dangers of mercury in children and adults have long been understood due to scientific data, but regulatory policy has lagged. A prominent example is the evolution of regulations governing mercury emissions from coal-fired power plants. Almost 70% of the 5,500 metric tons of mercury emitted into the Earth's atmosphere each year are now attributed to anthropogenic sources. Coal-fired power stations, chlorine facilities, and incinerators are the main contributors of these emissions in the US. Once released, electromagnetic mercury easily aerosolizes and accumulates in soil and water. It is changed into methylmercury by bacteria and then absorbed by fish, which are then devoured by bigger fish. Predatory species including swordfish, tuna, king mackerel, and shark have very high quantities of methylmercury. The main way that humans are exposed to methylmercury is via the consumption of contaminated seafood.

The first example of methylmercury poisoning was discovered in the 1950s in Minamata, Japan, when pregnant women consumed fish and at least thirty infants developed cerebral palsy. A similar incident happened in Iraq in 1972 when the usage of a methylmercury fungicide resulted in the poisoning of thousands of people.23 Research in New Zealand,25,26, the Faroe Islands,27,28, and the Seychelles Islands29 have followed cohorts to evaluate the effect of fetal methylmercury exposure. The National Academy of Sciences examined all three studies and found substantial evidence for neurotoxicity, even at low exposure levels.30 Following the NAS publication, an American cohort has linked high hair mercury levels to deteriorating newborn cognition. Even after adjusting for mothers' fish intake in the data analysis, the connection maintained.

Once the Environmental Protection Agency announced a proposal to relax stringent regulations on mercury emissions from coal-fired power stations in January 2003, the question of exposure to methylmercury in the womb and early childhood sparked a heated controversy. Contrary to current safeguards under the Clean Air Act, which would limit mercury emissions from coal-fired power plants to five tons per year by 200833, the proposed "Clear Skies Act" would have slowed recent progress in controlling mercury emission rates from electric generation facilities and would allow the above releases to remain as high as twenty-six tons per year through 2010.

A number of evaluations were conducted to estimate the health and financial consequences of prenatal methylmercury exposure in order to influence the policy debate. According to the first of these assessments, between 316,588 and 637,233 infants are born in the United States each year with mercury levels in their cord blood that are more than 5.8 mg/L. Mercury-related cognitive function reductions in these newborns range from 0.2 to 5.13 IQ points. According to the authors' calculations, each yearly birth cohort incurs a total economic cost of $8.7 billion annually as a consequence of this loss of cognitive function. Of this price, mercury emissions from US coal-fired power plants are responsible for $1.3 billion of it.

The rise in children with mental retardation linked to methylmercury exposure was assessed in a second research. This research was predicated on the fact that more children with IQ scores below 70 are found when methylmercury exposure alters the distribution of IQ in an exposed group lower. According to this data, IQ declines brought on by fetal exposure to methylmercury from anthropogenic sources are linked to 1,566 additional instances of MR yearly, or 3.2% of MR cases in the US. The annual expense of caring for these kids comes to $2.0 billion. The authors calculated that between 115 and 2,675 excess cases of MR, or 0.2%–5.4% of MR cases in the United States,

are related to methylmercury toxicity after accounting for uncertainties in the relationship between IQ loss and increases in blood mercury levels and using a range for the true cord/maternal mercury ratio. Care for children with methylmercury-associated MR is estimated to cost between $28 million and $3.3 billion, according to a sensitivity study. The American Academy of Pediatrics, the American Public Health Association, and a number of other prominent medical and public health organizations joined thirteen states in a lawsuit to force the EPA to implement more stringent mercury emission standards. As a result of these and other findings, the EPA's Clean Air Mercury Rule was widely criticized as being harmful to the public's health.

They used the proof we supplied in the peer-reviewed literature of the negative effects of methylmercury poisoning on human health and the economy in their attempts to overturn the EPA's Clean Air Mercury Rule. These assessments were utilized in the multistate lawsuit against EPA even though they ultimately did not modify the EPA regulation. the U.S. on February 8, 2008. Court of Appeals for Washington, D.C. By implementing a cap and trade regulation that permitted oil and coal-fired facilities to buy credits to offset excessive emissions rather than installing pollution controls, the Circuit concluded that the EPA had violated the Clean Air Act. Notwithstanding this triumph, it remained uncertain if the data supporting the methylmercury toxicity to developing human beings would be taken into account in amended regulation measures for mercury emissions from coal-fired power stations [7]–[9].

Lead as a Case Study

Recent reports have shown that lead-based paint risks remain large and persistent in American houses despite tremendous progress in the eradication of lead from gasoline and paint. A lead-based paint danger exists in an estimated 4.1 million American homes. Housing built before 1978 was particularly prone to lead-based paint risks, and even when the paint was in acceptable condition, more than 30% of dwelling units with lead-based paint carried hazards. The President's Task Force on Environmental Health Risks and Safety Risks to Children predicted that a $230 million per year investment over ten years would eliminate lead poisoning in low-income children under six years of age living in housing constructed before 196040. However, this recommendation was not followed. By 2010, the Secretary of Health and Human Services had set a national goal to end childhood lead poisoning.

Since the task force conducted its analysis, a number of studies have suggested the negative effects of lead levels in children below 10 mg/dL, the current definition of an elevated blood level by the Centers for Disease Control and Prevention.42,43 However, these studies have not resulted in further reductions in the action level established by the CDC. When additional evidence came in,44 more debate developed,45 partly as a result of the George W. Bush administration's attempt to remove members of the Childhood Lead Poisoning Prevention Federal Advisory Committee in order to pursue its political objectives. Regardless of the CDC action level, more must be done to eliminate lead-based paint and other risks. As other chemicals of concern emerge, scientific advisory committees cannot have their recommendations disregarded or thwarted by political or economic interests. The elimination of lead from gasoline produced economic benefits on the order of $110–319 billion annually in increased lifetime productivity.

Environmental Air Pollution: A Case Study

Between 1980 and 1996, the prevalence of asthma more than quadrupled, reaching exceptionally high rates in metropolitan areas, including 19% in Hartford, Connecticut, and 25% in the Harlem neighborhood of New York City. While more recent U.S. data indicates that there is no longer a

growing trend, despite significant efforts to improve outpatient care, only modest improvements in hospitalization and mortality rates for people with asthma have been reached in the U.S. The existence of outdoor air pollutants, which are known to exacerbate and sometimes even start the development of asthma, is a key contributing factor to this conundrum. In one particularly instructive research, Gent et al. contrasted 130 children with asthma who took maintenance drugs with 141 asthmatic children who did not. Each 50 ppb rise in 1-hour average ozone was linked to a higher chance of wheeze and chest tightness in the group using maintenance medication. When they included fine particles in their analysis, the authors specifically looked for any potential confounding effects of other air pollutants, but they were unable to detect any. As previously mentioned, the traffic restrictions during the 1996 Atlanta Olympics created a natural experiment that resulted in lower ozone levels, which explained lower outcomes for children with acute care asthma. A 2004 American Academy of Pediatrics policy statement titled "Ambient Air Pollution: Health Hazards to Children" recommended that national ambient air quality standards for PM10, PM2.5, O3, and NO2 be revised in light of recent studies that suggest children are not adequately protected from air pollution. However, 122 million people in the United States live in areas exceeding the EPA's ozone standard.

States have stepped in to adopt laws that restrict important point sources of outdoor air pollution since there aren't many federal restrictions in place. With regard to its standards for diesel emissions, California has established benchmark rules for other states and the federal government, putting a ceiling on particulate matter emissions in place starting with model year 2004. A few years later, the federal government put comparable rules into effect, mandating ultra-low sulfur diesel fuel and limiting particulate matter emissions from heavy-duty engines. Four states have passed laws or regulations limiting the amount of time school buses may idle and/or requiring a minimum parking distance between buses and school buildings in order to reduce exposures in the educational environment. Additionally, ten states have implemented retrofit programs for school buses. State policy interventions can be very effective in limiting exposures until national policy advances and takes into account scientific and public health concerns. Federal regulation and legislation can produce greater uniformity in prevention of childhood disease and disability across states.

Survey of National Children

The U.S. has taken action in response to increased prevalence of chronic pediatric illnesses and growing worries about how the environment may be contributing to these illnesses. The Children's Health Act of 2000 granted the National Institute of Child Health and Human Development the authority "to conduct a national longitudinal study of environmental influences on children's health and development". The National Institute of Environmental Health Sciences, the CDC, and the EPA have joined the NICHD in planning this study, now known as the National Children's Study, a longitudinal study of 100,000 U.S. children to identify the preventable factors that affect their health and development.

To determine the preventive and environmental causes of chronic illness in children, the NCS is a large-scale, observational, longitudinal research including 100,000 U.S. children. Before conception or throughout an early pregnancy, participants will be sought out, and their offspring will be monitored until age 21. A minimum of fifteen in-person meetings with research teams will be held with families who have signed up for the study during the course of various developmental phases. Eight of these visits will take occur in clinical settings, including the hospitals where the children were delivered, and seven will take place in the participants' homes. Through the age of

five, data will be gathered remotely every three months, and then once a year after that, via telephone, computer, or mail-in questionnaires. Throughout the course of the research, environmental samples such as air, water, soil, and dust from the child's home environment as well as biological samples from the mother and child to quantify body loads of environmental chemicals will be collected. The family composition, family conflict, mother's and/or father's past physical and mental health history, mother's and/or father's present emotional and cognitive adjustment, parent-child interaction, and caregiving environment quality are just a few of the specific parent, child, and family psychosocial domains to be evaluated. Obesity, injury, asthma, diabetes, schizophrenia, and autism are six of the chronic conditions that the research will look at, and they together cost America $642 billion annually. The yearly savings would be $6.4 billion if the NCS were to result in a 1% decrease in the incidence of these illnesses, which is far more than the $2.7 billion cost of the research over a 25-year period.

Regulation and Young People

Regulatory policy has lagged behind, despite mounting and developing scientific evidence of environmental risks to children's health. The Toxic Substances Control Act currently in effect, which is the primary piece of legislation governing approval of chemicals for their widespread distribution into the environment, makes the assumption that, even in the absence of toxicological testing data, chemicals do not cause health harm until harm is unquestionably proven. Prior to clearance, the EPA reviews chemicals for ninety days without requiring any toxicity testing. The majority of chemicals are allowed without even the most basic testing for their ability to be hazardous to people or animals. These deficiencies are mostly due to the fact that TSCA has not been amended since it was passed into law in 1976.

The U.S. has reacted to the NAS report's conclusions. The Food Quality Protection Act of 1996 was overwhelmingly approved by Congress. In contrast to TSCA, this legislation specifically instructs EPA to use an additional tenfold safety factor to account for the possibility of pre- and postnatal toxicity when assessing the risks to infants and children, particularly when the toxicology and exposure databases are deemed to be insufficient. The law also allows EPA to substitute a different factor for the default tenfold "FQPA safety factor" if, based on reliable data, the resulting margin would be sufficient to protect infants and children. Even though FQPA implementation is still a challenge and some regulatory thresholds have not yet been established, this legislation marks a turning point in the understanding of children's particular vulnerability to environmental hazards. prior to the U.S. Diazinon and chlorpyrifos were phased out by the Environmental Protection Agency as a consequence of FQPA; these pesticides were regularly found in the cord blood of infants in New York City and were linked to decreases in birth weight and length. After these phase-outs, neither the pesticides nor their link to indicators of cognitive capacity were found [10], [11].

President Bill Clinton's Executive Order 13045, which created a President's Task Force on Environmental Health Hazards and Safety Risks to Children, was another landmark decision. The Administrator of the Environmental Protection Agency and the Secretary of Health and Human Services jointly served as its co-chairs. The task group was charged with creating policies to safeguard kids from environmental dangers, and it was instrumental in raising money to pay the removal of lead-based paint concerns from residences. The task group was essential in influencing the National Children's Study's design, which helped to achieve the Surgeon General's Healthy People 2010 objective of eliminating childhood lead poisoning [12], [13].

CONCLUSION

The capacity of researchers to carry out ethical processes that provide scientifically sound solutions and sufficient safeguards for participant's rights and welfare is crucial to the relevance of children's environmental health science as a source of empirical support for environmental health policy. Children are particularly vulnerable to environmental toxins because of their mothers' exposure when they are still developing, as newborns and early children, and far into adolescence. Examples of heavy metals that may have an impact on brain development and IQ include mercury and lead. The National Children's Study will prospectively follow 100,000 kids to examine how environmental factors and genetics interact to cause disorders including obesity and autism.

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CHAPTER 8

ROLE OF COMMUNITY ADVOCACY GROUPS IN ENVIRONMENTAL PROTECTION

Ms. Meenakshi Jhanwar, Assistant Professor
Department of Environmental Science, Presidency University, Bangalore, India
Email Id-meenakshi@presidencyuniversity.in

ABSTRACT:

Programs aiming at lowering environmental dangers from pollutants such hazardous waste, fuels, and oils are included in environmental protection. Bring a reusable grocery bag and purchase fewer plastic items. Utilize light bulbs with a long life. Lighting with less energy output lowers greenhouse gas emissions. In this chapter author is discusses public pressure for health care.

KEYWORDS:

Advocacy, Community, Environment, Health, Pollution.

INTRODUCTION

One of the biggest environmental catastrophes to ever strike a major American metropolis was caused by the terrorist attacks on the World Trade Center in New York City on September 11, 2001. This serves as an example of how several labor-based and community groups from all around Lower Manhattan joined forces to pressure federal, state, and municipal authorities for a thorough emergency response to the environmental fallout from the 9/11 attacks. Throughout the eight years of struggle that followed, significant lessons were learnt. In order to offer specialist medical treatment for all locals, students, and employees whose health was impaired by WTC exposures, several affected organizations came together to push for the establishment of a federally financed World Trade Center Environmental Health Center.

The organizations established the Community Advisory Committee to the WTC EHC at New York City Health & Hospitals Corporation at Bellevue Hospital in 2007. Since then, the committee has grown to include two more clinics. The CAC's mission is to advise the WTC EHC and make sure that the changing health care requirements of the impacted areas are satisfied both now and in the future by using the knowledge and experiences of its members. The CAC acts as a think tank with an advanced collection of real-world lessons learnt that should provide a framework for community advocacy in the event of future calamities. This clarifies the viewpoint of these neighborhood-based lobbying groups [1]–[3].

To help residents, students, school parents, and office workers understand the health risks associated with exposure to the toxic dust and smoke that pervaded the area surrounding the World Trade Center, both inside and outside, after the disaster, government agencies must communicate information to them. 9/11 caused widespread relocations, a disruption of essential services, the closing of factories and small businesses, and job losses in Lower Manhattan. These impacts extended far beyond the region that was most severely damaged. Those who lived and worked in such communities, especially community champions and activists, faced tremendous hurdles in their attempts to meet the myriad of disability-related issues.

As citizens, employees, parents, and activists requested government assistance, they encountered a range of federal, state, and local entities that had been given various disaster-related responsibilities. Usually, authorities disavowed their responsibility for handling disasters and shifted blame to other organizations. On the subject of environmental health, the Environmental Protection Agency just asserted without providing any supporting data that the air was safe, and Mayor Rudy Giuliani and other organizations followed suit.

The community and some labor-based organizations engaged in on-the-ground organizing efforts in response to this government failure to protect the populace in order to force the government to disclose the WTC hazards and to inform their affected constituencies about the dangers in the dust and smoke. For the first six months following 9/11, various groups put forth a range of different environmental health demands, including, to name a few, a science-based effective cleanup of WTC contamination from people's homes, schools, and workplaces that would prevent further harm from chronic exposures, WTC health care for those already experiencing symptoms, reparations for those whose health and ability to work would be permanently damaged, and so forth.

These organizations have fought for the communities' health since 2003. They have pressed authorities who are still firmly committed to downplaying health hazards and long-term effects on health to take remedial measures. The EPA, the Federal Emergency Management Administration, the New York City Department of Health and Mental Hygiene, the New York City Office of Emergency Management, and the Lower Manhattan Development Corporation are just a few of the entities that the WTC EHC CAC has attempted to hold accountable. Even their greatest efforts sometimes fell short of stopping the government or its agencies from behaving even more carelessly. WTC EHC CAC, however, thinks they have achieved significant progress that will serve as a springboard for more work to strengthen the public's rights in the case of calamities [4]–[6].

The neighborhood first expressed concerns about the safety of the interior and outdoor air quality as well as the effectiveness of the government's reaction. The images of pivotal occasions in their battle are shown here. For many members of the CAC, working with WTC EHC has been their most fruitful cooperation with a government body. Towards the conclusion, a longer chronology is shown.

DISCUSSION

The World Trade Center complex was destroyed, over 2,800 people were killed, and several other buildings were badly damaged when terrorists hijacked four aircraft and crashed two of them into the two 110-story towers on September 11, 2001. Everything contained inside the WTC towers was destroyed and included in the dust cloud that was created when the buildings fell. In fact, hundreds of tons of asbestos, fiberglass, lead, extremely alkaline concrete dust, polycyclic aromatic hydrocarbons, and many other dangerous compounds were released in an unparalleled quantity as a consequence of the demolition of the towers. They were pursued along the streets by the enormous clouds left behind after the collapse, which also obscured the sun and choked anyone trapped in them. Moreover, the dust entered structures throughout a large region, driving minute particles through any opening that could be reached, including shuttered windows and ventilation systems. WTC flames could be smelled there for months, and debris from the towers reached as far as Brooklyn and New Jersey. Ground Zero became the main point for the cleaning and then the rescue, and cleanup personnel were referred to as "responders" and those exposed to the dust as

residents and employees in the vicinity as "survivors." The catastrophe would leave 16 acres of burning debris, instantly dubbed "the pile."

Residents, office employees, and students in the downtown area were left to fend for themselves in the absence of any agency-coordinated evacuation. Several people left the region, while many more remained nearby. First to fail were cellular communications, then came landlines, the Internet, power, water, and gas. Some homeowners and business employees were compelled to return to indoor settings that resembled moonscapes as early as September 12, with thick dust covering every surface. Many had nosebleeds, sore eyes and throats, and Severe cough. A strong stench that could be detected for miles was produced as fires burnt and smoldered, producing contaminants that were carried by the wind. Disorder ruled. Basic services were not available [6]–[8].

According to ABC News, "Despite flames and a pungent stench at the World Trade Center ruins, most testing for contaminants in New York's air have not sparked alarm," two days after 9/11, as locals dealt with the environmental conditions in their homes and businesses. U.S. A representative for the Environmental Protection Agency said on Wednesday that testing on the air and dust "actually don't identify any genuine hazard." Rudy Giuliani, the mayor of New York, echoed the views this morning. Once Christine Todd Whitman, the EPA administrator at the time, declared that the "air was safe to breathe" on September 18, individuals resumed their regular activities and were exposed to hazardous substances. Owners and renters were undoubtedly compelled to leave when federal and local officials reopened hazardous structures because insurance companies had ceased paying landlords, tenants, and residents.

Several disputes between renters and landlords resulted in court cases when landlords sued tenants who left, sometimes on the advice of their physicians and pediatricians. Almost 45% of the local region was vacant. The 9/11 Tenants Association was founded by several inhabitants of Battery Park City, and it subsequently grew to become the WTC Residents Coalition. Several structures to the north and east went through the same procedure. After being hauled in trucks with loose covers or in the open for many months after 9/11, the 16 acres of WTC dust and debris were eventually deposited onto a hazardous material barge in a residential neighborhood close to Stuyvesant High School's air intakes. Even after the large flames were put out, smaller fires ignited when the disposal of debris exposed them to air.

Early in the spring, groups of locals and school parents who had been hounded by their individual battles with uncooperative authorities started to see the need of uniting the many impacted constituencies. Seven months after 9/11, on April 12, 2002, the EPA continued to defy calls for it to address WTC pollution in interior business and residential areas. In his "White Paper: Lower Manhattan Air Quality," Rep. Jerrold Nadler urged the EPA "to redeem itself and to make Lower Manhattan really safe."

An environmental summit conference was soon planned by WTC residents, renters, environmental and parent organizations to define a new, unified strategy for purging their communities and schools of chemical pollution. More than forty organizations decided to give up the fight for land-landlord cleanup after hearing from Rep. Nadler and Hugh Kaufman, who was at the time the EPA's National Ombudsman's Office Chief Investigator, about the agency's legal obligations under the National Contingency Plan, which serves as the federal government's guide for handling both oil spills and hazardous substance releases. Instead, they decided to proceed together and demand

that the EPA take the initiative in a thorough interior test and cleaning program for all impacted locations.

After that, on May 9, 2002, there was a conference titled "After September 1 Environmental and Public Health Policy: A Working Conference." It was sponsored by 38 grassroots groups and coordinated by the City University of New York and the New York Committee for Occupational Safety and Health. There were more than 200 attendees, including representatives from more than 80 labor, community, religious, environmental, immigrant, tenant, and public health groups. Ironically, the Children's Allergy, Immunology and Respiratory Foundation presented Christie Todd Whitman, the administrator of the Environmental Protection Agency, with its Gift of Breath Award that evening for her dedication to asthma prevention and "for raising awareness of the environment as a possible first line of defense against asthma." Outside the event, 9/11 Environmental Action held a protest that was attended by about fifty affected residents, school parents, and worker safety advocates from NYCOSH.

The Beyond Ground Zero Network was established by community-based groups in the autumn of 2001 to address the catastrophic economic and health effects of 9/11 on Lower Manhattan's low-income areas. In 2002, the Asian American Legal Defense and Education Fund, the Commission of the Public's Health System, and the Community Development Project of the Urban Justice Center collaborated with the National Mobilization Against Sweatshops and the Chinese Staff and Workers' Association. This network brought together a rare mix of knowledge on worker's rights and compensation, as well as legal and political, public health, and participatory research experience.

The Lower East Side and Chinatown's poorest inhabitants and employees were the target demographic for the BGZ study, which started in 2002. BGZ discovered that there was no access to medical treatment or help, and that thousands of individuals were still dealing with health problems brought on by 9/11. Via a number of events, BGZ started to organize individuals to solve unmet healthcare needs on a broader scale. In May 2002, they held two significant town hall meetings, the first of which drew 2,000 attendees to PS 124 in Chinatown. After these discussions, on June 5, 2002, BGZ organized a 7,000-person march from the Lower East Side to Foley Square in Chinatown. BGZ funded the "March for Our Health, March for Our Lives," which attracted 1,000 participants, on July 31, 2002, in Washington, D.C., where the struggle for health care for locals and 9/11 survivors was then carried. At this period, the WTC Worker and Volunteer Medical Screening Program, which is run by the Mount Sinai Medical Center, was given first, restricted financing in the spring of 2002 as a consequence of the efforts of trade unions and certain governmental leaders. Yet at this point, neither the necessity for nor the money for the WTC health requirements of individuals living in and working at Ground Zero and beyond had been acknowledged.

The public was reassured by EPA's early public statements after the WTC towers collapsed regarding the safety of the air outside the Ground Zero area.1 However, when EPA declared on September 18 that the air was "safe to breathe," it lacked the data and analyses necessary to make such a broad declaration. Particulate matter and polychlorinated biphenyls were two pollutants of concern for which there were no air monitoring data available at the time. Also, via the collaborative process, The White House Council on Environmental Quality persuaded EPA to include encouraging comments and remove warning ones from its early news releases. This had an impact on the information that EPA communicated to the public. The general public was unlikely to experience short- or long-term health consequences from ambient air levels beyond the

first few days, according to an EPA draft risk study done more than a year after the assaults. Nevertheless, a conclusive determination of whether the air was safe to breathe may not be reached for years due to various uncertainties, including the quantity of the public's exposure and the absence of health-based standards. On September 26, 2003.5, the EPA OIG published a second evaluation report with the title "Evaluation Report: Survey of Air Quality Information Related to the World Trade Center Collapse." According to this report, "overall, the majority of respondents wanted more information regarding outdoor and indoor air quality, wanted this information in a timelier manner, but also did not believe the information they received."

Gains in environmental protection were gained thanks to greater public pressure during community board meetings and public hearings during the early years of the reconstruction effort, increased awareness of the effects of air quality after 9/11, and the need to make Lower Manhattan habitable. To aid in the planning and coordination of the Lower Manhattan reconstruction effort, a state-city entity known as the Lower Manhattan Development Corporation was established in November 2001. A U.S. community development block grant was used to finance LMDC. Housing and Urban Development Department. An environmental framework for the reconstruction of the WTC site was established by LMDC in 2003. It included the following four parts:

1. Sustainability, green design, and construction principles;
2. Creating an environmental protection strategy
3. Coordination between government agencies and the general public;
4. Resource baseline evaluation and coordinated cumulative effects analysis.

To achieve the Leadership in Energy and Environmental Design gold certification, each WTC office building, Santiago Calatrava's WTC Transportation Hub, and the 9/11 Memorial & Museum all worked hard. Through its building certification program, the U.S. Green Building Council promotes a sustainable building rating system that honors initiatives that achieve the highest levels of environmental and health performance. A Green Building Certification Institute oversees the administration of LEED professional credentials and tests. The biggest commercial sustainable site in the nation, the 16-acre WTC site is being monitored for sustainability by LMDC.

It was vital to lessen the effect of diesel engines throughout the reconstruction process due to growing public concern about air quality. A successful private public initiative known as the "7 WTC Diesel Emissions Reduction Project" involved developer Silverstein Properties and their contractors using best-available technology retrofits for off-road diesel construction equipment and less-polluting ultra-low-sulfur diesel fuel to reduce emissions pollutants in 2002. A result of this pilot research and community input, Mayor Michael Bloomberg signed Local Ordinance 77, Usage of Ultra Low Sulfur Diesel Fuel by Nonroad Vehicles, into law on December 22, 2003. All of Lower Manhattan now has ULSD usage, as well as public work contracts and retrofits. The employees and the neighborhood both benefited from this.

The Lower Manhattan Construction Command Center, a new state and municipal organization, was established in November 2004 with the assistance of corporate executives and the neighborhood. The WTC site and its surroundings underwent a significant makeover that cost more than $30 billion and included 60 active construction projects in a small area (less than one square mile) over a short period of time by local, state, and federal authorities, private developers, and utilities. The Environmental Performance Commitments, which include the supervision, monitoring, and mitigation of air, noise, and vibration, were also within the purview of the LMCCC. The real-time posting of the air quality monitoring data on a public access website was

requested by Community Board 1 in order to allow for any required prompt action. Engineering measures in Lower Manhattan kept the background particle matter levels below the National Air Quality Guidelines standard set by 9/11. For large-scale, intricate building projects in crowded metropolitan settings, the EPC framework could be taken into consideration.

The Community Emergency Response Team was established in the summer of 2003 in Battery Park City, a neighborhood to the west of the World Trade Center, as an illustration of community involvement in disaster response. The events of 9/11 and their aftermath directly led to the creation of the BPC CERT. It was the first CERT established on the east coast, and the Tribeca CERT, which protected the region to the north of the World Trade Center, followed it in April 2005. After a significant catastrophe like 9/11, the community learned that police, fire, and EMS personnel were overworked to the breaking point. The BPC CERT used experienced CERT trainers, police, firemen, and medical professionals to instruct locals in emergency rescue and medical care procedures. They received instruction in emergency medical care, crowd management, search and rescue, and fire suppression. A significant portion of the members completed and received their Red Cross First Aider certification. Eventually, with the acquisition of BPC's own rescue boat, maritime search and rescue was introduced. Some members of the group offered their assistance in New Orleans during Hurricane Katrina in 2005. CERT teams undoubtedly play a part, but they must be aware of how they may support other first responders during an emergency and when to leave the scene.

Working with the NYS Department of Health on a WTC Residents Respiratory Health Study, Dr. Joan Reibman, an academic pulmonary physician at Bellevue Hospital Center and a graduate of the NYU School of Medicine, evaluated the incidence of new-onset asthma and other respiratory symptoms after 9/11 as well as the persistence of symptoms. First Asthma Day was hosted in the vicinity of the World Trade Center in May 2002 by Asthma Moms. In order to attempt to address the medical queries of shocked and sometimes irate neighborhood residents, Dr. Reibman consented to go into the streets. BGZ had been meeting with Dr. Reibman throughout the years, but in 2004, BGZ contacted Bellevue Hospital armed with the results of the health survey. For BGZ residents and employees, Bellevue Hospital and the BGZ cooperation established the Bellevue WTC Health Impacts Clinic. This was the first initiative to address WTC-related ailments among nonresponders. Volunteers who conducted outreach via door-to-door surveys, town hall meetings, and the construction of a nearby community center were a distinctive aspect of the initiative. The September 11 Recovery Fund from the Red Cross provided funding for BGZ and Bellevue in 2005.

Sen. Hillary Clinton of New York compelled the EPA to set up this scientific advisory body to assess the agency's reaction in March 2004. The panel's goal was to "gain greater input on ongoing efforts to monitor the situation for workers and residents affected by the World Trade Center collapse. To assist the Agency in characterizing any remaining exposures and risks, identifying unmet public health needs, and suggesting any steps to further minimize the risks associated with the aftermath of the World Trade Center attacks, the EPA convened an expert technical review panel. Only after public pressure did the EPA include a community liaison as an ex-officio panel member. While community and labor representatives for the WTC met sometimes, the World Trade Center Community Labor Coalition was formally established after this twenty-one-month process. It merged into a force that was considerably stronger than the sum of its parts. The WTC EHC CAC currently has representation from several of these organizations.

Following numerous panel sessions and public pressure, EPA agreed to add a labor representative to the panel in July 2004 along with the community liaison. The 125 Cedar Street Residents, whose building is directly across the street from the heavily contaminated Deutsche Bank building, gave a PowerPoint presentation that same day, raising important issues and stressing the necessity for EPA to exercise oversight of all aspects of the building's demolition. This was a significant community win. Buildings destroyed by the WTC could still be torn down at the time without any environmental supervision or safety measures, as if there was no pollution.

The EPA WTC Expert Technical Panel was disbanded by EPA on December 13, 2005, after its twelfth meeting. Once EPA's final Test and Clean Program, which was underfunded and insufficient, was published, this occurred. The most significant limitations and flaws of the 2002 program, as identified by the inspector general, would be repeated by this technologically and scientifically faulty initiative. The shortcomings included designating a restricted geographic region, excluding mechanical ventilation systems, not considering buildings as an integrated system, and ignoring workplaces, schools, small companies, and firehouses. While there was initially a division between members of the scientific agency and the public-focused committee at the start of the panel procedure in March 2004, it ultimately came together against the EPA. Once again, the EPA proceeded with its constrained test program, which attracted little interest. Notwithstanding how unpleasant the panel process was, it did generate enough public pressure for the EPA to take the lead in demolishing many large WTC-contaminated buildings, notably 130 Liberty Street in December 2004. The community labor presentation urged the EPA to adhere to the "Precautionary Principle" throughout the EPA WTC Expert Technical Panel Process: If the precautionary principle had been initially applied, a significant amount of the exposure to the toxins from the WTC could have been prevented, and the first responders and community could have taken the necessary precautions, limiting liability, medical expenses, and legal costs.

As the five-year anniversary of 9/11 drew near, public demand for health care for WTC residents, students, and office employees who were impacted by 9/11 was growing. An official declaration by Mayor Bloomberg and a single public town hall meeting represented a significant turning point in the community's understanding of the effects of 9/11 on health. Mayor Bloomberg and President of the Health and Hospitals Corporation Alan Aviles announced the opening of the WTC Environmental Health Center at Bellevue Hospital Center on September 5, 2006. It would increase access to medical care and mental health services for nonresponders who were exposed to the WTC's harmful dust and gases. As the private Red Cross financing for the limited WTC-related health services for the BGZ population was about to expire in 2006, this timely financial contribution was essential. The first public monies to do outreach and treat residents, office employees, students, and other impacted persons hadn't been provided for five years. Since then, the WTC EHC has grown to include the hospitals in Georgetown and Elmhurst [9].

The next day, on September 6, 2006, 9/11 Environmental Action sponsored a town hall forum called "Affected but Neglected: the Impact of 9/11 on Community Health and a Call for Federal Action." Over 300 residents, office workers, parents, and students crowded into St. Paul's Chapel, which is located across the street from the site of the World Trade Center. Doctors from the two centers for excellence that cared for both responder and nonresponder groups as well as the New York Council on Occupational Safety and Health presented their findings. Juan Gonzalez served as the moderator. More than any other writer, Juan Gonzalez had authored early articles for the New York Daily News regarding the WTC air quality and the health effects of 9/11. After five

years, a lot of people still had questions. There was thus a fairly large queue at the microphone to ask the medical and scientific experts questions after the official speeches.

The flexible collaborative method used over the years to address environmental health problems that emerged after 9/11 gave rise to the Community Advisory Committee of the WTC EHC of the New York City Health and Hospitals Corporation. The CAC demonstrated the critical role that community participation can play in creating and providing high-quality medical care to a variety of communities, frequently requiring specialized outreach in languages ranging from Mandarin to Polish. Also, the CAC has played a crucial role in assisting WTC EHC experts with their planned study on the environmental and mental health effects on the neighborhood. Contrary to the community's extensive participation in the EPA WTC Expert Technical Panel Process, the WTC EHC CAC has used the community-based participatory research paradigm and shown what true collaboration can achieve. The WTC EHC CAC is a forum for the participating organizations and individual members to directly and meaningfully contribute. In October 2007, it was revealed that a doctor will join the Bellevue clinic team as a result of community pressure after it became apparent that children were experiencing severe and long-lasting health effects from the WTC [10], [11].

CONCLUSION

A concise summary of lessons learnt that will be useful to politicians as well as environmental activists. First, emphasize prevention. The basic guideline of environmental health is to stop new exposures to avoid further damage. The appropriate safety equipment, such as respirators, must be provided by the government's health and environmental authorities, who must also enforce the usage of this equipment. According to the National Contingency Plan, EPA was required to carry out representative testing and thorough cleaning, both inside and outside, in all impacted communities in the wake of the WTC tragedy. Apply the "Precautionary Principle," which states that the public should be protected from harm when there is a plausible risk even though a direct cause-and-effect relationship cannot always be established. It also states that the decision-making process should be democratic and involve the party who may be harmed. The burden of evidence should be placed on the side arguing for a course of action—or in this instance, inaction—rather than the community exposed, as in the case of the WTC environmental catastrophe, when emergent ailments were not immediately apparent. Throughout the EPA WTC Expert Technical Panel Process, the community urged the EPA to adhere to the Precautionary Principle.

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CHAPTER 9

MEDICAL RESPONSE TO AN ENVIRONMENTAL DISASTER

Dr. Krishnappa Venkatesharaju, Assistant Professor
Department of Environmental Science and Engineering, Presidency University, Bangalore, India
Email Id-venkateshraju.k@presidencyuniversity.in

ABSTRACT:

A catastrophe affecting the natural environment that is brought on by human activity is referred to as an environmental disaster or ecological disaster. This idea separates environmental catastrophes from other disruptions like natural catastrophes and deliberate acts of war like nuclear strikes. In this chapter author is discusses analysis of world trade center dust. Many municipal and federal authorities were tasked with the difficult job of juggling the demands for search and rescue efforts, a criminal investigation into the disaster's source, the necessity to revive the financial district, and the protection of the local populace and employees. There has been a great deal of criticism of the EPA, the National Institute for Occupational Safety and Health, the Occupational Safety and Health Administration, the New York State Department of Environmental Conservation, and the numerous other government agencies that were present during the aftermath.

KEYWORDS:

Disaster, Dust, Environment, Health, Medical.

INTRODUCTION

The World Trade Center in New York City was the target of terrorist attacks on September 11, 2001, which caused the towers to collapse, created a thick cloud of dust and fumes that spread across Lower Manhattan and Brooklyn, started fires that raged for months, and left more than a million tons of debris in one of the most densely populated and crucially important commercial districts in the entire world. In addition to the tragedy's catastrophic effects on New York City and the country's economy, politics, and personal lives, it also caused an unexpected and unparalleled environmental catastrophe. The emergency response in the immediate aftermath of the assault was very challenging due to the scope of the environmental damage, which included the amount and complexity of pollutants emitted as well as the number and variety of people at risk for severe health impacts [1], [2].

It is now well known that employees doing rescue, recovery, and cleaning operations did not always wear personal protective equipment. The famous quote from Christie Todd Whitman, the EPA's director at the time, "The air is safe to breathe, and the water is safe to drink," is often brought up. Assuaged by Whitman's reassurance, many locals and employees returned to their homes and places of business feeling that the danger was over. Furthermore, the inadequacies of the organizations in charge of counseling locals and employees on how to remove the debris may have unnecessarily exacerbated the exposure and health hazards of these people.

To a doubt, none of these organizations could have foreseen the severity of the crisis, however it is possible to argue that given the circumstances, each institution managed to fulfill its own purpose to some extent. However, political considerations overshadowed each agency's initiatives, which

prevented them from being combined into a comprehensive analysis of the situation at Ground Zero to inform health rules and safeguard first responders, employees, and the general public. Additionally, one may assume that public health departments would have intervened at an early stage; yet, in fact, these organizations are experts in infectious illnesses and preventative medicine but have little to no experience with acute environmental exposures. Many warning signs of possible health hazards were probably disregarded due to the absence of a single authority and intense political pressure to enable life in Lower Manhattan to restart.

This focuses on the role that the medical and scientific community had in understanding the properties and toxicity of WTC dust in the days, months, and years after 9/11 as well as in providing care for those who were exposed to it and suffered negative health consequences. We outline the body of information about the properties and toxicity of WTC dust. The account of how our knowledge of the health repercussions of the WTC developed via collaborations between medical, governmental, charitable, and community groups is then told in a general chronological order. We conclude by talking about the disaster's lessons for future catastrophes and environmental health in general.

This was finished before H.R. was signed. President Barack H. Obama signed into law H.R. 847, the "James Zadroga 9/11 Health and Compensation Act of 2010" on January 6, 2011. This law establishes a screening, monitoring, and treatment program for negative medical and mental health effects for rescue and recovery workers as well as community members as a result of the persistent efforts of congressional and senate members, community members, medical professionals, organized labor, and rescue and recovery workers. With the passage of this compromise legislation, funds will hopefully be available for ongoing population health monitoring and treatment. Onerous reporting requirements, tight limitations, and novel additions are feared to act as obstacles to care. Yet, the passage of this legislation, some 10 years after the incident, is the result of coordinated efforts by several organizations to persuade the federal government to provide a suitable health response to a tragedy of this scale [3], [4].

DISCUSSION

One week after the incident, residents, rescue personnel, and local employees were informed that it was safe to return to work. Federal agencies had already given assurances on the ingredients of the WTC dust as reports came in from a variety of federally supervised sites. Ground Zero was not designated by the EPA as a hazardous waste site or a Superfund site, allowing for less worker protective regulations and lessening the burden on building owners to restore their structures. The EPA also disputed that it had a legal obligation to determine or remedy indoor environmental pollution, leaving that duty to New York City authorities. In the end, no government organization assumed charge of indoor places. Commercial and residential tenants were left to deal with their private spaces, with building owners responsible for indoor environmental monitoring and repair of common areas. The technical advice provided by federal and local government agencies was inaccurate and incomplete, and none of the organizations sought outside assistance from academic or commercial sources who had knowledge in the fields they lacked. The EPA launched a non-mandatory "Test and Clean Program" in 2002, nearly a year after the incident, that was only applicable to residences.1,2 This program, which was focused on a small area, allowed for either testing or cleaning followed by testing. No Lower Manhattan business or institutional buildings were included, and just 18% of eligible flats were either cleaned or tested.

World Trade Center dust analysis

The National Institutes of Environmental Health Science increased funding of four existing Environmental Health Science Core Centers to conduct exposure assessments, characterize debris, and monitor health effects as it quickly became clear that the risks posed by the 9/11 event would require immediate and extensive study. These research facilities have a plethora of experience in toxicology and epidemiology investigations and were financed for toxicologic and environmental studies in adult and pediatric populations. These centers received more financing quickly to broaden their mission, and researchers with a variety of specialties were brought on board to design and carry out studies including air monitoring, toxicologic evaluation, and human effects. These facilities later offered a lot of knowledge about the unique risks presented by the dust and helped identify some of the resulting symptoms and syndromes that were well known in impacted populations. These centers worked as an NIEHS consortium apart from governmental organizations [5], [6].

It was very difficult to predict the consequences on health for a variety of reasons. The office buildings that made up the WTC site featured a huge variety of materials. According to some estimates, the buildings contained 300-400 tons of asbestos, 50,000 lead- and mercury-containing personal computers, 300 mainframe computers, hundreds of miles of polyvinyl chloride and copper wire and cable, thousands of mercury-containing fluorescent lights, unknown tons of plastics, which when burned, would release dioxins and furans, thousands of chairs and other office furniture containing polybrominated biphenyls, and several storage tanks. In the days after the assaults, members of the NIEHS collaboration gathered dust samples from the region. Within three days of the disaster, air sampling locations were established near Ground Zero for daily particulate matter sampling, and bulk samples of accumulated debris were collected from a number of indoor and outdoor sites for later analysis. An air sample from an ongoing sampling study in Manhattan was also donated. These samples provided some of the most thorough data on the characteristics that have come to be well-known, such as name, size, and shape of the particles. There were access issues, damage to the local infrastructure, a lack of skilled workers and sample equipment, and devices that were overwhelmed by too many particles while the first plume was there.

Notwithstanding their shortcomings, the NIEHS consortium research have provided a wealth of information. While these large particles are typically trapped and cleared by the upper respiratory tract, the enormous amount of material had the potential to overcome normal respiratory protective mechanisms, and a study from the consortium showed that these large fibers lodged in human lungs.6,7 These studies revealed that more than 90% of the particles in the bulk samples tested were >10 microns in diameter, and many were fibers with widths 5 microns and >10 microns. According to monitors available after September 21.9, PM2.5 levels in the air at the GZ perimeter were very high, frequently exceeding the EPA level of concern of 40 ug/m3, with sporadic increases to 100-400 ug/m3. Characterization of the PM2.5 revealed an alkaline pH similar to that of unfractionated dust, with subtle differences in the other constituents. There were worries that the dust from the WTC might pose a special health danger. The EPA researchers used materials from the NIEHS collaboration to show that WTC PM2.5 had a biological impact on a mouse model. They demonstrated that airway hyper responsiveness could be brought on by exposure, serving as proof of concept for the subsequently reported human investigations.

The EPA and members of the NIEHS group examined the dust's PAH composition. The kinds of PAH contained in the materials collected might be linked to the aircraft used in the assaults since various types of fuel combustion create different forms of PAH. When dust from the NIEHS

consortium was compared to dust collected several weeks later, it was discovered that the two samples had similar types of PAH, indicating that the fires that were still burning at the scene were a continuous source of toxic byproducts of jet fuel's incomplete combustion.4 Surface dust that had accumulated indoors was also examined, and it revealed a profile of PAH types that matched that of the dust collected outdoors in the early days following the event. A range of unburned and partly burnt hydrocarbons from the materials in the collapsed structures, as well as variations in the penetration of the outside dusts, were assumed to have caused these disparities in levels of individual PAH that were found in indoor bulk samples.

The results of the EPA, which had collected samples from the air filters, were in direct opposition to those of this study. The EPA came to the conclusion that the transient elevation in PAH posed a very low cancer risk among non-occupationally exposed residents of New York City, despite the fact that concentrations of mutagenic and carcinogenic PAH were among the highest reported for outdoor sources on the first days. Over the following 100 days, however, diesel sources predominated. This claim does not currently have any human data to back it up. Regarding sampling, analysis, publishing, or public distribution of data, there was little to no communication among the stakeholders involved in public health.

The New York Fire Department

Over 11,000 firefighters from the Fire Department of New York City participated in a continuous rescue and recovery operation at the WTC site starting minutes after the terrorist assaults on the building and lasting until May 2002. An additional 240 FDNY rescue personnel needed emergency medical attention during the course of the following 24 hours, most often for eye and respiratory tract irritation. During the collapse, 343 FDNY rescue employees perished. The FDNY had a well-established medical program for regular monitoring and treatment of its personnel. Three FDNY rescue workers required hospitalization due to life-threatening inhalational injuries. Members of the FDNY were obliged to submit to and pass annual medical exams that included tests of lung function. Rapid emergency medical services were provided by the medical officers of the FDNY Bureau of Health Services in response to the rescue and recovery operation at the WTC site. In September 2002, these doctors—many of whom were also engulfed in the first dust cloud—became the first to document the negative impacts on people's health caused by exposure to WTC dust and fumes.

For a number of reasons, studies of the firefighter community provide unique insights into the potential negative health impacts of WTC dust and fume exposure. First, the firemen were often exposed to high levels of WTC dust and gases, with many of them experiencing sustained daily exposure to the blazing debris over the course of many months. Second, case ascertainment is finished because all FDNY rescue personnel are required to report to the FDNY Bureau of Health Services for routine assessments if they visit hospitals or treatment facilities while performing their duties, need to take time off for medical reasons while on duty or off, file for workers' compensation, or need to file for retirement disability. Additionally, since they must pass a rigorous medical examination in order to be hired, firemen are often in better health than the average population. The only cohort studied so far for whom pre-9/11 clinical and pulmonary function data are consistently accessible is the firefighter community [7], [8].

After a few weeks of the terrorist attacks, the FDNY received a $4.8 million grant from the Centers for Disease Control and Prevention to evaluate its members for health issues related to their early and prolonged exposure to hazardous circumstances at Ground Zero. The federal government gave

funding the same year in appreciation of the large number of fatalities suffered by FDNY and the effect the WTC tragedy had on practically every member of the department.

$132 million was allocated for FDNY members' therapy, mental health evaluations, and crisis counseling in New York City and 10 neighboring counties for more than two years after the tragedy. The Federal Emergency Management Agency provided financing for Project Liberty, which was founded by the New York State Office of Mental Health with a Crisis Counseling Regular Services Grant, in order to disperse these monies. Because of Sen. Hillary Rodham Clinton's specific personal involvement, the federal government responded quickly to the New York congressional delegation's demands for money.

The work of the FDNY medical community allowed the first detection of harmful respiratory and other health effects in those who responded to the WTC crisis. Prezant and colleagues described "World Trade Center cough," which they defined as cough severe enough to require medical leave for four weeks, and bronchial hyper-responsiveness in FDNY firefighters. In less then 24 hours after exposure, all 332 firefighters with WTC cough reported a cough productive of black to green mucus. Ninety-five percent of the participants had dyspnea, 87% had symptoms of gastro-esophageal reflux, and 54% had nasal congestion. Among firefighters with WTC cough and those who had high- or intermediate-level exposure, bronchial hyperresponsiveness was a prevalent symptom. Because of the heightened rescue efforts during the first two weeks following the towers' collapse and the only intermittent use of respirators during that time, the use of respiratory protection was not significantly associated with a decreased risk of lower airway symptoms, decreased pulmonary function, or airway hyper-reactivity.

Prezant and colleagues demonstrated that these firemen weren't only symptomatic they also had severe lung function declines that were linked to their symptoms. However, forced vital capacity and forced expiratory volume in one second showed a drop of at least 0.5 liters in 58% and 54% of firefighters before and after 9/11, respectively.18 Of the 78 firefighters with normal findings on plain chest radiography, high resolution inspiratory and expiratory CT scans were obtained, and air trapping was seen in more than 50% and bronchial wall thickening in 30% of the fi Just 34% of firefighters with symptoms mostly affecting the lower respiratory tract were permitted to resume their duties during the six-month follow-up period, compared to almost all of those with upper airway problems.

Tests on the firefighters showed that exposure to WTC particles caused an inflammatory reaction in the lungs both immediately after exposure and for years after the incident. Fly ash, broken glass fibers, chrysotile, asbestos, silicates, chromium, and fly ash were all found in the bronchoalveolar lavage fluid from a firefighter who was working on the WTC pile on September 24, 2001, and who later developed respiratory failure due to acute eosinophilic pneumonia.8 Sputum samples taken from 38 highly exposed FDNY firefighters two years after the incident also showed persistent inflammation in the lungs.

In order to assess symptoms, lung function, and use of personal protective equipment in firefighters, the FDNY Bureau of Health Services collaborated with the National Institute for Occupational Safety and Health20. In this study using a stratified random sample of 362 fire-fighters, firefighters were classified as high exposure if they were present the morning of September 11th. According to the firemen, during the first two weeks, 19% of people did not use respira- tors, 50% wore them only sometimes, and by the end of the second week, almost 70% had switched to a half-face respirator or disposable mask. Early in October 2001, over 80% of high-

and intermediate-exposure groups, 46% of low-exposure groups, and 9% of those who had not been exposed reported experiencing respiratory symptoms. Spirometry conducted immediately after WTC exposure revealed mean decreases of 268 mL and 264 mL for FVC and FEV1, respectively, when compared to lung function tests conducted the previous year. Both dramatically decreased with a remarkable dose-response in the high- and intermediate-exposure groups, and respiratory symptoms were strongly linked with lung function reduction.

The durability of symptoms, whether individuals who acquired additional symptoms had a delayed or more chronic asthma-like appearance, and if the symptoms were severe enough to induce handicap were all issues that were addressed in further investigations of the FDNY. Bronchial hyper-reactivity was linked to exposure intensity and airflow obstruction in a sample of 179 rescue workers firefighters at one, three, and six months.21 High-exposure FDNY were nearly 7 times more likely to have bronchial hyper-reactivity than those who had intermediate exposure, and initial hyper-reactivity predicted persistent hyper-reactivity at six months. One more time, a clear exposure intensity-response gradient was observed, with the most severely exposed individuals faring the worst. This time, 12,079 FDNY rescue workers who had been exposed to WTC dust experienced a significant decline in adjusted average FEV1 during the year following the attacks, which was equivalent to twelve years of aging-related decline in lung function. The FDNY study went on to discuss substantial mental health impacts as well as a greater frequency of sarcoid-like granulomatous lung disease in FDNY rescue employees. For its members, the FDNY created a lung function referral and treatment program.

A medical screening program for WTC employees

In the days, weeks, and months after September 11, 2001, an estimated 40,000 non-FDNY laborers assisted the 11,000 FDNY employees who were working on rescue and recovery efforts by cleaning up Ground Zero and the Staten Island landfill. These workers included a range of first responders, including police officers, construction workers, ironworkers, laborers, and employees of the public sector.24,25 Within weeks of the incident, the Mount Sinai Irving J. Selikoff Center for Occupational and Environmental Medicine, a university-based, occupational health center supported by the New York State Department of Health, started evaluating these workers. To improve communication among the medical professionals caring for the responders, National Institute for Occupational Safety and Health officials started holding frequent conference calls. Several labor groups that cared about the wellbeing of their constituents as well as doctors at Mount Sinai Medical Center started promoting the necessity for a monitoring program among national elected leaders and representatives. Federal money for the construction of a medical monitoring program for WTC rescue and recovery personnel was awarded as a consequence of these efforts in April 2002. The State University of New York at Stony Brook, Queens College, UMDNJ-RWJ New Jersey Medical School, and New York University-Bellevue Hospital were also clinic locations for the WTC Worker and Volunteer Medical Screening Program, all of which were a part of the state's pre-existing infrastructure.

Network of Occupational Health Clinics

Although some of the clinical screening evaluations were based on asbestos screening, the clinical screening examination was expanded. The design of this program began in April 2002, and implementation began three months later.26 A number of challenges were encountered during the design of the program, including the lack of systematic responder rosters, the potential for a wide range of responder needs, and the limited data on exposures and potential health consequences.

These original monies were not meant for the treatment of these people, but rather for the medical and mental health screening of those participating in rescue, recovery, and debris clearance. Moreover, funding was never long-term accessible; instead, it was given as legislative allocations, necessitating ongoing lobbying efforts and preventing long-term planning. Sen. Hillary Clinton, Reps. Caroline Maloney, Jerrold Nadler, and Vito Fossella advocated for the first congressional appropriation of $90 million for the FDNY and workers' responder program, now known as the WTC Worker and Volunteer Screening and Monitoring Program, which provided ongoing funding for the program and support for a long-term monitoring program. A program for the treatment of some of the first responders was supported by private generosity; it was extended in 2005 with additional financing from the American Red Cross Liberty Disaster Relief fund. The WTC Worker and Volunteer Monitoring and Treatment Program was created in 2006 with additional funding from NIOSH to cover therapy.

In the WTC Worker and Volunteer Monitoring Program's initial 9,442 responders examined between 2002 and 2004, 69% of them reported developing new or worsening respiratory symptoms while working at the WTC, and 59% of them continued to have these symptoms at the time of examination.25 Sixty percent of these workers claimed to have been in the initial dust cloud on 9/11. The most prevalent symptoms were upper respiratory symptoms, cough, dyspnea, chest tightness, and wheezing. There was a strong correlation between the occurrence of a low FVC and the time of arrival to the location, with earlier arrivals having a greater incidence of abnormality. In a study of 3,160 employees' longitudinal lung function, which included baseline and follow-up spirometry, 20% had a poor FVC on the first examination and 16% on the second.28 8% had blockage during both exams. 13 mL/year less FEV1 was lost, however 131 people lost more than 300 mL of FVC annually. Respiratory symptoms at initial assessment did not indicate a reduction in lung function, and no particular connections were seen for this fast decline group. Data from this worker cohort also gave reports of gastric reflux symptoms30 and information on social and mental health difficulties. Radiographic imaging utilizing CT scans in a subset of employees revealed air trapping, comparable with that reported in the FDNY research. In a study of more than 10,000 employees, 11% reported signs of post-traumatic stress disorder, which is greater than the percentage for the general population31. Many also reported concomitant despair and anxiety [9].

CONCLUSION

In conclusion, the cooperation between labor forces and an existing occupational program enabled the quick development of a complete medical program and the capacity to lobby for financing for this program at the federal level. The transition from a screening and monitoring program to a program giving medical care needed ongoing advocacy, but it turned out to be a priceless resource for those without access to appropriate health insurance and enabled the growth of medical professionals' skills. Natural catastrophes have the potential to seriously harm the environment. It is past time to acknowledge that human activity may potentially contribute to natural catastrophes. The effects of our actions on the environment may have an adverse effect on ourselves.

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CHAPTER 10

A BRIEF DISCUSSION ON WTC HEALTH REGISTRY

Ms. Meenakshi Jhanwar, Assistant Professor
Department of Environmental Science, Presidency University, Bangalore, India
Email Id-meenakshi@presidencyuniversity.in

ABSTRACT:

It functions as a non-partisan umbrella organization where members collaborate to provide trade services and foster global trade ties. A Global Trade Center houses several worldwide commerce-related services under one roof. In this chapter author is discusses the number of people affected by the disaster.

KEYWORDS:

Community, Environment, Health, Registry, Residents.

INTRODUCTION

At the local level, there was no formally formed organization of citizens on 9/11. A few small-scale initiatives to reduce community health concerns were made after 9/11. The New York City Department of Health and Mental Hygiene distributed leaflets recommending cleaning methods, such as shampooing carpets, using wet rags and mops, and using HEPA vacuum cleaners.33 Community physicians were less prepared to deal with exposure complications than were occupational physi- cians. For instance, the EPA advised tenants to use "appropriate" equipment but failed to specify respirators. Community doctors had less informational resources available to them and no specific patient advice, which was why this occurred. Those who listened to the monitoring data supplied by the EPA and the NYCDOHMH attempted to allay the patients' anxieties. Some advised patients to relocate, even only briefly [1]–[3].

Given the amount of individuals that were impacted by the accident, these issues were very severe. Indeed, estimates indicate that about 300,000 non-responders were at risk of exposure from the WTC disaster.34 This population included the daily workforce, grade school students, students in local colleges, and the more than 60,000 residents living south of Canal Street.34,35 The local population of residents, workers, and students had the potential for multiple exposures to WTC dust, fumes, and gasses. After the buildings were struck, several people became trapped in the first rubble. Several people were trapped in the early dust clouds when the many buildings fell, and some people spent hours wandering among the rubble just after the fall. 19,000 families were uprooted from their homes on the west side of Manhattan and forced to find temporary housing; some stayed there for more than a year.36 These people were particularly at danger since there was no organized method for cleaning the impacted apartments. Some cleaned on their own, while others used cleaning companies, the majority of which employed unskilled labor. Ventilation systems weren't consistently cleaned. While some people had access to financing for new carpets and furniture, the distribution of this money was haphazard, and there were no recommendations as to when furniture should be changed.

Workers

Risks were also posed to others who worked nearby. While Lower Manhattan companies shuttered right away after the incident, one week later almost all of them were back open. Offices that have undergone varying degrees of cleanliness welcomed back workers with patriotic excitement. Likewise, in the lack of official recommendations, some were meticulously cleaned while others were just partially cleaned, omitting ventilation systems. Schools also had issues that resulted in exposure. The neighborhood schools responded to the situation on 9/11 in a number of different ways. Some instructed the kids to leave after opening their doors. Some locked the kids inside the building and didn't let them out until the buildings had fallen. over many weeks to months. These schools' various cleanliness initiatives rely on the support of parent-led groups. The continuous flames' gases and dust, as well as the re-suspension of dust from the WTC site, necessitated continual cleaning efforts, none of which were publicly advised by government authorities. Within days, anecdotes of respiratory complaints started to surface.

In response to these numerous risks to the neighborhood, the New York State Department of Health and medical professionals from New York University started working together to develop a research to look at the impacts on local people' respiratory health. The Centers for Disease Control contributed funding for this investigation. Together, they attended meetings with local advocacy groups, community boards, newly created environmental organizations, and representatives of tenants' organizations. Throughout the first six months after 9/11, the WTC Residents Respiratory Health Study was developed, put into practice, and finished. Residents living within a mile of Ground Zero and participants in a control group were sampled for this research. Since the research at the time was the sole survey of inhabitants, the exposed population was oversampled with the intention of creating a longitudinal cohort. English, Spanish, and Chinese questionnaires were despatched, but owing to the attack's interruption of the postal service and the ensuing anthrax panic, they had to be hand-delivered, building by building, door to door [4], [5].

In the more than 2,800 residents who responded to the questionnaire, there was a presence of new-onset persistent respiratory symptoms that was more than three times higher than in the control population, making this study the first to document the presence of health effects in a local population of residents exposed to deconstructed, pulverized, and incinerated buildings37. Compared to the control group, more than six times as many exposed individuals had new-onset wheeze. Adverse home conditions, such as the presence of physical damage, dust, and odors, were related to new-onset respiratory symptoms, with the greatest risk observed in individuals who reported an increased duration or frequency of dust or odors in their homes, suggesting a dose-response.38 Unplanned medical visits and increased use of rescue inhaler medications were also associated with higher rates of new-onset upper respiratory symptoms. Several studies that revealed higher asthma prevalence in the neighborhood and an increase in asthma-related clinic visits among asthmatic children residing close to the WTC site after 9/11 corroborated the findings.

Children

Due to the sensitivity of developing organ systems, the neurologic system in particular, developing fetuses and early children are often more sensitive to negative consequences from toxic environmental exposures. The number of children and expectant mothers in the region was significant, as Lower Manhattan had grown to be a preferred place for young families. Also, there were a lot of expectant workers. The NIEHS Environmental Center at Mount Sinai Hospital looked at a cohort of 187 pregnant women who had exposures from their homes or places of employment,

stratified by an exposure index that took their distance from the site and the direction that debris would be dispersed based on local PM measurements. Women whose samples were taken soon after the event had higher levels of DNA adducts related to PAH exposure than those whose samples were taken months later, even though no statistically significant differences in the formation of DNA adducts related to exposure to PCBs, dioxins, or other PAHs were found. Moreover, it was shown that intrauterine development was decreased.42,43

A number of studies were conducted at the Columbia Center for Children's Environmental Health at the Mailman School of Public Health at Columbia University to identify any phenotypic impact the exposure could have had on fetal and developmental outcomes. Babies delivered at term to mothers exposed to the WTC had considerably lower birth weights and lengths than infants born to women who were not exposed, according to an initial analysis of birth data from three hospitals in midtown Manhattan. As compared to women who were not pregnant during the attacks, first-trimester pregnant women had a tiny but noticeably shorter gestation duration and infants with lower head size.

No change in mercury levels in cord blood between WTC-exposed and control participants could be identified. exposed during later stages of pregnancy. Although the level of DNA adducts was lower than that found in Poland and China, cities with higher levels of pollution, there was an increase, suggesting a cancer-related risk.45,46 The difference in DNA adducts present in the WTC area compared to other areas of NYC correlated with smaller birth sizes as well as with standardized measurements of child development.45,47 Long-term developmental effects are still a topic of concern and ongoing research. Unfortunately, no money has been found to continue the Mount Sinai Hospital's first cohort of children's longitudinal studies. Children who were nearby residents or students at the time of the incident are now part of the WTC EHC screening and treatment program. Medical guidelines for the diagnosis or care of WTC-related illnesses in children have been made available by the DOHMH.

WTC Environmental Health Center

There were several places where locals and employees who had WTC-related illnesses sought assistance. Several individuals sought treatment at the Bellevue Hospital Asthma Clinic as a because of the WTC Residents Respiratory Study's high visibility and Bellevue Hospital's capacity to accept uninsured patients as a nearby public hospital. In order to treat citizens with suspected WTC-related illnesses, the Beyond Ground Zero Network contacted Bellevue Hospital's management after failing to get a government program. Along with the doctors overseeing the asthma treatment, they launched a comprehensive program. When this program acquired three years of financing from the American Red Cross Liberty Disaster Relief fund in 2005, it was able to construct the first treatment program for nearby citizens and personnel who had been exposed to the WTC and had symptoms.

To assist in identifying the groups most in need, to promote the program, and to provide direction about the services required, a community advisory committee was established. The group grew to include a variety of impacted parties, including locals, employees, entrepreneurs, students, and labor organizations. Due to the advocacy of these community groups, the City of New York agreed to support an enlarged and continuing treatment program for adults as well as the start of a children program for an additional five years. In 2008, money was given to the Centers for Disease Control and a three-year grant was given by NIOSH for a "nonresponder" program to provide expanded medical and mental health treatment services for community members with presumptive HIV

infection. This was done as a result of advocacy from government representatives, including then-senators Clinton and Schumer and congressional representatives Maloney, Nadler, and Fossella [6]–[8].

Based on demands from community members, the World Trade Center Environmental Health Center was created as an all-inclusive medical and mental health treatment program. More than 5,000 people have signed up for the program's therapy even though recruiting is still ongoing. About eight years after 9/11, some individuals are still experiencing respiratory issues, namely dyspnea, coughing, and wheezing48. Some have aberrant lung function while others have hypersensitive airways. The prevalence of PTSD, sadness, and anxiety is relatively high, and many people also have concomitant gastrointestinal problems. The need of the program has been questioned, and the issues of causation and attribution have come up frequently. Causation can only be assumed based on accepted criteria since there are no pre-existing medical records in this community and no program offering screening and assessment immediately after the occurrence.

While the attack's physical effects were not fully apparent for some weeks after it happened, the possibility of serious mental health problems was identified and addressed right away. Several governmental and nonprofit relief organizations offered walk-in mental health assistance, and many of the big corporations in the financial district recruited on-site counselors to assist their employees in coping with the stress and panic caused by the attacks. Within a few weeks, the New York Academy of Medicine, in collaboration with New York University, Columbia University, and the National Crime Victims' Research and Treatment Center of the Medical University of South Carolina, conducted a formal survey of a significant portion of the city. The prevalence of symptoms compatible with PTSD or depression was 7.5% and 9.7%, respectively, according to data collected from 1,008 respondents, which is about double the rate indicated by previous estimates. In the month the survey was conducted, between mid-October and November 2001, there were 67,000 people with PTSD symptoms and 87,000 people with depression, according to extrapolation of these estimates to the geographic area sampled49. A follow-up survey conducted by a different group of investigators three to six months after the attacks revealed that while the number of those with symptoms had decreased, only a small percentage had sought psychiatric services.

A program to gather information on the physical and mental health problems in the exposed populations was started in 2003 by the New York City Department of Health and Mental Hygiene in collaboration with federal, state, and private entities. The WTC Health Registry was given to this. The federal Agency for Toxic Substance and Disease Registry and the New York City DOHMH collaborated on a $20 million study initiative with the aim of monitoring the health of those who were directly exposed. Also, it would develop and provide recommendations for potential calamities. Local labor and community people initially opposed the project since they weren't involved in its creation; nevertheless, an advisory council that included these advocacy organizations was later created. With more than 71,000 exposed participants, the WTCHR is now the biggest initiative in American history to examine the health impacts of a catastrophe. The cohort will be watched for at least twenty years; nevertheless, financing for the study is provided by government organizations.

In 2003–2004, the WTCHR introduced optional enrolment. People who were invited to participate in a confidential baseline health survey that asked about their location on 9/11, their experiences that day and in the days that followed, as well as any symptoms they experienced as a result of their exposure were those who lived there, worked there, or helped with rescue and recovery

efforts. According to the results of the first adult survey conducted in the register in 2006, 67% of those who had survived collapsed or damaged buildings had respiratory symptoms such coughing, shortness of breath, wheezing, or nasal discomfort. The mental health outcomes were observed; 16% of adult enrollees screened positive for current PTSD, with 8% having serious psychological distress.34,51 Health findings among children in the registry demonstrated that WTC exposure increased the likelihood of a new asthma diagnosis, with twice the likelihood observed in adults. Nearly 3% reported a new asthma diagnosis after 9/11, suggesting a 2-3 times higher rate than would be expected in the general population. The data show that the registry participants were exposed to significant physical and psychological risks, and that these exposures are correlated with symptoms.51 The WTC Registry had some drawbacks, such as the delay in survey implementation that allowed for recall bias, the absence of a control population that made it challenging to estimate the expected background incidence of illnesses, and the potential for selection bias. Notwithstanding these drawbacks, the WTCHR is a crucial tool for figuring out how the 9/11 attacks on adults and children have affected their long-term health.

To ascertain the health consequences in certain populations, a number of subsets of the registry population, including residents, local workers, and rescue and recovery personnel, have consented to thorough evaluations. The registry studies' conclusions to far have been in line with those of the FDNY and labor studies, while differing in methodology from those of the clinical center research. A review of registry data on 25,748 rescue, recovery, and cleanup workers revealed that their risk of developing asthma was twelve times greater than the background three-year risk expected in the general population.53 Significant risk factors for poorer health outcomes included earlier arrival at the site, longer work hours, exposure to the dust cloud, and working on the pile at the WTC site.

Other comprehensive studies have examined mental health problems, notably among volunteers and professionals in rescue and recovery. The prevalence of PTSD was 12.4% in a study of 28,962 WTCHR rescue and recovery workers who were interviewed two to three years after the disaster; the rates ranged from 6.2% for police officers to 21.2% for unaffiliated volunteers.54 The highest rates of PTSD were observed in construction workers and engineers, volunteers, and sanitation workers, indicating that performing tasks unrelated to one's occupation poses a distinct risk, a finding that is relevant for future disasters. The rate of probable PTSD was estimated to be 12.6% in Lower Manhattan residents who lived within a mile of the WTC site and was associated with older age, female gender, Hispanic ethnicity, and a low level of socioeconomic status. This rate was estimated to be three times higher than would have been expected had the WTC attack not occurred, and it has increased awareness that psychological symptoms may persist eight years after an event.

Lessons Learned

The horrific events of 9/11 and their aftermath led to New York City's largest environmental catastrophe in recorded history. Who is in charge of the medical response in a natural disaster? The medical community's reaction reveals both its strengths and limitations, and some lessons have already been discussed elsewhere. What is the command structure? Several medical professionals rushed to the WTC site to give their assistance during the first crisis, and for the first few days, all hospitals were on emergency standby; nevertheless, there was little coordination for the medical response to later environmental challenges. Collaborations with specialists in the area may have addressed the local governmental authorities' lack of knowledge in toxicologic or environmental health monitoring, which became obvious early on. These partnerships were sluggish to form, but

they have become stronger in the years thereafter. Additionally, the inherent conflict of interest may endanger communities when choices about public health are made by governmental bodies also concerned with economic and security problems. Thus, in the event of environmental catastrophes, quick independent input from the private as well as academic medical and scientific sectors is required[9], [10].

The academic and medical sectors must learn to collaborate for the benefit of society. The medical community creates and publishes its data at a glacially slow rate, which conflicts with the requirement for quick information. Data must first be published in a peer-reviewed publication before being offered to the media, which is the quickest channel for communication. Yet since it relies on reviewers and editors who could have become bored with the topic, the peer review and publishing process might take months or even years. However, the truth is that medical communities are autonomous, competing groupings that each compete for money for their respective institutions. This rivalry often makes it difficult to collaborate. Several pre-existing structures were utilised in the academic and medical response to the WTC catastrophe to get around some of these restrictions. A network of NIEHS centers allowed for communication and the opportunity to pool resources, which helped to produce some of the most thorough toxicologic assessments. The construction of the WTC Workers Monitoring and Treatment Program's network of programs was made possible by the existence of pre-existing occupational health institutions. This need is highlighted by the lack of a similar network for the nonresponder group.

Ultimately, toxicologic research and health responses are two different things. Toxicologic investigations track chemical concentrations, but human studies are necessary to understand how these toxins affect people. Some of the chemical elements in the dust from the WTC may have been predicted to be there, while others are yet unknown because of the intense pressure and heat. The actual exposure amounts will never be known. In a varied community with people who could be more vulnerable to negative health impacts, assumptions drawn from research of healthy persons might not hold true. As a result, it's important to monitor all groups, even those who may have less exposure but are more susceptible. Additionally, assuming the absence of a negative health effect should wait until study results are available if there is no information available regarding the response to a compound or combination of compounds, or if the level of exposure is unknown, as in the case of those exposed to the dust cloud. The discovery of negative WTC health impacts in every demographic evaluated points to the need of increased caution in the event of future calamities. Any study that is criticized for having a memory bias or lacking control populations should serve as a reminder that these studies should have been carried out more quickly. It's too late two years later.

CONCLUSION

The need of collaboration between the impacted populations and academic institutions and governmental organizations is perhaps the most significant lesson to be drawn from the medical response to the WTC disasters. Due to the fact that it was already in place on 9/11 as a part of an ongoing medical program, the medical response for the FDNY had an edge. In contrast, political labor groups structured their efforts to create a health program for their communities. And it was the noisy, persistent, often irate efforts of various grass-roots community groups that in the end succeeded in securing a health program for their different neighborhoods. Physicians and scientists should take into account these reports as the most sensitive and first indicator of a necessity for a medical and scientific reaction, rather than disregarding lay anecdotes and tales. Following the BP Gulf oil spill, workers are exposed to high levels of crude oil and its volatiles and dispersants,

cleanup workers are exposed to oil and tar balls that wash up on beaches, and local residents are exposed to oil and volatile hydrocarbons as well as the mental stress associated with lost income. This is a repeat of the WTC environmental disaster of respiratory exposures to alkaline dust with adsorbed PAH, metals, and other compounds.

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CHAPTER 11

CHLOROFLUOROCARBONS AND THE DEVELOPMENT OF THE OZONE HOLE

Dr. Krishnappa Venkatesharaju, Assistant Professor
Department of Environmental Science and Engineering, Presidency University, Bangalore, India
Email Id-venkateshraju.k@presidencyuniversity.in

ABSTRACT:

Chemicals with carbon, chlorine, and fluorine atoms are known as chlorofluorocarbons (CFCs), and they are neither poisonous nor combustible. They are used as solvents, refrigerants, blowing agents manufacturing foams and packaging materials, and aerosol sprays. In this chapter author is discusses the biologic effects of ultraviolet radiation. Chlorofluorocarbons have been linked to the rapid loss of ozone in the Earth's stratosphere, along with other chemicals containing chlorine and bromine. CFCs were created in the early 1930s and are used in a wide range of industrial, commercial, and domestic applications. As the need for items needing their usage increased, so did production and use of chlorofluorocarbons. The connection between CFCs and ozone depletion wasn't discovered until the early 1970s.

KEYWORDS:

CFCs, Environment, Health, Ozone, Radiation.

INTRODUCTION

Observations of the ozone layer itself showed that depletion was indeed taking place; the most dramatic loss was discovered over Antarctica by the British Antarctic Survey in 1984. Molina and Rowland first proposed in Nature in 1974 that stratospheric ozone could be diminished as a result of chlorofluorocarbons being released into the environment. The loss of ozone serves as a perfect example of the environmental issues we confront on a global scale since it is an unexpected result of human activities. A lot of people, including scientists, technologists, economists, lawyers, environmentalists, and legislators, contributed to how it was solved [1]–[3].

Chlorofluorocarbons

Thomas Midgley3 created CFCs in the 1930s while looking for harmless materials that might be used as refrigerants in household refrigerators. The CFCs were dubbed "wonder compounds" because to their chemical stability and inertness. These substances have no hazardous effects, don't burn, and don't react with other chemicals. They are excellent for numerous applications due to their favorable safety qualities, stable thermodynamic properties, and use as aerosol propellants, electronic cleaning solvents, and blowing agents, among others. With almost 20 billion pounds of CFCs generated globally since the 1930s, all this activity resulted in an annual industrial consumption of around one million tons, which increased every six to seven years. While chemical inertness was formerly thought to be a benefit of CFCs, scientists today understand that this same quality has led to a large-scale issue. CFCs may now be found in the stratosphere, where they break down and release chlorine atoms that have an impact on the ozone layer.

Layer of Ozone

The atmosphere of the Earth contains the gas ozone naturally. The Swiss scientist C. made the discovery of ozone. When viewing an electrical discharge in 1840, F. Sch€oenbein took notice of its particularly strong fragrance and gave it the Greek word "ozone," which means "smell." Instead of the two oxygen atoms found in a typical oxygen molecule, which makes up 21% of the air we breathe, an ozone molecule is made up of three. While most of the ozone is trapped in the stratosphere, where it is present at levels of several parts per million by volume, the average concentration of ozone in the atmosphere is around 30 parts per million by volume. Even though it only happens in such minute amounts,

Ozone is essential to maintaining life on Earth. The action of solar radiation on molecular oxygen, mostly in the high stratosphere and at low latitudes, produces it continually. Regrettably, a number of chemical processes are continuously destroying ozone throughout the atmosphere. Solar light with wavelengths of 200 nm or less is absorbed by molecular oxygen, which releases oxygen atoms that combine with oxygen molecules to generate ozone very quickly. A sun photon is indicated by hv in reactions 1 and 3. Ozone is destroyed by the process of solar radiation absorption at wavelengths between 200 and 300 nm, however the oxygen atoms created by this reaction easily renew the ozone molecule via reaction 2. In summary, processes 2 and 3 result in the conversion of solar energy to heat without ozone ozone damage. The stratosphere is created as a result of this process, which results in an increase in temperature with altitude. The stratosphere's inverted temperature profile is what provides this layer its significant stability against vertical motions. The temperature falls with height in the lowest layer, the troposphere, while winds dissipate atmospheric traces of com ponents on a global scale, through timescales of a few months within each hemisphere, and a year or two between the two hemispheres, quite effectively.

Ozone is created by oxygen atoms the most of the time, but on rare occasions, it is also destroyed. There must be additional processes that help to reduce the ozone concentration since the estimated ozone concentration using Chapman's method was much greater than the actual quantity. Crutzen6 and Johnston separately proposed that traces of nitrogen oxides formed in the early 1970s. by the breakdown of chemically stable nitrous oxide, which is produced by soil-borne microbes, in the stratosphere, the troposphere also contains ozone, some of which is produced there by photochemical processes and some of which is transferred from the stratosphere. Due to the fact that NOx, hydrocarbon shards, and solar radiation are the components for its photochemical synthesis, NOx serves a dual purpose depending on altitude, either destroying or producing O3. Ozone is a crucial component of urban smog, where it is present in quantities that are minor globally but substantial locally due to the impact on human health. These chemical equations' depiction was recognized as a pinnacle accomplishment, and in 1995, its creators were awarded the Nobel Prize in Chemistry [4]–[6].

Nevertheless, there are very few naturally occurring chlorine compounds in the stratosphere; the sole significant source is methyl chloride, which is present at a concentration of less than one ppbv. At the Earth's surface, biological activity and biomass burning both contribute to the production of this species; the most of the CH3Cl is destroyed in the troposphere, but a little amount makes it to the stratosphere. At the Earth's surface, there are significant natural supplies of inorganic chlorine compounds, such as NaCl and HCl from the seas. However, since these compounds are water soluble, they are effectively removed from the atmosphere by clouds and rains before they can reach the stratosphere.

On the other hand, since they are almost insoluble in water, CFCs are not captured by precipitation. Moreover, they are inert to the OH radical, which reacts with it to generate water, starting the process that causes hydrocarbons in the lower atmosphere to oxidize, producing CO2 and water in the process. Hence, the typical atmospheric cleaning systems that function in the lower atmosphere are unable to remove the CFCs. The stratospheric ozone layer, which protects the Earth's surface from ultraviolet radiation, effectively shelters CFC molecules below 25 km since they are transparent from 230 nm through the visible wavelengths. Instead, they ascend into the stratosphere, where short-wavelength solar UV radiation finally destroys them. It takes a CFC molecule fifteen years on average to go to the stratosphere, where it may linger for a century and disintegrate up to 100,000 ozone molecules.

Lovelock and colleagues were able to identify quantifiable concentrations of CFCs in the atmosphere across the South and North Atlantic in 1973 using the newly created electron capture detector. Rowland and Molina1 made the decision to look into these wonder chemicals' ultimate atmospheric destiny. They came to the conclusion that solar UV photolysis in the middle stratosphere was the only substantial sink after conducting a thorough examination of all potential chemical and physical mechanisms that may degrade CFCs in the lower atmosphere.

DISCUSSION

Chlorine atoms are released when CFCs are destroyed by solar radiation and take part in cycles that destroy ozone. These atoms attack ozone in a matter of seconds and regenerate over the course of minutes. The chlorine-containing product species HCl, ClONO2, and HOCl serve as temporary inert reservoirs for chlorine, which is eventually broken down by reactions with other free radicals or by solar radiation, converting chlorine back to its catalytically active free radical form.9 At low latitudes and in the upper stratosphere, where ozone formation is fastest, a small percentage of the chlorine radicals are ionized. There are two causes for the prolonged stratospheric residence time: first, the inverted temperature profile makes vertical transport very slow; second, there is no rain or cloud formation in the stratosphere, which slows down the rapid re-motion of water-soluble compounds like the chlorine reservoir species. This is because the stratosphere is very dry since a significant portion of the water vapor found at lower altitudes condenses as it ascends. a diagram that shows how these processes work [7]–[9].

In addition to chlorine, bromine also contributes significantly to stratospheric chemistry. There are both natural and anthropogenic sources of brominated hydrocarbons; the two most significant ones are halons and methyl bromide. A frequent fumigant used in agriculture is methyl bromide. CF3Br and CF2ClBr are two examples of the halons, which are completely halogenated hydrocarbons manufactured industrially for use as fire extinguishers. In contrast to chlorine, which is released to the stratosphere at parts per billion volume levels, these sources emit bromine at parts per trillion volume levels. A large portion of the bromine compounds are present as free radicals because the temporary reservoirs are less stable and form at much slower rates than the commensurate chlorine reservoirs. On the other hand, bromine atoms are about 50 times more efficient than chlorine atoms for destroying ozone on an atom-per-atom basis. The extraordinarily stable hydrogen fluoride molecule, which acts as a permanent inert fluorine reservoir, is created when fluorine atoms quickly steal hydrogen atoms from methane and water vapor. As a result, fluorine-free radicals are exceedingly rare, and fluorine has little impact on stratospheric ozone.

Chemistry of Polar Ozone

Before one can grasp how an ozone hole might emerge and what this implies in the context of human-made anthropogenic pollution of our planet in the current era, it is crucial to comprehend the specific characteristics of the polar areas that have an impact on ozone chemistry. In various aspects, the polar stratosphere is special. The short-wavelength solar energy that is absorbed by molecular oxygen is insufficient there due to the solar inclination, which is why ozone is not produced there. Since ozone is carried toward the poles from higher altitudes and lower latitudes, the overall ozone column abundance at high latitudes is also high. In addition, the stratosphere above the poles has the lowest average temperatures between the winter and spring, notably over Antarctica. When just gas phase chemical and photochemical processes are taken into account, ozone is thus predicted to remain very stable over the poles since the re-generation of ozone-destroying free radicals from the reservoir species would happen only very slowly at such temperatures.

The seasonal presence of polar stratospheric clouds is another significant aspect of the polar stratosphere. PSCs are clouds found in the winter polar stratosphere between 15,000 and 25,000 meters in height. Because they facilitate chemical processes that result in active chlorine, which catalyzes ozone destruction, and because they remove gaseous nitric acid, which disturbs the nitrogen and chlorine cycles in a manner that enhances ozone destruction, they are involved in the creation of ozone holes. The stratosphere is very dry, as was previously indicated; water is only present at levels of a few ppmv, which is equivalent to ozone itself. Because to the oxidation of methane, there is a little bit more water over the poles. Moreover, throughout the winter and spring months, temperatures over Antarctica may plummet to below -85°C, which causes the creation of ice clouds, also known as PSCs II in type. Nitric and sulfuric acids, which may create type I PSCs, can build cloud particles made of crystalline hydrates, which enable the production of polar stratospheric clouds a few degrees above the frost threshold.

In the gas phase, according to laboratory experiments, this reaction proceeds extremely slowly, if at all; nevertheless, in the presence of ice surfaces, it moves forward with amazing efficiency.15 HCl is absorbed by liquid water very effectively, dissolving to produce hydrochloric acid. While HCl is little soluble in the ice matrix, essentially pure water ice develops when diluted hydrochloric acid solutions freeze because the ice crystals reject contaminants. Theoretical calculations16 and experimental findings15 show that HCl dissolves easily and converts to hydrochloric acid on the surface of the ice. The ice surface is irregular compared to the crystal; it acts more like a liquid than a solid, which explains why ice has a high affinity for HCl. As a result, ionic processes similar to those in aqueous solutions are used to drive chlorine activation reactions on the surfaces of ice crystals.

As nitric acid, which condenses in the cloud particles, is the source of these free radicals in the polar stratosphere, the presence of PSCs also results in the removal of nitrogen oxides from the gas phase. Also, a process known as denitrification permanently removes the nitric acid from the atmosphere by causing some of the particles to include big enough ice crystals to fall out of the stratosphere. This process has significant repercussions: normally, nitrogen oxides scavenge chlorine monoxide to produce chlorine nitrate, as in reaction 11.17, which inhibits the catalytic ozone loss reactions involving chlorine oxides. In the absence of nitrogen oxides, chlorine radicals destroy ozone much more quickly.

Measurements in the Study of Atmospheric Trace Species

Following the initial publication of the Molina-Rowland article, several fundamental aspects of the CFC-ozone depletion hypothesis were verified in the late 1970s and early 1980s.1 Measurements of the atmospheric concentrations of the CFCs showed that they accumulated in the lower atmosphere and that they reached the stratosphere in the amounts predicted. Together with other species including HCl, ClONO2, HOCl, O, NO, NO2, OH, HO2, and so on, chlorine atoms and ClO radicals were discovered in the stratosphere. The measured concentrations were in fair accord with the predictions made by the model. On the other hand, due to the high amount of natural variability in this species, a decline in stratospheric ozone levels was not detectable at that time. Nevertheless, Farman and colleagues18 first noted a sharp decline in ozone levels in the antarctic stratosphere in the spring months beginning in the early 1980s in 1985. Later, it became clear that the Northern Hemisphere was also losing ozone, especially at high latitudes and throughout the winter and spring. Later, by examining the ozone records, it was possible to demonstrate that significant changes had also occurred in the lower stratosphere at mid-latitudes.11 Additionally, satellite measurements have directly supported findings that the majority of the chlorine present in the stratosphere is caused by human activity.

The atmospheric sciences community did not predict the ozone hole, or the depletion of ozone over Antarctica. However, in the years that followed, the cause of this depletion was made abundantly clear: laboratory tests, field measurements over Antarctica, and model calculations all unmistakably demonstrated that the ozone hole could be linked to industrial CFCs. The objective of the next study phase was to map the size of the ozone hole using different scientific methods. Using a spectrophotometer, Farman et al.18 measured the rapid ozone loss in the stratosphere over Antarctica. Their findings were later corroborated by satellite data from the total ozone mapping spectrometer,20 which measures ozone using a similar method by observing at two wavelengths the attenuation of solar radiation that has been backscattered from the atmosphere below the ozone layer. The amount of ozone depletion over Antarctica in the spring months is believed to have continued to worsen after 1985, according to more recent data from satellites and high-altitude balloons.

In the years that followed the first ozone hole discovery, a number of missions were made to detect trace species in the stratosphere above Antarctica; for instance, NASA utilized ER-2 high-altitude planes. The findings offered compelling evidence for the occurrence of the aforementioned chemical reactions and, consequently, for the critical role that industrial chlorine played in the ozone hole. A significant portion of chlorine is present as a free radical when ozone is being severely depleted in the polar stratosphere. Chlorine monoxide concentrations were measured by Anderson et al. and were strongly inversely correlated with ozone loss as measured by Proffitt et al. An analysis of these measurements revealed that about three-fourths of the observed ozone loss was caused by the chlorine peroxide cycle, with the remaining portion being caused by the bromine cycle. Nitric acid was also found to be present in the cloud particles. These findings added credence to the theory that CFC emissions caused ozone loss and the ozone hole over the Antarctic.

A significant portion of the chlorine is also activated in the Arctic stratosphere, according to atmospheric field measurements that have been made there. However, because the temperatures are not as low as they are over Antarctica, the active chlorine does not stay in contact with the ozone for long enough or at low enough temperatures to destroy it before the stratospheric air over the Arctic mixes with warmer air from lower latitudes. As a result, ozone depletion is less severe and less localized over the Arctic. This was the case across northern Europe in 1995–1996

however, cold winters cause severe ozone depletion—30% or more—over sizable regions. However, as was already indicated, ozone levels at mid-latitudes are also somewhat declining.

Ozone Depletion and UV-B Radiation

Increases in solar UV radiation, mostly at wavelengths between 290 and 320 nm, or so-called UV-B radiation, reaching the Earth's surface are caused by stratospheric ozone loss. About 90% of the sun photons are absorbed by atmospheric ozone at shorter wavelengths, while the absorption is minimal at longer wavelengths. Clouds, dust, and air pollution partly block UV-B rays. With a clear sky, however, each 1% decrease in the total ozone column causes an increase in UV-B intensity at ground level of around 1.3%. At other latitudes, where ozone depletion is less severe, the UV radiation increases are correspondingly smaller and more challenging to establish due to the lack of direct long-term measurements. Under the Antarctic ozone hole, where the UV-B levels can rise above the maximum summer values measured at San Diego, California, this increase is well documented by direct measurements.

UV Radiation's Impact on Biological Systems

Ozone loss causes an increase in UV-B radiation, which poses a danger to aquatic ecosystems, plants, and people. One such danger is human acute skin injury. Increases in the morbidity and incidence of skin cancer, eye conditions, and infectious diseases are potential negative effects of increased UV-B radiation on human health.26 Assessment reports on the environmental and health effects of stratospheric ozone depletion have been compiled.27,28 Human epidemiology studies and animal experiments have shown that UV-B radiation is a significant risk factor for the development of nonmelanoma skin cancer in humans. Reduced O3 and elevated UV-B levels in Punta Arenas, Chile, have been linked to a significant rise in springtime sunburns over the past five years, as well as a 56% increase in melanoma and a 46% increase in nonmelanoma skin cancer over the course of seven years.31 Over the past 20 springs, there have been 143 days with an ozone loss of more than 25% there. During ozone hole circumstances, significant increases in UV-B were seen, particularly at wavelengths around 300 nm, which are the most cancer-causing ones.

The situation is less clear when it comes to cutaneous melanoma, however there are signs that sun exposure raises the risk. UV radiation-induced p53 mutations may very well be the mechanism causing the UV damage. When p53 is functioning, apoptosis increases during sunburn, which may help remove damaged cells. Yet, it may be more challenging for a cell to undergo apoptosis if one of the p53 alleles is damaged by UV radiation. UV radiation may injure the eyes and the immune system in addition to the skin. Several studies have shown that UV-B radiation may harm the cornea and lens of the eye, and that long-term exposure to this radiation increases the chance of developing cortical and posterior subcapsular cataracts. The induction of certain immune responses may be suppressed by exposure to UV-B radiation, according to research done on humans, and studies done on animals demonstrate that this exposure reduces the immune system's response to skin cancer and some pathogenic pathogens. The immune system is sensitive to the effects of UV-B radiation because it contains certain components that are also found in the skin.

Terrestrial plants may also be harmed by UV-B radiation, albeit the severity of the effects vary greatly depending on the species. Aquatic ecosystems can also be harmed by UV-B radiation; for instance, there is evidence of impaired larval development and decreased reproductive capacity in some amphibians, shrimp, and fish. In addition to stunting plant growth, the changes induced by UV radiation can be indirect, affecting, for example, the timing of developmental phases or the allocation of biomass to the different parts of the plant33. Increased UV-B radiation and UV-B

suppression of photosynthesis occurred when the O3 layer shrank by up to 50%, which might have a negative impact on the productivity of indigenous phytoplankton populations in Antarctic seas. Global warming also has a negative impact on phytophlankton populations, which has an impact farther up the food chain and jeopardizes the health of penguin colonies.

The Montreal Protocol and policy

In a 1976 report, the National Academy of Sciences, which is tasked with reporting on scientific issues, concluded that the atmospheric sequence described by Molina and Rowland was essentially accurate35. In response, the United States and a few other nations banned the sale of aerosol spray cans containing CFCs in the late 1970s, which temporarily slowed the rise in global demand for CFCs. Yet, the chemicals' widespread usage persisted, and manufacturing rates started to increase once again. Under the auspices of the United Nations Environment Programme, a global agreement restricting the manufacture of CFCs was adopted in September 1987. By the end of the twentieth century, the Montreal Protocol on Substances that Deplete the Ozone Layer originally aimed for a decrease in CFC production of just 50%. The London and Copenhagen amendments to the protocol, which were made in 1990 and 1992, respectively, enhanced the original provisions in light of the strength of the scientific data that emerged in the years that followed. Towards the end of 1995, the manufacture of CFCs was phased out in developed nations, and regulations were also put in place for additional chemicals such halon, methyl bromide, carbon tetrachloride, and methyl chloroform. Methyl chloroform and carbon tetrachloride were phased out in 2000 and 2002, respectively. The Montreal Protocol was eventually ratified by 166 nations, after the first signing in 1987 by 22 nations, including the United States. The 1990 Clean Air Act revisions included the Montreal Protocol as part of its legal framework.

To ease their transition to the more recent CFC-free technology, developing nations were permitted to continue producing CFCs up to 2010. The Montreal Protocol's creation of a financial mechanism to assist these nations in covering the expenses of adhering to the agreement and any later revisions was a key component. It featured the establishment of the Multilateral Fund, which was funded by industrialized nations; the World Bank, UNEP, the United Nations Industrial Organization, and the United Nations Development Programme served as the implementation agencies. $5,250 projects totaling $2 billion have been funded by this fund in 139 poor nations. The World Bank implemented multilateral finance projects that phased out CFCs in mobile air conditioning and commercial refrigeration and lowered halons from 30,060 tons in 1998 to 1,000 tons by 2008. China emerged as the greatest emitter of ozone-depleting compounds.

Assessing the Montreal Protocol's Efficacy

Generally, the Montreal Protocol's rules have been effectively implemented. Chlorine levels have already peaked; in fact, atmospheric measurements show that the amount of chlorine present in CFCs and other chlorocarbons is already decreasing in response to Montreal Protocol regulations36. On the other hand, due to the long residence times of CFCs in the atmosphere, relatively high chlorine levels in the stratosphere—and the resulting ozone depletion—are anticipated to persist well into the twenty-first century.

Conservation and recycling are being used to cope with a significant portion of the previous CFC consumption. Additionally, hydrochlorofluorocarbons, which have comparable physical qualities to CFCs but are less persistent in the atmosphere, are temporarily replacing around 25% of the historical usage of CFCs. Before entering the stratosphere, a significant portion of the industrially released HCFCs react with the OH radical in the lower atmosphere, forming water and an organic

free radical that quickly photo-oxidizes to produce water-soluble products that are then primarily removed from the atmosphere by rainfall. Certain hydrofluorocarbons, such as HFC-134a, are utilized in lieu of CFCs in applications like automotive air conditioning even though they don't contain chlorine atoms. About half of CFC usage has been replaced by non-in-kind compounds. For instance, CFC-113, a solvent that was frequently used to clean electronic components, has been phased out in favor of CFC-free cleaning methods like soap and water or solvents based on terpenes. There are also new techniques for producing clean electronic boards.

Yet, there are drawbacks to employing HCFCs. Three of the twelve HCFCs, in actuality, may degrade into trifluoroacetic acid, which is present in wetlands. Three HCFCs, HCFC-123, -124, and HFC-134a, interact with OH radicals in the atmosphere to create TFA. TFA is essentially indigestible by most plants and animals and is resistant to processes that lead to destruction, such as photolysis and hydrolysis. Due to the large concentrations of OH radical in metropolitan areas' air pollution, TFA could be dangerous. TFA has also been shown to bioaccumulate by at least a factor of 30 in vascular plants and is highly mobile in xylem tissue of plants. Hence, the remedy for CFCs can have unforeseen effects. The Clean Air Act Amendments of 1990, which incorporated the Montreal Protocol's stipulations to U.S. law in response to these problems, also suggested a phase-out of HCFCs by 2030 under the Stratospheric Ozone and Global Climate Protection Act [10], [11].

The overall combined effective amount of ozone-depleting chemicals continues to progressively decrease from its high, which occurred about 1993, according to atmospheric observations. Total chlorine is decreasing as expected, while bromine from industrial halides was still marginally rising at the start of the twenty-first century. Nonetheless, HCFC abundances in the atmosphere are still rising. Antarctica has seen significant springtime ozone depletion throughout the latter decade of the 20th century and the early years of the 21st. Out of 25 million km2, the Antarctic O3 hole will be reduced by one million km2 by 2015. Recovery will start in 2024, be practically complete in 2050, and return to 1980 levels in 2068. As a result of shifting climatic conditions in the stratosphere from one winter to the next, win- ter/spring ozone loss in the Arctic is also very variable; in some recent harsh Northern winters, ozone losses have reached 30%. The concentrations of halogens in the stratosphere are predicted to resemble those in 1980, when the ozone hole began to form, by the middle of the twenty-first century. Climate change, however, may hasten or slow the ozone layer's recovery.

Environment and Climate Change

In recent years, there has been a greater understanding of how ozone depletion and climate change interact. The stratosphere is anticipated to cool as a result of both CO2 increases and long-term ozone decreases, which is significant given that ozone is a greenhouse gas. Austin et al. noted that this should increase the likelihood of PSCs forming and over Arctic because the saturation vapor pressure of gas-phase water and nitric acid is a strong exponential function of temperature. More ozone destruction caused by chlorine and bromine may be anticipated over the Arctic region in areas with significant PSCs. Halons and other ozone-depleting compounds like CFCs have a role in climate change. The ozone layer's future may be impacted by certain climatic changes. Changes in stratospheric winds and temperatures have an impact on ozone levels. The stratosphere is anticipated to cool while the Earth's surface is anticipated to warm in response to the positive radiative forcing brought on by increases in carbon dioxide. The length of time that PSCs are present in the polar area would increase if the stratosphere were colder. This modification might hasten the ozone hole in the winter. Climate change will thus probably cause the regeneration of

the ozone layer after the drop in chlorine and bromine chemicals reaching the stratosphere to be delayed, but the exact nature of the interaction is yet unknown.

Methyl bromide poses new problems for the ozone layer. During the mid-1900s, the total amount of organic bromine from methyl bromide and halons has increased in the atmosphere by more than double. The composition of Southern Hemisphere air archives and samples of air bubbles trapped in compressed Antarctic snow have both been used to deduce this information. Based on our understanding of source and sink magnitudes, the atmospheric lifespan of methyl bromide is predicted to be around 0.7 years, and the percentage of emissions generated from industrially produced methyl bromide is projected to be 10–40%. This finding supports the notion that, in order to avoid delaying the ozone layer's recovery, the industrial production of methyl bromide must be further restricted, as required by the Montreal Protocol.

Medihaler Barriers to Ozone Depletion Control

The fact that 450 million aerosols are used annually by more than 70 million people with asthma and chronic obstructive pulmonary disease globally is another barrier to attempts to reduce ozone depletion. To obtain the necessary vapor pressure, conventional CFC-based metered dosage inhalers included two propellants: CFC-11 served as a carrier for medication suspension to enable loading into the can and CFC-12 served as the propellant. The function of CFCs was significantly superseded by the introduction of hydrofluoroalkane HFA 134a as a liquefied compressed gas and new MDIs with improved metering valves. Inhalable dry powders also became quite popular. The last generic MDI, albuterol, required 1,200 tons of CFCs annually to create. Proventil HFA-134a and Ventolin HFA-134a, as well as Proair HFA and Xopenex HFA, have received FDA approval as non-CFC albuterol MDIs.

Sen. Hillary Rodham Clinton wrote to the FDA in 2004 to request that the agency immediately remove CFCs from MDIs in response to these technical advancements. The FDA published a final regulation in March 2005 stating that after December 31, 2008, CFC-containing albuterol MDIs cannot be manufactured, marketed, or sold in the United States. The realization that nitrous oxide is the main ozone-depleting substance emitted in the twenty-first century38 has recently temporized the success of removing CFCs. Nitrous oxide has anthropogenic sources from synthetic and organic fertilizers, production, and combustion. Nitrous oxide has a CFC-free product, Proventil HFA, and Schering-Plough and its Warrick subsidiary announced in 2007 that it was phasing out production of CFC-propelled albuterol [12]. It has grown by 20% over the last 200 years and is carried to the stratosphere where it disintegrates into NOx and ozone is destroyed. Although persisting for more than 120 years, it is mostly eliminated from the atmosphere by photolysis and mixing with reactive oxygen species.

CONCLUSION

Depletion of the ozone layer is a serious catastrophe that affects all living things, including people, by increasing the amount of UV-B radiation that reaches the Earth's surface. This century's worldwide climate shifts have been mostly caused by anthropogenic activities, which have also been the primary cause of ozone layer depletion. It is increasingly obvious that human activity may cause significant environmental issues both locally and globally. The promotion of internationalism, or the widely held belief that all of our human problems are interrelated, is one of the crucial elements in any sane strategy for solving global environmental challenges. The resolution of environmental issues will need both regional and global collaboration. The Montreal Protocol establishes a crucial precedent for tackling global environmental issues. It shows how the

many societal groups—scientists, businesspeople, legislators, and environmentalists—can cooperate and be highly effective by acting in a collaborative rather than an adversarial manner.

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CHAPTER 12

GLOBAL WARMING SCIENCE AND CONSEQUENCES

Ms. Meenakshi Jhanwar, Assistant Professor
Department of Environmental Science, Presidency University, Bangalore, India
Email Id-meenakshi@presidencyuniversity.in

ABSTRACT:

The gradual increase in the planet's surface temperature is known as global warming. While this warming trend has been around for a while, the combustion of fossil fuels has greatly accelerated its speed during the last century. The amount of fossil fuels burnt has grown along with the growth in the human population. In this chapter author is discusses the different country sign of global warming. Climate is the pattern of weather over a long period of time in a place or worldwide, as opposed to weather, which is what we experience locally during a short period of time. Global warming refers to the widely recognized notion that human or anthropogenic activities are causing climate change by changing the ratio of heat-trapping substances in the atmosphere.

KEYWORDS:

Environment, Fossil Fuel, Global Warming, Health, Science.

INTRODUCTION

In order to conclude that the preceding decade was the hottest on record and that the Planet has been becoming warmer during the previous fifty years, the National Oceanic and Atmospheric Administration gathered data from 300 scientists from 48 different nations. Seven of the ten indicators air temperature over land, sea surface temperature, air temperature over oceans, sea level, ocean heat, humidity, and tropospheric temperature in the layer of the atmosphere known as "active weather" that is closest to the surface of the Earth—were increasing. Arctic sea ice, glaciers, and spring snow cover in the Northern Hemisphere were three indicators that were decreasing [1], [2]. The greatest threat to our world, our kids, and next generations is global warming. In order to enjoy technology without contributing to global climate change, we must stop relying on fossil fuels and the pollution they cause. Al Gore, a former vice president, and Rajendra K. Pachauri, the head of the Intergovernmental Panel on Climate Change, received the 2007 Nobel Peace Prize.1,2 Al Gore said in his acceptance speech.

Due to severe droughts and glacier melt, major cities in North and South America, Asia, and Australia are almost completely without water. Residents on low-lying Pacific islands are preparing to leave the homes they have known for a long time. Overwhelming wildfires have evicted 500,000 people from their homes. Greater storms have endangered whole cities in the Pacific and Atlantic. Massive flooding has caused millions of people to lose their homes in South Asia, Mexico, and 18 nations in Africa. Tens of thousands of people have died as a result of the rise in temperature extremes. We are carelessly burning and removing our woods, causing the extinction of an increasing number of species. The entire fabric of existence upon which we rely is being torn and shredded.

Svante Arrhenius determined that if we doubled the quantity of CO2 in the atmosphere, the average temperature of the world would rise by several degrees by manually solving 10,000 equations. After seventy years, my instructor Roger Revelle and his colleague David Keeling started carefully charting the daily rise in CO2 levels. We have everything we need to start fixing this catastrophe, with the potential exception of the resolve to act, Al Gore said. Our willingness to act, however, is a renewable resource in America.

Fundamental Science of Global Warming: Greenhouse Gases

The Earth's temperature is regulated by greenhouse gases, which include CO2, CH4, and NOx, among many others. They create a layer in the troposphere of the planet that reflects infrared light back to the surface, warming it. Visible light may get through the greenhouse gas layer in the troposphere and reach the surface, where it activates infra-red, heating it and raising it to the troposphere. Around 30% of the visible light spectrum is reflected back into space, another 20% is absorbed in the troposphere before reaching the Earth, allowing the remaining 50% to reach the Earth's surface, where the greenhouse gas layer reflects it back again, boosting heating [3], [4].

The most widespread and typical of the several forms of greenhouse gases is carbon dioxide. Although being a significant greenhouse gas, water vapor fluctuates daily as a result of the weather and has little impact on the climate. Condensation and precipitation are used to eliminate it. Methane is the second most significant greenhouse gas and is 22 times more effective than CO2 at reflecting infrared radiation back to Earth's surface. CO2 is the main greenhouse gas; it results from burning fossil fuels; it is long-lived in the troposphere. According to James Hansen of the Goddard Space Institute, NASA, one-fourth of anthropogenic CO2 may persist up to 500 years in the Earth's troposphere. Methane and nitrous oxide make up 18% and 9%, respectively, of the world's greenhouse gases, although the United States emits 84% CO2, 7.4% methane, and 6.5% N2O.

Natural sinks for carbon dioxide, such as photosynthesis by plants, marine plankton, and oceans, balance out natural supplies of carbon dioxide, which are 20 times bigger than human sources. Since 1990, we have known that a terrestrial carbon sink yearly absorbs nearly one-third of the world's fossil fuel emissions; by the middle of the 21st century, the median model predicts that this sink might annually absorb 5 billion metric tons of carbon. The atmospheric concentration of carbon dioxide stayed between 260 and 280 parts per million throughout the previous 400,000–900,000 years as a consequence of this historical equilibrium. The excessive human emissions previously mentioned provide evidence for a recent rise in CO2 atmospheric concentrations [5], [6].

The burning of fossil fuels and deforestation are the primary human-caused sources of greenhouse gases. Up to one-third of the total anthropogenic CO2 emissions are attributed to land use change. According to calculations, plants can store 113 billion tons of CO2 globally in 1900, and that number could rise to 171 billion tons by 2100. If surface ozone pollution is reduced, however, more than 200 billion tons of CO2 could be absorbed by plants by the year 2100.4 Livestock enteric fermentation and manure management, paddy rice farming, land use and wetland changes, pipeline leaks, and covered landfill emissions result in higher meth- ane atmo- spheres. While certain tropical plants have lately been recognized as in situ sources of methane release, methane levels have quadrupled since preindustrial times. Fertilizers used in agricultural operations are the major sources of nitrous oxide concentrations. Electricity generation accounts for 34% of annual CO2 emissions, followed by transportation (28%), industry (19%), industrial (8%), agricultural

(8%), commercial (6%), and residential (5%). Worldwide CO2 emissions, at over 28 million metric tons annually, are about 4 times as great as the annual emissions of fossil fuels, which total more than 7 million metric tons. From 18 million metric tons of CO2 in 1980, this is an increase. The concentration of CO2 has increased by about 100 ppm, with the first 50 ppm occurring from the beginning of the Industrial Revolution to about 1973 and the second 50 ppm occurring in about 35 years, from 1973 to 2008.1 Human-caused greenhouse gas emissions have increased by 70% between 1970 and 2004. The radiative forcing capabilities of the greenhouse gases vary, with CO2 having a radiative forcing capability of 1.46, methane having a radiative forcing capability of 0.48, nitrous oxide having a radiative forcing capability of 0.15, and halocarbons having a radiative forcing capability of 0.34.3,6,7

The most prevalent of these greenhouse gases is CO2, and according to Hansen's calculations, the Earth is now collecting 0.85 watts per square meter more solar radiation than it is expelling into space. The spectacular expansion and industrialisation of developing nations is mostly to blame for the increase in CO2 from 1.1% to >3.5% per year since 2000. Although nitrous oxide has grown by 0.25% year, methane has not increased much. With 7.15 million metric tons of CO2 emitted between 1990 and 2008, the United States raised its greenhouse gas emissions by 17.2%, only to be topped by China, who released 7.2 million metric tons of CO2. China's fossil CO2 emissions rose by 8.7% in 2006 compared to 2005, whereas similar emissions in the US rose by 1.4% in 2007. The United States releases around 24 tons of GHG per person, compared to 4 tons in China, 9 tons in Japan, 12 tons in Germany, 21 tons in Canada, and 11 tons in Great Britain. The historical CO2 range of 180-280 ppm keeps the climate stable. If this trend continues, total CO2 emissions might reach 42 million metric tons by 2030 and 450 parts per million by 2050.

Hansen discusses the difficulties in stabilizing methane and nitrous oxide, which are indirect byproducts of global warming, such as the release of methane from melting peat bogs as a result of anthropogenic CO2 induced global warming, in the context of achieving a 1C increase limit due to global warming. Since the International Meteorological Organization started keeping data in 1886, the average annual temperature has increased from 14.5°C to 15.4°C. The polar regions are warming faster than normal. In 2001, the annual average temperature was 57.8°F, which was 0.9°F higher than the long-term average between 1886 and 2000. Since 1995, eleven of the twelve warmest years on record have occurred, with 2008 ranking as the ninth hottest. According to the Goddard Institute, the summer of 2010 was the fourth-hottest on record. According to the IPCC's Fourth Assessment Report, "Warming of the climate system is unmistakable, as is now obvious from observations of rise in global average air and ocean temperatures, widespread melting of snow and ice, and increasing global average sea level." They stated that "the observed increase in anthropogenic greenhouse gas concentrations is very likely to be responsible for the majority of the observed increase in globally averaged temperatures since the mid-20th century." They predicted that if CO2 concentrations doubled from their levels in 1750, the world would likely warm by 3°C plus or minus 1°C.

As part of the International Geophysical Year, Charles David Keeling measured the atmospheric CO2 concentration on the summit of Mauna Loa in Hawaii in 1958. He was able to continue these measurements over the ensuing years with little financial support.8 What has emerged is an accurate record of CO2 concentration starting at 315.98 ppm in 1959, rising 19.4% to 377.38 ppm by 2004, and further increasing to 380 ppm by 2007. Keeling recorded the increase in CO2 concentration that has occurred since 2000 and noted a yearly variation in CO2 in the Northern Hemisphere. As summer vegetation and leaves used CO2 for photosynthesis, there was a CO2 fall

that was followed by a corresponding rise in CO2 during the winter when the vegetation's leaves withered.

The temperature and CO2 content of ice cores can be calculated using dielectric conductivity, deuterium, and 18O.9 Samples from the Antarctic Lake Vostok ice cores, dating back as far as 440,000 years, have been examined, and they show natural variation in temperature, with current temperatures at the highest level on record. Also, across these millennia, the CO2 content in these ice cores varied between 180 and 280 ppm. The maximum of this ice record is now exceeded by the current level of 380 ppm. Methane concentrations were also measured; they ranged from 400 to 800 parts per billion (ppb), compared to the current level of >1700 ppb.10 Deep ice cores have now been drilled in Antarctica Dome C to a depth that corresponds to time that can be estimated back another 800,000 years, with confirmation of the more recent data from the first 440,000 years.9,11. Arctic ice cover shrank

The Arctic Ocean has a floating ice cover every year that varies from roughly 16 106 km2 in March to 7 106 km2 at the conclusion of the summer melt season in September, or 8.6 2.9% every decade from 1979 to 2006, or nearly 100,000 km2. The September minimum is decreasing each year, reaching 5.56 106 km2 in 2005. By September 2007, this minimum, which was 2.05 million square miles in 2005, had amazingly shrunk to 1.6 million square miles [7]. While scant sample makes interpretation difficult, Navy nuclear submarines reported that the average ice thickness has decreased from 3.1 meters to 1.8 meters, or 15% each decade, from 1958 to 1997. The possibility that this happened because of natural cycles is less than 0.1%, while the Arctic ice has lost 24% of its volume in the last three decades. In fact, summer shipping via the Northwest Passage from the northern Canadian coast to Alaska may be possible in a few short years. Moreover, the area of multi-year ice is reducing. Moreover, the Arctic icepack melts more quickly because the polar icecaps reflect 80% of solar radiation whereas the open ocean only reflects 10%.

Polar scientists' journeys over the Northern Greenland ice sheet in 1953–1954 and 1995 found considerable thinning on the northwestern part, ranging from 16.5 to 31 cm/year. 10% of the world's ice mass, or 2.5 million cubic kilometers, is found in Greenland. Since 1979, summer melt calculated from satellite observations over Greenland has increased from about 450,000 km2 to more than 600,000 km2.17 Since 1997, warmer ocean waters have been responsible for the rapid thinning of the Jakobshavn Isbrae, a floating glacial ice tongue over a deep-water fjord in western Greenland. Melting has accelerated from 82 to 239 cubic kilometers per year. In the last ten years, Jakobshavn's melting rate has quadrupled, and it currently releases 11 cubic miles of icebergs every day, clogging its fjord.

Alaska

The name "drunken forest" refers to how melting tundra causes the roots of Alaskan spruce forests to lose their anchor and tilt in different directions. As a result of the warming climate, spruce bark beetles are now not destroyed by the harsh cold, and hundreds of acres of spruce are afflicted. In the Kenai Peninsula in Alaska, bark beetles have destroyed 3 million acres of spruce, or about half of the peninsula. Warming permits beetles to overwinter, spread into higher elevations and latitudes, and sneak in an additional generation each year, while drought damages trees by drying the glue that drowns the beetles as they bore through the bark. Similar infestations have spread across the American Mountain West, especially in Colorado along the continental divide.

Another major issue is the permafrost thawing. If permafrost thawed, up to a third of all soil carbon, or 350–450 gigatons of carbon, may be released. Alaska and 24% of the Planet are covered by

permafrost. The faster snowmelt decreases albedo and increases local heating by around 3 watts/m2, which is approximately equivalent to doubling the amount of CO2 in the atmosphere on a global scale. The growth of more shrubs in the tundra and the expansion of the boreal forest farther north may also be encouraged by global warming. Despite the fact that methane emission may be drastically changing this equilibrium, this may make peatlands a net C sink.

Mining and oil industries transport massive supplies using 18-wheeler trucks across the Arctic on winter highways. The number of travel days across Alaska's winter tundra has been rapidly decreasing as a result of global warming. Arctic towns are also more vulnerable to storms, winds over open sea, and coastline erosion as a result of retreating ice. The lack of ice also has an impact on Inuit hunting customs and is a factor in the regional decreases in polar bear population and health.

Ornithologist George Divoky has been researching guillemots and their mating in the Arctic for many years. These black, pigeon-like Arctic birds travel to Cooper Island in Northern Alaska for an eighty-day cycle of egg-laying and young fledging. They forage on the edge of the Arctic icepack. Divoky observed that the birds came and placed their eggs five days sooner each decade from 1974 to 2001. He later observed that because of the longer flight distance to the receding icepack for food, there is a progressive population decline, lower adult survival, and increased sibling antagonism. He noticed a significant drop in 13C in guillemot feathers from museum collections as the icepack retreated farther north and the birds' eating area shifted from the nutrient-rich Bering Sea to the sparser Beaufort and Chuckchi seas.

Antarctica

Compared to the rest of the continent, the Antarctic Peninsula has warmed by several degrees. This has caused the ice shelf to break apart and vanish more often. Since 1989, ice shelves surrounding James Ross Island have broken apart, leading to the loss of the Larsen B Ice Shelf, which was reported on the front page of the New York Times on March 20, 2002. As a result, significant warming has occurred beyond the Antarctic Peninsula to cover most of West Antarctica, an area comprising almost a third of the continent.21 West Antarctica warming exceeds 0.1C per decade over the past 50 years, and is strongest in winter and spring. In 2006, Antarctica lost three-quarters more ice than it did a decade earlier; the net ice loss was nearly 200 billion tons, comparable to Greenland's annual loss.

The increase in the average near-surface temperature throughout the continent is positive, even if East Antarctica partially balances this owing to fall cooling. The Terre Adelie colony has seen population collapses when the sea ice recedes; for instance, an 11% decrease in sea ice was accompanied by a 50% abrupt decline in the colony population.22 Winters with extensive sea ice increase krill abundance, and emperor penguins primarily feed on fish species that depend on krill and other crustaceans. These trends are concerning for emperor penguin populations. Up to 2100, the average number of breeding pairs of emperor penguins is predicted to drop from 6,000 to 400, with a 36% probability of quasi-extinction.

Glaciers

Due to global warming, mid-latitude glaciers are in grave danger of melting and disappearing. Between 1912 and 2000, the amount of ice on Mount Kilimanjaro fell by 81 percent. From around 12.5 square kilometers to 1.8 square kilometers, the area has decreased. There is also a threat to other mid-latitude glaciers. Since they feed 10 million people with fresh water, the Andes glaciers

above Lima, Peru, are among the bigger issues. The city is at great danger since it is located in a desert with the Pacific Ocean on one side and the Mountains preventing access to the Amazon basin. The melting of the glaciers that provide Quito, Ecuador, Lima, Peru, and La Paz, Bolivia with drinking water has intensified due to the mid-latitude temperature rise of 0.11C per decade compared to the tropical Andes' worldwide average of 0.06C per decade. Due to the melting ice packs, this warming has also reduced water supplies to hydroelectric facilities. There won't be any water left to use for hydroelectric plants or for drinking after the glaciers have gone. The Alps' glaciers are all melting, putting hydroelectric dams and energy supply at jeopardy.

During the last 150 years, Switzerland has lost 50% of its glacial surface area, and 100 out of the country's 2000 glaciers have vanished. Also, when mountain slopes melt, landslides are becoming frequent. Ice content in the Himalayas and Kun Lun is 100 times more than in the Alps. 40% of the world's population is supplied by seven Asian rivers that flow from these Himalayan glaciers. The Tibetan Plateau is frequently referred to as the "Third Pole." Under continued warming scenarios, Glacier National Park in northwest Montana may lose its glaciers in two decades, and its native bull trout, which depends on extremely cold, icy water from glacial melt in the late summer, may be in trouble. W. The Opening of a New Landscape: Columbia Glacier at Mid-Retreat, published by Tad Pfeffer in 2008,23 details the glacier retreat in Alaska and explores how melting has altered the region's natural environment. During a period of 1,000 years, Columbia Glacier advanced 18 miles into its fjord and remained there for around 300 years before retreating. It has retreated 9 kilometers since 1994.

Increase in Sea Level

One of the most alarming effects of global climate change is the slow increase in sea level, particularly because this trend is anticipated to pick up speed as global warming intensifies. There are two processes at play: first, the melting of land-based ice leads to a rise in the amount of water in the seas; second, thermal expansion causes the ocean's volume to expand without changing its mass. According to the Fourth IPCC Report, the average rate of sea level rise throughout the twentieth century was 15 cm/century. A increase in sea level of 14 inches is predicted for the twenty-first century. More than 100 million people live within one meter of mean sea level, and sea-level rise is particularly urgent and serious for the low-lying small island nations of the world. The Institute of Arctic and Alpine Research calculated the most likely glacial melting scenarios, which suggested a range of sea-level rise to 2100, including increased ice dynamics, to just be between 0.8 and 2.0 meters. According to the IPCC, sea level has risen on average at a rate of 1.8 millimeters per year since 1961 and at a rate of 3.1 millimeters per year since 1993.

Biodiversity

As a result of climatic change brought on by global warming, organisms' evolutionary variety may be constrained. The biodiversity of the planet is under danger due to global warming. The extinction of 67% of the 110 species of Costa Rican harlequin frog and golden toad has been attributed to global warming. The pathogenic chytrid fungus shifted its growth optimum as a result of global warming, harming and endangering the harlequin frog.25 According to mid-range climate warming scenarios, 15–37% of species may go extinct by 2050.26 Global warming will make it more challenging to achieve biodiversity in the U.S. Computer models are extremely uncertain but predict wide-ranging shifts, high global extinction rates, and reorganized communities. For instance, climatic change has caused wetland desiccation in Yellowstone National Park, which has caused precipitous declines in populations of once-common amphibian

species. By resampling a large elevational transect from 60 to 3,300 meters above sea level that Joseph Grinnell and colleagues surveyed from 1914 to 192029, Moritz and colleagues quantified nearly a century of climatic change on the small mammal community of Yosemite National Park in California. There was a 500 m average increase in elevation for affected species, which was consistent with estimated warming of 3C. Low-elevation species extended their ranges higher, but high-elevation species often underwent range reductions. In order to live, the pika may retreat to tiny, high mountain islands [8].

The Arctic may see changes in snow conditions due to climate change. Warming spells may cause snow to melt, which is then followed by freezing and an ice sheet covering the tundra. As a result, herbivores like lemmings, muskoxen, and Peary reindeer find it challenging to get food. Lemmings thrive in a subnivean space, which is a gap formed when warmth from the ground melts a thin layer of snow above it and creates a place where they can feed on mosses without fear of being eaten.30 However, due to climate change, the subnivean space no longer exists for as much of the year as it once did, and worse yet, it is less likely to form in the first place. Since 1994, there haven't been any predicted peak rodent years due to the dynamics of the lemming population altering as a result of changing snow conditions. Lack of lemmings causes predators like foxes to redirect their focus to other species like willow grouse and ptarmigan, which negatively affects the populations of those animals.

Global warming is also probably going to have an impact on polar bears. With more open ice, they must seek their prey, seals, more treacherously. Already, there has been a sharp fall in their population in the western Hudson Bay area. During the next two decades, it's possible that more than half of the estimated 20,000 polar bears in the Arctic will vanish. Southern Ocean warming is putting the number of king penguins in the Antarctic in danger, mostly due to dwindling food sources. On Crozet Island, where two-thirds of the King penguin population breeds, nine years of monitoring reveal a 9% loss in adult survival for a 0.26°C warming. The Southern Ocean is expected to continue rising by 0.2C every decade, according to the IPCC Fourth Assessment.

Although the Concord area has many underdeveloped natural areas, climate change is thought to be the cause of 27% of species becoming locally extinct and 36% existing in such low-population abundance that their extirpation may be imminent. Henry David Thoreau started a dataset of Walden Pond, Massachusetts, flora that spans 150 years and provides information on changes in species abundance and flowering time. Extinction may be phylogenetically biased, as shown by the overrepresentation of extinct species in certain plant groups. During the last 100 years, the average annual temperature in the Concord region has increased by 2.4°C. This temperature change is correlated with a shift in species' blooming times, which have shifted seven days earlier than in Thoreau's day [9].

CONCLUSION

The polar ice caps are melting, the seas are rising, and greenhouse gas levels are at their highest point ever. These are just a few of the assertions made by proponents of the global warming theory. Science has shown their accuracy. The combustion of fossil fuels produces these dangerous greenhouse gases. The polar ice caps will melt as a consequence of global warming, which will also cause the ocean level to rise and drown islands and coastal areas. Several locations will see population displacement as a result of the catastrophic weather. Yet, it is concluded that global natural systems are being impacted by regional climate changes, particularly temperature rises,

and that manmade greenhouse gas emissions are most likely to blame for these temperature increases.

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CHAPTER 13

A BRIEF DISCUSSION ON DEFORESTATION

Dr. Krishnappa Venkatesharaju, Assistant Professor
Department of Environmental Science and Engineering, Presidency University, Bangalore, India
Email Id-venkateshraju.k@presidencyuniversity.in

ABSTRACT:

In order to utilize the area where the trees formerly stood for farming, grazing, extraction (mine, oil, or gas), or development as the population grows and people migrate, humans must first destroy or thin forests for timber. In this chapter author is discusses the hurricanes and tropical storms. With deforestation accounting for 20% of GHG emissions, it poses a serious danger to the climate change scenarios. Deforestation reduces CO2 absorption and causes more wildfires, which increase CO2 production. Roads, hydropower plants, forest fires, and soybean cultivation all contribute to the 5.8 million acres of Amazonian Forest that are lost every year to deforestation. Illegal loggers cut the trees in place and transport the completed timber on their boats, removing the majority of the enormous virgin trees. In three decades, an area approximately the size of India would have lost more than 11 million hectares of forest.33 Second-growth forests, however, are likely to be able to keep up with the CO2 transpiration requirements.

KEYWORDS:

Climate, Deforestation, Environment, Health, Storm.

INTRODUCTION

Black ash and red maple are displacing spruce, white cedar, sugar maple, and pine species in temperate forests in the northern hemisphere. In Vermont, there has been a forty-year tendency of the sap flowing two weeks sooner, and most problematically, it is anticipated that oak, hickory, and pine will take the place of sugar maple by the end of the twenty-first century. With global warming, major wildfires are predicted to become more common, particularly in dry and drought-stricken areas. 40% of the world's CO2 emissions came from 5.2 million acres of burning Borneo peat in 1997. Suharto began a massive rice project that was later shelved, but the canals that had been built to dry off the peat bogs caught fire and burnt. Siberian forest fires burnt 48 million acres and produced 250 million tons of CO2 in 2003 [1], [2].

Coral reefs are Deteriorating

Reefs sustain up to 800 different varieties of coral, 4,000 different species of fish, and numerous invertebrates, making them the dynamic hubs of the planet's most concentrated biodiversity. It has been calculated that they are worth more than $300 billion annually to society. Coral reef bleaching is happening more often. This problem may have many root causes, including ocean warming, an increase in ocean pollution, and a rise in ocean acidity due to human-caused increases in CO2. The symbiotic relationship that coral organisms often have with the algae known as zooxanthellae is disrupted by excessive heat. In exchange for the protection and access to sunlight that the reefs give, zooxanthellae deliver carbon, one of the vital nutrients generated by photosynthesis, to the corals. The corals' color is provided by the algae, but coral bleaching occurs when the

dinoflagellates, which are sensitive to temperature changes and die as a result, starve and become white. Since 1979, there have been many instances of widespread coral bleaching. Due to the El Nino sea surface temperature spike in 1997–1998, 16% of the world's reef-building corals perished. Many illnesses, such as white plague, yellow band disease, and white pox, may affect bleached coral.

Ocean acidification, which results in a drop in pH from 8.16 to 8.05 from carbonic acid owing to rising CO2, has a detrimental effect on reefs as well. Ocean acidification impacts fish populations and fish reproduction in species that reside near coral reefs, which has a knock-on effect on coastal people that rely on fish for sustenance.

Experimentally, acidification has a greater impact on bleaching than calcification because it destroys the outer shells of coccolithopores, a kind of microscopic plankton that serves as the foundation of food webs. Thirty percent of the world's 285,000 square kilometers of known reefs have been destroyed, and elkhorn and staghorn corals in the United States are in categories with heightened risk of extinction. Of the 704 species of coral that might be given conservation status, 32.8% were in. Threatened species have been assigned to the Virgin Islands.

Coral that has been bleached loses its color and is often seen across the eastern Caribbean, from Florida to Puerto Rico. The Great Barrier Reef off the coast of Australia would theoretically become extinct in the twenty-first century owing to coral bleaching brought on by human-caused global warming, according to the IPCC Fourth Assessment Report. Recent research from Australia in Porites looking at annual coral growth rings revealed a decline in calcification from 1990 to 2005 from 1.76 to 1.51 gm/cm2 or 14.2% compared to a stable growth rate going right back 400 years.37 They hypothesized that rising sea surface temperature was the primary heat stressor, though the contribution or synergism with ocean acidification may also play a role [3]–[5].

Hurricanes and Tropical Storms

There is consensus on hurricane and tropical storm frequency, but less so for hurricane and tropical storm intensity. Since 1957, the seas have collected 22 times as much heat as the atmosphere. Extreme weather occurrences have grown in the continental United States during the 1970s, according to data from the National Climatic Data Center. The evaporation rate, cloud formation, and subsequent heavy downpours are all accelerated by a rise in water surface temperature. The length of droughts has increased, as have the intensity of precipitation bursts. These occurrences were more frequent in the 1980s than in the 1970s, and more frequent in the 1990s than in the 1980s. During the 1970s, weather-related disaster damage has multiplied fifty times, and big insurers Swiss Re and AIG have taken action to warn their clients that reducing their carbon footprint is necessary.

The costs for society and insurers have increased stepwise twice: from $4 billion a year to $40 billion a year in the 1990s, then $123 billion in 2004 and $200 billion in 2005. This is because return periods between disasters are getting shorter and the frequency of unusual, novel weather events is increasing. When additional weather-related catastrophes struck Europe, Japan, and the United States, the proportion of insured losses also quadrupled, rising from 10% to more than 30%. Although climate change particularly the warming of the deep ocean is exacerbating natural variability, and insurers and reinsurers are preparing for more consecutive years with big losses, we are in the middle of a normal cycle of enhanced hurricane activity lasting twenty to thirty years [6], [7].

DISCUSSION

Local and regional leaders have been condemned for being unprepared by the U.S. Climate Change Science Program for possibly disastrous developments. According to the IPCC Fourth Assessment Report, by the end of the twenty-first century, climate change would cause water scarcity for 1.1 to 3.2 billion people, food shortages for an extra 200 to 600 million people worldwide, and coastal flooding for an additional 7 million households. Responses in the public health sector may be complicated by extreme disasters like drought or floods. Flooding danger may grow with more rain and storms, as has been witnessed in China, Haiti, Venezuela, and other areas. The fast rising of rivers, diarrheal illnesses like cholera, typhoid fever, and cryptosporidiosis, and chemical pollution of the water by pesticides, metals, and organic compounds are all major health concerns. The number of traumatic injuries will rise as storm and hurricane intensity rises39,40. The health effects of extreme weather events range from acute trauma and fatalities to indirect effects like home loss, widespread population displacement, damage to the sanitation system, interruption of food production, damage to the health care system, and post-traumatic stress disorder. Heavy precipitation events' storm-water runoff may raise nutrient loads and fecal bacterial populations in coastal waters, which when combined with rising sea surface temperatures can enhance the frequency and breadth of algal blooms. When their climate changes as a result of a decrease in regional precipitation, the western and southeast regions of the United States may face severe droughts.

Heat-producing Gulf Stream

The Gulf Stream is a component of a vast ocean "conveyor belt" that physically serves to balance the climate and deliver cooling temperatures to northern Europe. A cold, freshwater lens is forming in Greenland as a result of all the warming around the North Pole42 and more rain evaporating off warm tropical oceans and falling at high latitudes. Due to its density and tendency to sink, cold, salty water creates an overturning pump that pushes the Gulf Stream north and propels the ocean conveyor belt. Thermohaline circulation has slowed by 30–50% during the last 50 years,43,44 and it may even stop. The United Kingdom and Europe might experience far colder temperatures if the Gulf Stream were to stop operating. We have certainly reached uncharted waters given the present CO2 accumulation, the expected extent of global warming.

Health Impacts on People

The majority of health and climate analyses categorize health difficulties as a direct consequence, an indirect effect, or as a result of a social or economic upheaval. The Centers for Disease Control and Prevention have called for the expansion of environmental public health tracking systems for health surveillance of climate-sensitive pathogens and vectors. There may be future changes in infectious diseases like "year-round influenza" in the tropics. Down-stream effects include changes in food yields and water supplies that could cause malnutrition or dehydration. As there is no influenza season close to the equator, as temperatures rise, tropical regions will grow and there will be more influenza year-round. The relationship between infectious illnesses and the climate will need more study. Given the case for increases in temperature, particularly in cities, health effects attributable to global warming will include increased mortality from heat waves, increased cardiovascular and pulmonary diseases from synergy with ground-level air pollutants, and increases in vector-borne diseases. The World Health Organization estimates that the warming and precipitation trends due to anthropogenic climate change of both the past thirty years already claim more than 150,000 lives each year.

Warmth Stress

The immediate health impact of global warming is heat stress. Heat exhaustion, where the skin may be wet and seem flushed, and heat stroke, where the skin may be dry but the temperature is noticeably higher, dehydration may be followed by convulsions, and loss of consciousness are the two conditions that define heat stress. Events of extreme heat lead to a rise in fatalities from accidents, murder, suicide, diabetes, stroke, and ischemic heart disease. Patients with chronic obstructive pulmonary disease who are hospitalized and not provided with the proper temperature control have a serious risk of mortality. Heat exposure is also associated with a higher risk of heat exhaustion, heat stroke, heat syncope, and heat cramps. Studies show that the likelihood of extreme heat events has doubled or even quadrupled with global warming. This change would exacerbate an already significant urban heat island effect.

An increase in average temperature is expected to boost the number and severity of extreme heat waves in some areas. The dark asphalt and buildings that absorb more visible light and infrared radiation are to blame for the heat island effect, which causes a 2–10°C rise in localized temperature. Cities in the mid-latitudes that often suffer heat waves cities like Washington, D.C., St. Louis, Chicago, and New York seem to be particularly vulnerable to these consequences. The frequency of days with temperatures exceeding 38°C will grow with a mean rise of 2–5°C during the next 50–100 years. By the middle of the twenty-first century, Washington, D.C., which now has one to two days a year with temperatures over 38°C, may have an average of twelve such days. More sickness and mortality would result from this, especially in the very young, the old, the fragile, and the chronically ill. An extreme example is the 726 fatalities in Chicago during the summer of 1995 that were ascribed to the heat wave. The majority of survivors had near-normal renal, hematologic, and respiratory status improvements; nevertheless, disability lingered, leaving 33% of patients with moderate to severe functional impairment at hospital release. After one year, no patient's functional level had improved, and a further 28% of patients had passed away.

In 2003, a summer heat wave in Europe led to 32,000 additional deaths, wilted crops, ignited forests, and melted 10% of the Alpine glacial mass. Another instance of heat stress occurred during the heat wave in August in France, when the mean maximum temperature exceeded the seasonal norm by 11–12C on nine consecutive days. With a high of 2,000 heat-related fatalities on one day, France alone had around 15,000 excess heat-related deaths. There were an estimated 23,000 excess deaths in August 2003, which represented a 60% increase over the usual August mortality rates. These deaths were attributed to causes involving the respiratory, cardiac, and nervous systems, as well as heat stroke, dehydration, and hyperthermia. Mortality was 15% higher in women than in men, and increases were seen in the elderly, widowed, single, and divorced people, as well as those residing in retirement institutions. In a study from Lyon, Heat waves are positively correlated with mortality in the elderly, particularly in old women and those who are socially isolated.

In hospitals, houses, and nursing homes, there was an increase in mortality. The lack of relief at night is a key factor in all of these heat waves. Minimum temperatures are expected to rise more quickly than average temperatures as a result of global warming. Since a hotter atmosphere can contain more water vapor, we are seeing more intense precipitation events, higher cloud cover, and increased humidity during heat waves. While the number of suffering could be decreased, air conditioning consumes more fossil fuels, which contributes to the production of greenhouse gases. The formation of ground-level ozone is encouraged by higher surface temperatures, particularly in urban areas, and has been shown to increase mortality further. The researchers examined time-

series trends for nine French cities with deaths regressed on temperatures and ozone levels and discovered that the excess risk of death was significant for an increase of 10 mg/m3 in O3.

While there is a definite need to develop an appropriate warning system to notify the public and government agencies when oppressive air masses are forecast, the rise in mortality may be somewhat countered by a reduction in winter fatalities from hypothermia and cold. They separated severe temperatures from fifty U.S. cities and conducted a case-only study using daily mortality and hourly meteorological data from 1989 to 2000. High temperatures in U.S. cities increase mortality for diabetes and cardiovascular reasons, particularly among Blacks. Older participants, Black people, and those dying outside of a hospital were all associated with higher odds ratios. 3,443 heat-related fatalities were recorded in the United States from 1999 to 2003, a five-year span. The frequency of heat waves increased significantly in both the east and west of the country from 1949 to 1995, by around 20%. The National Morbidity and Mortality Study from 95 large U.S. communities from 1987 to 2000 found an 8.3% difference between the highest level of ozone concentrations and the lowest, and air pollution studies show that a 10°C increase in temperature on a comparable summer day was associated with an increase in cardiovascular mortality by 1.17%.64 Schwartz and colleagues discovered an association between elevated temperatures and short-term increases in cardiovasc.

To estimate the impact of heat waves on hospital admissions and mortality for mental, behavioral, and cognitive disorders, Alana Hansen and colleagues in Australia used health outcome data from Adelaide from 1993 to 2006.67 Above a threshold of 26.7°C, they found a 7.3% increase in hospital admissions for mental and behavioral disorders during heat wave periods compared to non-heat wave periods. Disorders of psychological development, dementia, mood disorders, neurotic, stress-related, and somatoform diseases, as well as senility, were among the illnesses. Deaths caused by these conditions rose during heat waves in those aged 65 to 74. Allergic Diseases, Asthma, and Hay Fever with Increased Pollen and Global Warming. About 40 million Americans suffer from allergic rhinitis, and the CDC estimates that there are 16 million people who have asthma.68 Asthma prevalence increased by 75% between 1980 and 1994 in both adults and children, but by 160% in preschool-aged children.69 Climate change has caused phenological changes in plants, advancing the spring allergenic pollen season. A laboratory study using an enzyme-linked immunosorbent assay for ragweed's main allergen, Amb a 1, revealed that protein levels remained constant as CO2 increased; however, Amb a 1 increased 1.8 times as CO2 increased from 280 to 370, and increased 1.6 times as CO2 increased further from 370 to 600 ppm. Ragweed grown at twice the ambient CO2 from 350 to 700 ppm has greater biomass and 40–60% more pollen.

In and around Baltimore, Maryland, in 2001, the U.S. Department of Agriculture seeded ragweed from the end of August through the beginning of September. The urban plot had higher CO2 levels and a pollen count of 12,138 grains/m3, compared to 3,262 in the suburban plot and 2,294 in the rural plot. Pollen-bearing trees have proliferated at the cost of weeds like ragweed in longer-term studies. According to Beggs, "This shows that future climate change may significantly alter the aeroallergen features of our environment, with the potential for more pollen and mold spores, more allergenic pollen, an earlier start to the pollen and mold season, and changes in pollen distribution. One adaptation strategy that has been suggested is aeroallergen biomonitoring. This will make it possible to alert both children and adults who are at risk for allergic rhinitis and asthma [1], [2].

Burning Biomass and Hut Lung

Black soot, a newly discovered human driver of global warming, is a product of burning biomass. Children's lower respiratory tract infections and chronic obstructive pulmonary disease in women are both serious health problems that have surfaced in developing nations due to indoor air pollution from biomass burning. The inhalation of silicates from food grinding on stones as well as biomass burning inside houses has been referred to as "hut lung." Hut lung74 patients may present with cough, sputum production, and shortness of breath. Chronic exposure to biomass smoke is implicated as the leading cause of chronic bronchitis among non-smokers in rural countries and accounts for up to 50% of the total disease burden among the rural poor. The chest radiograph may reveal tiny, irregular, spherical opacities. Possible pulmonary function reduction. Lung tissue biopsies reveal engorged alveolar macrophages with black particulate matter, and peribronchiolar distributions of dark anthracotic pigment are detected in the peripheral small airways. By switching to gas or more energy-efficient stoves, one may lessen both the burden of sickness and the contribution of black carbon to global warming.

Virus-Borne Illnesses

Infectious diseases, such as vector-borne illnesses like malaria and dengue fever, will be impacted by climate change. Temperature may have an impact on how pathogens grow inside vectors and interact with humidity to determine how long they can survive. The availability of breeding grounds for mosquitoes and other species with aquatic immature stages may be significantly influenced by local seasonality and precipitation levels. The range of vectors that transmit West Nile and Lyme disease may also expand. Malaria continues to kill 881,000 people year, mostly African children, with 247 million cases. According to the argument, as the world warms, mosquitoes will spread their range to higher latitudes and more temperate latitudes, increasing the risk of malaria for more individuals. The malaria parasite within the mosquito has a shorter incubation period as the temperature rises. Anopheles gambiae mosquito populations per home and survival rates in water bodies are higher in open, treeless settings or those close to farms in East Africa.

Nonlinear singular spectral analysis has shown that over the period 1950–2002, a 0.5°C rise in temperature can result in an increase in mosquito abundance of 30%–100%.78 Patz and Olson suggested that their findings supported the significance of malaria's nonlinear and threshold responses to regional temperature change. They added that the biological response of mosquito populations to warming can be more than an order of magnitude greater than the measured change in temperature. Recently, temperature and rainfall data from nearby meteorological stations were connected to hospital data from more than three decades of malaria surveillance in the tea highlands of western Kenya. Predicted malaria cases showed a very nonlinear response to warming. Real instances outperformed expected trends, indicating that climate change was already a significant factor in the spread of malaria in this area.

The Dengue Virus

The RNA Flavivirus, which has four different serotypes and causes both dengue fever and dengue hemorrhagic fever, is the culprit. Those who live in a dengue-endemic region might get the disease more than once in their lives since infection with one of these serotypes confers immunity to only that serotype for life. 3,806 suspected imported dengue cases were recorded in the United States between 1977 and 2004, and 864 of those cases were later proven to be dengue. The symptoms of dengue fever are similar to those of the flu and include a strong headache, muscular and joint

problems, discomfort behind the eye, and rash. Chills, lightheadedness, appetite loss, and bleeding from the gums, nose, or mouth are other symptoms. Patients with DF have a six to seven-day period of febrile illness during which they are contagious if bitten by a mosquito vector. DF is often misdiagnosed, particularly when moderate and without a rash. An incubation period of three to fourteen days, most often four to seven days, follows the bite of an infected mosquito before symptoms may occur. As a result, many tourists inadvertently aid in the spread of this illness. Rest and water are the main components of dengue treatment, while acetoaminophen is administered to lower fever and discomfort.

When someone has dengue hemorrhagic fever, the sickness starts off with a fast spike in temperature, various flu-like symptoms, and a face rash. Convulsions might happen, and the early stages of DHF are followed by symptoms of disorientation, irritability, and fatigue. Increased vascular permeability, internal hemorrhage, circulatory failure, and shock may occur together with a reduction in temperature. Intravenous fluids are used as a kind of treatment to keep blood pressure stable. The Bill & Melinda Gates Foundation promised $55 million over six years in 2003 to promote the development of a dengue fever vaccine and halt the disease's spread around the world. The prevalence of dengue fever has roughly tripled in the previous 50 years, making it the most serious virus-transmitted illness worldwide. At least 50 million individuals are infected with dengue each year in more than 100 countries, mostly in South America, Africa, and Asia. Around 890,000 dengue cases were recorded in the Americas in 2007, of which 26,000 cases were Dengue hemorrhagic fever. As a consequence, any anticipated weather patterns that raise the potential for dengue transmission or expand the habitat of mosquito larvae might have far-reaching effects.

In the past, dengue largely affected the poor in urban areas, but today it affects people of all socioeconomic classes equally. Aedes albopictus and Stegomyia aegypti mosquitoes, as well as more recently the J. The Stegomyia genome was sequenced by the Craig Venter Institute and the University of Notre Dame, who discovered 1.38 billion base pairs comprising the insect's estimated 15,419 protein coding sequences. As Stegomyia may also spread yellow fever, these mosquitoes were eliminated from the Americas in the 1950s and 1960s. However, the United States stopped its eradication operations in 1970, and Latin American nations soon followed. S. Egyptians have adapted to city living and now prefer to reside in houses and breed in backyard or house containers. Bed nets are not as effective as home pesticide spraying against these mosquitoes since they attack throughout the day. Highest adult survival rates fall between 20 and 30 degrees Celsius. Faster growth and smaller adult mosquitoes result from higher temperatures. Hales and colleagues calculated that 5–6 billion people would be at danger of dengue transmission by 2085 using modeling approaches, while only 3.5 billion people would be at risk if climate change did not occur.

Worldwide Community and Global Warming

The World Meteorological Organization and the United Nations Environment Programme met in 1990 to establish the Intergovernmental Panel on Climate Change (IPCC), which was created to provide a "objective, balanced, and internationally coordinated scientific assessment of the understanding of the effects of increasing concentrations of greenhouse gases on the Earth's climate and on ways in which these changes may impact socio-economic problems"1. It is divided into three working groups: Working Group I focuses on the most recent scientific findings; Working Group II focuses on the effects of climate change on the environment and the economy; and Working Group III is tasked with developing response plans for these effects. A core membership of thirteen to seventeen nations makes up each Working Group. All IPCC action is

supervised by a bureau that consists of the IPCC chair, three vice chairs, and the co-chairs and vice chairs of each working group.

The IPCC has thus far published four assessment reports on the effects of global warming and has picked 831 members for the fifth report, which is expected in 2014. The major scientific report for the IPCC 4th Assessment of 2007 included more than 1,600 pages and was written by 150 scientists who served as main writers, 400 scientists who served as contributing authors, a group of review editors, and around 600 reviewers. The Fourth Assessment Report of the IPCC from 2007 states that the global surface temperature increased by 0.74 0.18C during the 20th century. The IPCC reports are consensus documents that are by nature conservative, and their models can even miss events like the disintegration of the Larsen B ice shelf collapse along the Antarctic Peninsula on January 31, 2002. The majority of the observed temperature rise since the middle of the 20th century was attributed to rising greenhouse gas concentrations, which are a consequence of human activities like burning fossil fuels and deforestation [8], [9].

CONCLUSION

When forests are cleared, their ability to absorb carbon from the atmosphere declines. Climate change is a result of both forest loss and forest degradation. Carbon emissions may be decreased by reducing forest loss. The reduction of emissions from the land use and agricultural sectors depends on forests. Many social, behavioral, and environmental variables also have an impact on the health outcomes under consideration, and climate change presents a variety of challenges to human health. GHG emissions must be significantly reduced due to the wide-ranging potential effects of global warming, with a focus on energy efficiency, renewable energy sources, and preparation for severe health effects. According to Ramanathan and Feng, since the preindustrial period, GHGs have caused the Earth to warm by 2.4°C, and any more increases will push the planet dangerously closer to meddling from humans.

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CHAPTER 14

A STUDY ON NATIONAL GREEN ENERGY PLAN

Kul Bhushan Anand, Assistant Professor
Department of Mechanical Engineering, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email id-anand_kb1980@rediffmail.com

ABSTRACT:

Plans for green energy are long-term expenditures made to expand the production of renewable energy sources and integrate them into Alberta's electrical infrastructure. Enrolling in "Green Energy" does not ensure that your house, farm, or place of business will get electricity right away from a sustainable source. In this chapter author is discusses the economic costs.

KEYWORDS:

Energy Plan, Environment, Economic, Electrical, Grid.

INTRODUCTION

The emergency of global climate change is now acknowledged on a global scale. On April 17, 1977, President Jimmy Carter said that we had a moral obligation to address the energy situation. Our carbon emissions would rise from around 7 billion metric tons in 2008 to 13 billion metric tons in 2050 under the baseline scenario for business as usual. But, if we want to keep the CO2 concentration at 450 ppm and the world temperature at 2C above preindustrial levels, we must cut carbon emissions to 1.5 billion metric tons by 2050. This is an 80% decrease from the existing levels [1].

The United States, Europe, Russia, and China are the largest worldwide contributors to global warming. Two significant sources of greenhouse emissions that need to be under control in order to create a national green energy strategy are transportation and power production. The end-use sectors in the US with the highest CO2 emissions are transportation, industry, residential, and commercial. Just 6% of the energy used in the United States comes from renewable sources, 8% from nuclear power, and the remainder from fossil fuels. Coal makes up 52% of the world's electricity production now, followed by nuclear energy, 20%, natural gas, 16%, hydropower, 7%, oil, and 2% from renewable sources. The chances for conservation are often where experts start when redesigning energy use scenarios.

Energy Savings

Energy conservation, improving product efficiency, and developing renewable energy technologies might be a huge step toward the U.S. carbon emissions reductions that are required to keep the concentration of CO2 in the atmosphere between 450 and 500 ppm. Around 50% of the rise in US energy demand since 1970 has been successfully met thanks to better energy efficiency. If homes used more energy-efficient equipment or if we mandated more efficient standards, we may save more power in the future. Since 1979, California has implemented efficiency measures and saved $700 billion. Manufacturers of refrigerators in California fought against the efficiency rules, but were unsuccessful, therefore engineers were tasked with

revamping them. The size of refrigerators increased by almost 10% throughout the next decade as a consequence of requirements being placed on them nationally. At the same time, the price in dollars adjusted for inflation was reduced in half, and the amount of energy used decreased by two-thirds. The California Public Utilities Commission separated the sales and earnings of utilities in 1982. Instead of raising profits only via higher energy sales, decoupling encourages utilities toward energy-saving methods with protected earnings. In order to save a significant amount of electricity, chargers and tele-visions may be turned off using remote controls.

The Grid Electrical

More than 150,000 miles of high-voltage transmission lines transport electricity from 5,400 producing facilities controlled by more than 3,000 utilities throughout Canada and the United States, totaling one million megawatts. Making the electricity grid more efficient would significantly increase efficiency. Nowadays, transmission losses of power are about 10%. Future energy demands would be substantially met by higher electrical efficiency. If there was a more effective electrical system, remote wind and other energy sources for big population centers could be transferred these great distances. For instance, by thinking outside the box, we may be able to develop a new method of transporting power from the Great Plains to the East using an underground superconductor of hydrogen surrounded by liquid nitrogen and two layers of insulation. Due to its simplicity in being readily stepped up using transformers, transmitted, and then again stepped down to a safer home voltage of 110 or 220, alternating current prevailed over direct current. At very long distances, high-voltage direct current is recommended because, although being more difficult to manufacture than alternating current, it loses even less power.

The Energy Independence and Security Act of 2007 gave utilities $100 million in financial support to adopt smart grid technology. A $100 million project called SmartGridCity, for instance, is being planned by Xcel Energy Company in Boulder, Colorado. It will rely on a network of fiber optic cables, sophisticated meters, and sensor-equipped transformers to give power stations real-time data on demand throughout the grid, enabling them to adjust the electrical supply, spot malfunctioning equipment, and anticipate overloads. Customers will also be able to use Web-enabled control panels in their homes as part of this initiative, giving them greater control over how much energy they use. For instance, they will be able to program their air conditioners to automatically use less electricity during peak hours. The grid needs additional storage to accommodate green energy, and one way to do this is using lithium-ion batteries in electric vehicles that might function as two-way flow, providing energy when needed and recharging when there is an abundance of wind or solar.

Lighting

As the 100-year-old incandescent light bulb is only 5% efficient, or that 95% of the energy it receives is lost in producing light, lighting provides another big potential to increase the end-use efficiency of electricity. Modern compact fluorescent light bulbs are 7%–9% more efficient than incandescent bulbs, last 9–10 times longer, and generate light that is brighter and of higher quality. They also fit into a regular light socket, although using decorative lights and dimmers with them is still challenging. Mercury contamination after the disposal of compact fluorescent bulbs is a source of considerable worry. Presently, the incandescent bulb business is worth $10 billion annually, compared to the $2 billion market for compact fluorescent bulbs. The usage of incandescent bulbs is prohibited in Australia starting in 2011. About three months earlier than expected, Wal-Mart exceeded their target of selling 100 million compact fluorescent light bulbs by

2007. Much better energy efficiency is predicted by the new LED lighting fixtures now being developed.

Oil

Oil is the most versatile fossil fuel since it can be used to produce energy, heat homes, and power vehicles. Although cheap, simple to get, and transport, more than half of the world's oil has already been used up. The remaining will need a greater financial and environmental sacrifice due to the ongoing greenhouse gas output.

Consumption

1,078 billion barrels of oil have already been produced, leaving an estimated 1,245 billion barrels available. In addition to these sources, there are additional, unconventional reserves, including roughly 704 billion in oil shale extracts, 592 in enhanced recovery, 444 extra-heavy, and 758 in "exploration potential." The world uses about 85 million barrels of oil per day, with the United States using 25 million barrels per day. At the current pace of consumption, which is 29.2 billion barrels annually, it will take us 41 years to consume the remaining 1,245 billion barrels! Nonetheless, the daily rate of consumption is increasing, and despite the exploration potential, no significant new finds have been announced in recent years [2]–[4].

Economic Costs

In 2007, 70% of the oil used in the United States was imported, compared to 58% in 2000. In September 2008, the top 10 oil exporters to the United States were Saudi Arabia, Canada, Venezuela, Mexico, Iraq, Nigeria, Angola, Algeria, Ecuador, and Brazil. The Hubbert peak for the lower forty-eight states was predicted for the early 1970s, and the global peak has been predicted for sometime around 20101. Under the George W. Bush administration, federal oil and gas leases continued almost unabatedly, with 8.3 million acres of the Gulf of Mexico offered in 2006 and Alaska's Bristol Bay opened; under the Obama administration, Secretary of the Interior Ken Salazar cancelled proposed offshore lease sales. Over two-thirds of the 36 billion barrels of oil thought to be located on federal land mostly in the Rocky Mountain West and Alaska are now accessible or are about to undergo environmental studies. Four fifths of the estimated 89 billion barrels of recoverable oil thought to reside offshore are accessible to industry, mostly in the Gulf of Mexico and in the seas near Alaska. 90 million acres of the property that the oil firms have leased from the federal government total 68 million acres that do not seem to be being utilized by the oil companies for the production of energy. This is what lies underneath the 1981 congressional offshore drilling embargo, which was put in place to safeguard coastal economies that rely on clear water and beaches [5], [6].

DISCUSSION

Oil is mostly used in transportation. There are around 136 million automobiles and 105 million trucks and sport utility vehicles on American roads. 2 billion automobiles will be in use globally by the year 2050. The Environmental Protection Agency estimates that each gallon of fuel emits about 20 pounds of CO2. Since 1975, the average weight of American cars has climbed from 3,200 pounds to 4,100 pounds, while their acceleration time from 0 to 60 mph has decreased from 14.4 seconds to 9.9 seconds. Diesel is used by 50% of all automobiles in Europe, using 30% less fuel than gasoline.

In 1975, the corporate average fuel efficiency benchmark was 27.5 mpg, then from 1987 to 2007 it fell to 21 mpg from 22 mpg. In comparison to the 2003 model, the Prius from Toyota earned 48

mpg and had average GHG emissions of 4 tons 15.3 mpg and 12.3 tons of yearly GHG emissions for the Toyota Sequoia 4WD. The corresponding 2008 CAFE passenger vehicle criteria in other countries were 47 mpg in Japan, 44 mpg in the European Union, 36 mpg in China, 32 mpg in Australia, and 27.5 mpg in the United States.

Light vehicles classed as SUVs or passenger vans are no longer exempt under CAFE modifications. The national fuel efficiency requirement was set at 35 mpg by 2020 by the Energy Independence and Security Act of 2007. To achieve 40 mpg, however, would save 3 million barrels of oil every day, $45 billion at the petrol pump, and 300 million tons of CO2 annually. By 2016, higher CAFE criteria of 30 mpg for trucks and 39 mpg for passenger vehicles, for an average of 35.5 mpg overall, were required, up from the current levels of 23 mpg for trucks and 27.5 mpg for automobiles. According to the Obama administration, the new policies would result in a seven-year oil savings of 1.8 billion barrels. This requirement nullified a California regulation that had been adopted by 14 other states but had been contested in court by the car industry.

While a small gasoline engine will increase mileage for long-distance driving, switching to hybrid engines with battery power will be necessary for the transition away from fossil fuels. Additionally, all-electric vehicles are being developed, and genetically engineered biofuels may expand the possibilities for a liquid-fueled engine. The plug-in hybrid vehicle is quickly coming into its own, with batteries that can run simple passenger cars for more than 200 kilometers before switching to gasoline engines for further ranges before recharging. As the most recent technology, lithium batteries have been created for computers and mobile phones. Batteries have advanced rapidly.

costly hydrogen fuel cells as the preferred option for moving away from oil. Battery technology is straightforward: Ions are trapped at one electrode by chemical bonds until the circuit is activated, at which point they pass through a separator and onto a second electrode where they release electrons to create an electric current. To store energy in a rechargeable battery, the chemical process must be reversed. A battery must overcome obstacles related to price, safety, toughness, power, and sheer capacity. The nickel metal hydride battery, the next-generation battery, only goes 50% farther on a charge than the lead acid battery, which has a range of just approximately 150 km. High capacity lithium-ion batteries are small and lightweight. The lithium cobalt oxide battery has possible safety issues, thus manganese oxides and iron phosphates are taking its place. The 2011 Chevrolet Volt electric vehicle is intended to go 40 miles on a single charge and has a 1.4 liter gas engine to increase its range. This is different from the Toyota Prius, which increases total fuel economy by charging the battery while braking. A 400-pound lithium battery will cost $4,000 and be included in the Chevy Volt [7], [8].

$10,000, however buyers could be eligible for a $7,500 tax rebate. A business initiative called Better Place has chosen to provide monthly leases or mobility shares that allow customers to utilize electric cars with a range of up to 160 km and charge them at the end of the trip. Many little nations, like Israel and Denmark, are testing the plug-in, which can use renewable energy. Bolivia, which has the greatest lithium resources in the world, has indicated that it wants to become more than simply a provider of raw materials for the production of lithium batteries. Lithium will be needed to build batteries.

Sands of Tar

The 57,000 square mile (about Florida-sized) Alberta tar sands of Canada are made up of bitumen, a dense combination of hydrocarbons. This deposit contains an astounding 1.7 trillion barrels of synthetic oil, but only a small portion, approximately 10%, is recoverable. 1.2 million barrels of

synthetic crude are now exported, however it is anticipated that this number will double by 2010 and quadruple by 2015. At open pit mining, 4,500 pounds of tar sands must be extracted in order to produce one barrel of synthetic oil. Using hot water tanks that spin down the sand and suck out the released bitumen, bitumen must be separated from the tar sands. In tailings ponds that are tainted with mercury and other contaminants, heated water must be kept. The bitumen is next heated to over 900° F and refined to a viscous mixture of no more than 20 carbon-containing hydrocarbons. For in-situ oil extraction, gravity drainage with steam assistance is one option. Compared to conventional petroleum, oil from oil sands produces 1,030% higher greenhouse emissions.

According to anecdotal accounts from Cree and Athabascan tribes near Fort Chipewyan, poisonous substances from the mines and tailings ponds are making their way down the Athabasca River to Lake Athabasca, where lake trout and pike are starting to exhibit toxic symptoms. Migratory birds have been put at danger by tailings ponds. According to the Natural Resources Defense Council, the disturbance of the boreal forest and tailings ponds would result in the loss of 6 million to 166 million birds over the next 30 to 50 years. The approval of a pipeline from the Canadian tar sands to Chicago by U.S. policymakers has allowed this technology to have a market in the United States, although largely in the Midwest. Since the oil is sold to the United States, this has ramifications for American fossil fuel consumption and policy. The tar sands industry has stopped Canada from fulfilling its Kyoto Protocol targets because its carbon footprint has not diminished.

Impacts on the Environment

Surface regions such as marshes, rivers, seas, and forests may get contaminated while drilling for oil in delicate settings. Several oil spills have occurred as a result of Arctic pipeline failures, hunters targeting the Alaska pipeline, accidents in Ecuador, and Niger Delta sabotage. Oil ships going aground have caused the biggest oil spills in history. The Exxon Valdez, which grounded on Bligh Reef in Alaska's Prince William Sound in 1989, is thought to be the biggest of them. A total of 257,000 barrels or almost 11 million gallons were spilled, contaminating 1,300 kilometers of unspoiled coastline. Not all beaches were cleaned, and it took four seasons to complete the cleaning. At its height, the cleaning operation employed 10,000 people and cost $2.1 billion. It also included 1,000 boats, 100 aircraft, and 100 helicopters. On numerous beaches, fertilized bacteria were utilized to devour hydrocarbons via the process of bioremediation. The best estimates indicated that up to 22 killer whales, 250 bald eagles, 250,000 seabirds, 2,800 sea otters, 300 harbor seals, billions of salmon and herring eggs, and 2,800 sea otters perished. Animals were harmed by oil on their fur, which reduced their ability to insulate, or poisoned by eating and drinking the oil, which caused toxicity to their reproductive, hepatic, and renal systems.

Environmental health has become a national priority as a result of the Deepwater Horizon Mississippi Canyon-252 explosion in April 2010 and the 35,000–60,000 barrels of oil per day that followed it into the Gulf of Mexico. On the rig, eleven employees perished and seventeen others were injured. About 5,000 feet below the ocean's surface, the Deepwater well head is located. At least 2,500 square miles of the ensuing oil slick were affected, and its size changed daily depending on the weather. There were also significant oil smells underwater that were invisible from the surface. Many hundreds of oil and gas employees have been exposed to oil, smoke, and particulates via cutaneous and respiratory routes of exposure as a result of the endeavor to stop the leak and clean up the area. In order to remove the sheen on the surface and gather oil into booms, 5,400 skimmers have been operating on boats and skiffs, as highlighted by President Obama. Workers cleaning up oil have walked the Louisiana beaches for 27 thousand km, picking up tar balls and

collecting oil in trash bags. Many people are removing oil from dirty birds and marsh plants. Many hazardous substances that might be dangerous to people as a consequence of oil exposure include volatile organic compounds including aldehydes, alcohols, esters, aliphatic hydrocarbons, aromatics like benzene, and polycyclic hydrocarbons with cancer-causing properties. In the mile-deep seas, around a million gallons of oil dispersants had been used. For aquatic animals, Corexit 9527 dispersion is around four times more hazardous than crude oil. Propylene glycol, 2-butoxyethyl alcohol, organic sulfonic acid, and petroleum distillates (10%–30%) are all ingredients in Corexit. Their toxicity to both people and the environment has not been extensively studied. Research is required on the concoctions of crude oil, gas, and dispersants.

Studies on the epidemiology of oil spill catastrophes such as the Exxon Valdez, the Prestige oil leak in Spain in 2002, and the Braer oil spill in the United Kingdom in 1993 have assessed the effects of the clean-up on workers and locals. Eye, upper respiratory tract, skin irritation, nausea, and exhaustion symptoms all rose considerably. Injury rates were higher for those specifically engaged in the physical and cleaning of the birds. The tension or worry experienced by the inhabitants and employees, however, was far more apparent. This might result from direct exposure, ecological losses, direct and indirect financial losses, or perhaps both. There haven't been any long-term studies on the function of the liver, kidneys, or lungs, nor have there been any research on the long-term risks of cancer, cardiovascular disease, infertility, or neurological or brain issues.

An open-ended study, rather than one focused on a specific number of end points, will be conducted by the National Institute of Environmental Health Sciences on 55,000 Gulf oil spill workers.2 Contaminants of concern include benzene and polycyclic aromatic hydrocarbons; exposed individuals include workers with chemical exposures; for instance, the National Institute of Occupational Safety and Health counted 52,000 workers responding to the Gulf oil spill by August 2010. NIEHS has expertise in environmental health education and training for employees thanks to the Superfund rules and amendments, and it has already taught more than 20,000 workers in the Gulf area. Academic institutions affiliated with NIEHS provide clinical epidemiology and translational medicine training. British Petroleum has been blamed by the U.S. government for the Deepwater Horizon leak, and authorities have promised to make the firm liable for all cleaning expenses and other harm to regional industry [9].

CONCLUSION

In today's civilizations, energy is essential. It is necessary to create power and serves as a key input to all industries, including manufacturing, transportation, and residential. To put it another way, all civilizations depend on energy services to provide for necessities like transportation, warmth, and lighting. The truth is that fossil fuels must go because they cannot provide our energy demands in a sustainable way. We can establish a fully sustainable future for our energy supply without harming the planet we all share by creating a range of green energy alternatives. Energy conservation refers to any effort made to reduce energy use. Less energy may be used to achieve this. Protecting our natural resources is crucial.

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CHAPTER 15

A BRIEF DISCUSSION ON OIL AND THE GOVERNMENT

Shri Bhagwan, Assistant Professor
Department of Mechanical Engineering, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email id-Shribhagwanme@gmail.com

ABSTRACT:

A fossil fuel is petroleum, sometimes referred to as crude oil. Petroleum was created from the remnants of extinct marine animals including plants, algae, and bacteria, much like coal and natural gas. If an organization has incurred expenditures from carrying out oil removal actions in compliance with the Clean Water Act National Contingency Plan, it is eligible to collect removal costs from a responsible party underneath the Oil Pollution Act. In this chapter author is discusses the coal-fired power plants. A public health emergency resulted from the Deepwater Horizon tragedy. The task was to create cohorts of potentially exposed and comparable groups as soon as possible in case of calamity). At least three groups are at risk: highly exposed BP employees who were involved in the WTC Dust incident; water skimmers who were exposed to oil sheens; and beach cleanup personnel.

KEYWORDS:

Act, Environment, Government, Oil, Pollution.

INTRODUCTION

The U.S. enacted the Oil Pollution Act of 1990 in reaction to the Exxon Valdez catastrophe. The Oil Pollution Act of 1990 was approved by Congress. This comprehensive legislation addressed oil spill responsibility, response, and compensation.

The Act includes a provision that forbids any vessel from operating in Prince William Sound if, after March 22, 1989, it has produced an oil leak of more than one million U.S. gallons in any maritime region. 18 ships have already been kept out of Prince William Sound by OPA as early 2002. A timeline was also established by OPA for the progressive introduction of double-hull designs, which offer an extra barrier between the water and the oil tanks. A Coast Guard analysis concluded that a double hull would have reduced the quantity of oil spilt by 60% even though it was unlikely to have stopped the Valdez tragedy. It was determined that the responsible person was accountable for the incident's expenditures associated with oil cleanup and damages. For the purpose of covering the expenses of oil cleanup in accordance with the National Contingency Plan, the Oil Spill Liability Trust Fund was created for the President. Holders of leases or licenses for offshore facilities were liable for up to $75 million each leak; liability for responsible parties for onshore facilities and deepwater ports was up to $350 million per spill. To coordinate a comprehensive program of research, technological development, and demonstration on oil pollution among federal agencies, in collaboration and coordination with business, academic institutions, and state governments, an inter-agency coordinating committee on the subject was created [1].

Their exposures to crude oil, volatile organics, duration of exposure, intensity of exposure, and other factors need to be thoroughly evaluated. To benefit from the WTC Dust experience, health assessments and questionnaires evaluating symptoms need to be organized ahead of time. Planning should be done in advance for blood, respiratory function, exposure tests, and general health examinations. It is necessary to set up databases, central labs, and blood depots for data input. It will be crucial to create a central organization that coordinates health research. After the WTC Dust incident, a variety of federal, state, municipal, academic, and other entities with various specialties and purposes began to overlap. The WTC Dust disaster necessitated congressional earmarks for funding for clinical health examinations of FDNY employees, funding for evaluations of clean-up workers' health at a central coordination center and five clinics, and funding for residents' health at a New York City Health and Hospitals Clinic. The prohibition against health assessments without the crucial research component to address compelling scientific questions or epidemiology and study design inquiries to generate illness patterns and investigations on disease processes was a major gap.

The Minerals Management Service of the Department of the Interior was in charge of promoting industrial development on federal lands and the outer continental shelf, collecting royalties owed to the federal government, and supervising the same industry to make sure it adhered to applicable federal laws. The inspector general of the Interior harshly criticized this for creating multiple conflicts of interest and being dependent on the business it oversaw. The sustainable development of the conventional and renewable energy resources on the outer continental shelf, including resource evaluation, planning, and leasing, will fall under the purview of the newly established Bureau of Ocean Energy Management, which will report to the Assistant Secretary for Land and Minerals Management. The new Bureau of Safety and Environmental Enforcement, also under the same assistant secretary, will be in charge of making sure that all offshore energy operations are thoroughly supervised in terms of both safety and environmental protection.

The Assistant Secretary for Policy, Management, and Budget will oversee the new Office of Natural Resources Revenue, which will be in charge of managing all aspects of royalty and revenue management, including asset management, auditing and compliance, and income collection and distribution. On June 18, 2010, the Bureau of Ocean Energy Management, Regulation, and Enforcement was established, replacing the Minerals Management Service. In order to investigate the cause of the BP accident and make recommendations for solutions and regulatory reform to prevent similar accidents in the future, President Obama established the BP Commission, which is chaired by former Florida senator Bob Graham and former EPA administrator William K. Reilly. According to their final assessment, "Minerals Management Service has consistently lacked the resources, technical know-how, and petroleum engineering expertise that are vitally essential to ensure that offshore drilling is carried out in a safe and responsible way. It is unacceptable for a regulatory body to fall so far short of fulfilling its crucial safety duty [2], [3].''

Natural Gas

90% of natural gas is methane, although there are also significant amounts of ethane, propane, butane, and pentane. Natural gas must go through a lot of processing to nearly completely eliminate all substances outside methane before it can be utilized as fuel. Ethane, propane, butanes, pentanes, higher molecular weight hydrocarbons, elemental sulfur, and sometimes helium and nitrogen are among the by-products of that operation. Natural gas's low density makes transportation and storage the main points of difficulty in utilization. It is transported throughout North America via pipelines, and liquefied natural gas ships may be used to transport it across seas. Tank trucks can

also transport compressed or liquefied natural gas over shorter distances. From gas pipes, significant volumes of methane escape. The ordinarily colorless and odorless gas has a little quantity of t-butyl mercaptan added to it so that leaks may be discovered. This odorant has a stench similar to that of rotten cabbage. In a process known as a combined cycle, gas turbines and steam turbines work together to produce electricity. A significant feedstock for the Haber process, which produces ammonia for use in fertilizer manufacture, is natural gas. In addition to being able to manufacture hydrogen, it can be used to power vehicles like automobiles, buses, and trucks while burning more cleanly than gasoline.

DISCUSSION

Using natural gas produces 30% less CO2 than burning petroleum, while coal releases 45% more CO2. According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, natural gas generated around 5,300 million tons of CO2 annually in 2004, but coal and oil produced twice as much CO2. As natural gas is mostly methane, it has 22 times the climatic forcing relative to CO2 as a GHG in terms of raising surface temperature. Nevertheless, this will quadruple by 2030. Over 2,600 billion m3 of the world's annual production of which 550 billion m3 are generated in the United States are produced there. By using shale formations like the Barnett in Texas, the Marcellus in Appalachia, and the Haynesville in Louisiana, supplies in the United States might endure for several hundred years.

Now, proved reserves are estimated to be 284 trillion cubic feet, with estimated reserves being above 2,037 trillion cubic feet. According to the Prospective Gas Committee, there are 1,800 trillion cubic feet of gas reserves, including 616 trillion cubic feet from shale gas. As it could quickly start up power plants when the wind isn't blowing and during cloudy times, natural gas is being marketed as a natural backup for other sources of energy. As it may replace coal in power plants in the eastern United States while remaining reasonably cheap and plentiful, natural gas might act as a stopgap measure against climate change. Hydro-fracking to produce natural gas from Appalachian shale resources may pollute ground water, necessitating constant monitoring by state and federal environmental regulators for a number of pollutants [4]–[6].

Accidental methane leaks from gas and oil wells, pipelines, and storage tanks are a big issue with natural gas. Methane leaks are thought to total 3 trillion cubic feet annually, with Russia leading the way with 427 billion cubic feet, the United States coming in second with 346 billion cubic feet, and Ukraine coming in third with 225 billion cubic feet. According to the EPA, natural gas leaks have a warming effect equivalent to more than half of the country's coal facilities. There will be additional projects and pipelines to keep an eye on since Energy Department predictions indicate that gas output will expand by 50% over the next 20 years. EPA authorities will issue regulations specifically for the >700,000 oil and gas wells in the United States, which would have been excluded from the original greenhouse gas reporting requirement.

Hydraulic fracking, which employs proprietary chemicals in pressurized water to boost natural gas flows, has caused environmental concerns due to the rise of natural gas drilling in the United States, particularly in the shales of New York and Pennsylvania. A well may be fracked up to eight million gallons of water, and it may be fracked more than once. Benzene, toluene, xylene, and ethylbenzene are some of these compounds. The water table is approximately 1,000 feet below ground level, while natural gas wells are typically 8,000 feet below. If the cement casing surrounding the natural gas well leaks, the natural gas might get into the water supply. The bigger issue is that the injected water must be properly disposed of in deep disposal pits since it has been

tainted with fracking chemicals. Moreover, a lot of volatile organic compounds are evaporated from the polluted water, and these substances may help produce smog or ground-level ozone. The Department of Environmental Conservation of New York State has prohibited gas drilling on the areas covered by the New York Marcellus shale, which makes up a large portion of the watershed for New York City.

Gas Hydrogen

A hydrogen-based energy economy seems to be the most difficult, while being futuristic. As hydrogen is a gas at normal temperature and an energy transporter rather than an energy producer, it is challenging to compress. Due to its limited availability, hydrogen must be created by splitting water into hydrogen and oxygen, which needs energy. When hydrogen is burned, the majority of that energy is recovered. Renewable energy sources may be used to split water, and distribution and storage systems may also be created. Presently, hydrogen may provide electrical energy in a fuel cell or heat energy in a combustion engine. Due to the use of precious metal catalysts in the power generation process, fuel cells are two orders of magnitude costlier than internal combustion engines. It is still technically challenging to create a hydrogen power train for a fuel cell and/or electric motor. By concentrating the hydrogen program on fundamental research, this significant alternative will be given the proper long-term attention.

Coal

Of of its 496 billion tons of reserves, the United States possesses 275 billion tons of recoverable coal. With 1.16 billion tons mined in 2006, there are around one billion tons produced annually. The extraction of coal itself entails a number of risks. First, coal dust may cause coal worker pneumoconiosis, however recent years have seen a significant drop in cases because to better ventilation and dust management. Coal mine dust in the lung causes CWP, which mostly affects underground miners and causes tissue reactions such localized emphysema and peribronchiolar fibrosis. Second, miners who are exposed to a lot of dust may get progressive severe fibrosis. Reduced pulmonary function and mid-upper lung zone fibrosis are its defining features. The release of monocyte chemotactic factor by activated macrophages attracts other macrophages that produce reactive oxygen species, fibronectin, and fibrotic growth factors, which promote the buildup of collagen. The localized emphysema is exacerbated by neutrophil elastase. Between 1992 and 2002, black lung disease claimed the lives of 12,000 miners.

In the history of coal mining in the United States, 1907 saw 3,242 fatalities. At Monongahela, West Virginia, that year, the worst mine explosion in American history claimed 358 lives. Thirty-four coal mining deaths occurred in 2007, compared to an all-time low of twenty-three in 2005. In contrast to the four deaths per 100,000 employees in the whole private sector, the mortality rate for coal mining increased to 49.5% in 2006 from 26.8% in 2005. 47 coal mining deaths were reported in 2006; of them, 43% were caused by fires or explosions, 34% by coming into touch with items or machinery, and 19% by transportation-related mishaps. About 100,000 coal miners have perished in mine accidents and explosions since 1900, including 25 workers who perished in an explosion in the first few days of April 2010. Methane seepage, which has the ability to mobilize significant volumes of coal dust and has much more explosive properties, is the primary cause of coal mine explosions. The EPA estimates that 26% of all energy-related methane emissions in the United States originate from coal mining, which also releases methane into the environment [7], [8].

In order to better guide and oversee the mining industry, cover all types of miners, mandate or encourage the use of successful safety procedures and technology, offer efficient miner training, and concentrate on reducing or eliminating the most serious hazards, federal and state laws have been passed. The Federal Coal Mine Health and Safety Act of 1969, which established a worker's compensation scheme for black lung, and the more comprehensive Federal Mine Safety and Health Act of 1977 were the two statutes with the greatest scope. The Mine Safety and Health Administration was established by this statute and transferred to the Department of Labor. According to MSHA reporting requirements, there were 4881 injuries and 34 deaths in 2007, representing an incidence rate of 4.21 and 0.03 per 200,000 work hours, respectively. For deep coal seams, underground mining methods must be used, although surface mining is far less expensive, safer, and more efficient. Wyoming has become the state with the most coal extracted because to surface mining. Also, the low sulfur content of such coal contributes to the reduction of SO2 and acid rain concerns.

Removal of Mountains

Coal mining has resumed in both West Virginia and Kentucky as a result of mountaintop removal, however this practice harms streams and rivers and dumps tons of debris into nearby ravines. More than 7% of the forest cover in Appalachia was destroyed between 1985 and 2001 by mountaintop removal coal mining, which also buried more than 1,200 kilometers of streams. A formal regulation issued by the Interior Department and the EPA permits coal firms to discharge mountaintop trash into nearby lowlands' rivers and streams. The regulation, according to the EPA, has been updated to safeguard streams, fish, and other species as well as national and state water quality criteria. The last step before a regulation may be published in the Federal Register is approval by the White House Office of Management and Budget, which is coordinated by the Council of Environmental Quality.

A trade association for the mining industry, the National Mining Association, supported the regulation, while environmental groups including the Sierra Club, the Environmental Defense Fund, Earthjustice, and the Natural Resources Defense Council opposed it. The Democratic governors of Kentucky and Tennessee wrote to the Bush administration urging them not to accept the regulation, claiming that it would hasten "the devastation of mountains, woods, and streams across Appalachia." When mountaintop fill was utilized in river valleys, the EPA published guidelines for mining firms to follow as part of the Clean Water Act's protection of water quality. Final guidance that was scheduled to be released in April 2011 was postponed while the Office of Information and Regulatory Affairs in the Office of Management and Budget examined this significant rule that, in accordance with Executive Order 12866, had an impact of at least $100 million on the economy.

In 2004, harmful chemicals from coal mining were directly or indirectly dumped into streams or landfills in excess of 13 million pounds. American coal-fired power stations produce 130 million tons of ash and sludge annually, which contains hazardous materials including nickel, chromium, and arsenic. Just 26% of these surface ponds, where around half of these facilities deposit their waste, are lined to keep pollution from escaping. At the Kingston Fossil Tennessee Valley Authority facility, 1.1 billion gallons of coal fly ash slurry leaked on December 22, 2008. It descended, causing up to six feet of muck to blanket the surrounding terrain, destroying local buildings, and pouring into nearby rivers.

Coal-Fired Power Plants

In the United States, there are more than 500 large coal-fired power plants, and 154 more are anticipated by 2030, just 24 of which will use cutting-edge coal-burning technology. This would result in a capacity increase of 37.7 gigawatts and an annual CO2 output of 247.8 million tons. A 500 megawatt coal plant can power 500,000 houses while emitting the same amount of CO2 as 750,000 automobiles. Flue gases include 14% CO2, which has to be cleaned before being captured. When heated, amine solutions absorb CO2 and release it. More over half of the electricity produced in Poland, Germany, and the United Kingdom comes from coal. The world's plans are astounding: by 2012, out of the 31 billion tons of carbon dioxide emissions from all sources in that year, 7,474 coal-fired power plants in 79 nations will be blasting out 9 billion tons of carbon dioxide yearly.

The process of coal liquefaction, known as Fischer-Tropsch after German scientists in the 1920s, may create coal-based diesel. The use of synthetic fuels has been classified by the Natural Resources Defense Council as taking a brown route rather than a green one. High temperatures and pressures create the gas, which is then sent into a reactor where catalysts re-unite carbon and hydrogen to create hydrogen chains of various lengths, including diesel and gasoline. Before liquefying the gas, mercury and sulfur are removed from it since they might hinder the process. Therefore, compared to diesel made from oil, coal-liquefied diesel has lower levels of mercury, sulfur, particulates, and volatile organic compounds. Yet, producing two barrels of coal-based oil requires one ton of bituminous coal. Because of how energy-intensive this process is, coal-derived fuels would still emit 80% more CO2 than fuels made from petroleum, even with carbon capture and storage.

Carbon Sequestration and Storage

Carbon capture and storage will be crucial for clean coal technologies in order to stop the atmosphere from continuing to fill up with human CO2. Since it is heavier than air, CO2 tends to stay in deep wells. Germany has a CCS test site near Berlin called Ketzin, where 60,000 tons of CO2 will be pumped 700 meters under the surface into a saltwater aquifer. The G8 summit sessions specifically up this CCS. At the location, scientists will keep an eye out for any unintended chemical reactions between CO2 and minerals or acidification of brine that might theoretically erode cap rock or taint potable ground water. By 2030, the cost of CO2 transport, storage, injection, and pumping facilities will be at least $80 billion, which is a minor sum compared to the energy expenditures required at that time. Norway has pumped 10 million tons of CO2 into the Utsira Sand deposit 1,000 meters under the North Sea. 9% of the 12 billion cubic feet of natural gas that Sleipner West pumps each year is CO2, which is removed on site and injected underground. They have been infusing around a million tons of CO2 annually since 1996.

The BP Carson Oil Refinery is constructing a $1 billion facility in Southern California to burn petroleum coke to produce H2 and CO2. Hydrogen would power turbines and generate energy. To force petroleum that is difficult to get toward the surface, CO2 would be pumped into an oil well. The well would be permanently sealed after being emptied, capturing the CO2. Storage in deep, salty brine pools below earth, deep coal seams or porous rock like sandstone, or depleted oil and gas fields are three CCS techniques. The most alluring aquifers are those that are salty because to their enormous storage capacity and widespread dispersion. With about 2 billion tons of CO2 to inject annually, coal-fired power facilities in the US create a colossal quantity of CO2. Terra preta, an Amazonian soil that contains more carbon than nearby soils from Indo-farmers 7,000 years ago, is the subject of much investigation. How to replicate this carbon sequestration is important

because, for instance, a 2-acre parcel of land may contain 250 tons of carbon, compared to 100 tons in unimproved soils. The use of such char in large-scale agriculture and carbon sequestration is possible. While the integrated gasification combined cycle costs 20% more, it is easier to extract CO2. A 450-Megawatt IGCC facility will get a $1.3 billion investment from Germany. From 2003, the U.S. Department of Energy has been developing an IGCC named FutureGen, with an investment of $600 million from the Department of Energy and an additional >$250 million from enterprises in the United States, Australia, China, and India. Due to this technology, a demonstration facility must start operating in 2012. Using carbon sequestration, it would utilize coal to create power and hydrogen gas. The purpose of coal gasification is to create H2 and CO, which, when combined with steam, will generate more H2 and concentrated CO2. H2 will power fuel cells and electricity-generating turbines. The H2 from the gasifier and the shift reaction powers a gas turbine, while the heat from that turbine and the gasifier powers a separate steam turbine in IGCC facilities.

Since IGCCs have several cycles, their efficiency should exceed the 40% of the most technologically sophisticated conventional coal plants. The output of IGCC power plants in the Netherlands and Japan has consistently fluctuated between 50% and 100% load in less than an hour. A single plant's H2 output may be utilized to cogenerate stream, manufacture chemicals and liquid fuels, and generate electricity. The state of Illinois was picked when the site selection process was finished in 2007. Future-275 Gen's MW of electrical output will be sufficient to power 150,000 typical U.S. houses. Prices skyrocketed to $6.5 million per MW, compared to less than $2 million per MW for wind turbines, leading to project cancellation. In 2009, Secretary of Energy Steven Chu resurrected the project with stimulus money. The announcement of Futurgen 2.0, a revamped coal-fired power station employing modern oxy-combustion technology with CO2 sequestration, came at the beginning of 2010. It is anticipated that the 18-month Environmental Impact Statement will start in the spring of 2011 [9], [10].

CONCLUSION

Hence, it follows that oil spills occur when oil or other petroleum products seep onto land or the sea via vessels, wells, or oil storage containers. This leak causes oil spill pollution, which may also result in an oil catastrophe, which is another kind of pollution. Companies that move oil in the US are subject to extra regulations under the Oil Pollution Act. A vessel or facility that has been judged to be liable for oil discharge or that has significantly increased the risk of oil discharge is considered a responsible party under the OPA. When petroleum escapes in liquid form into an environment as a result of anthropogenic (human) sources, oil pollution occurs. Oil spills, which discharge a significant volume of oil into marine and coastal waterways and have disastrous effects, are the most prevalent kind of oil pollution.

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CHAPTER 16

A BRIEF DISCUSSION ON BIOFUELS

Sunil Kumar, Assistant Professor
Department of Mechanical Engineering, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email id- sunilgju123@gmail.com

ABSTRACT:

In contrast to other renewable energy sources, biomass may be immediately transformed into liquid fuels, or "biofuels," to assist fulfill the need for transportation fuel. Ethanol and biodiesel, the two most prevalent kinds of biofuels now in use, are both products of the first generation of biofuel technology. In this chapter author is discusses the geothermal energy and hydropower. Glycerin is extracted from fat and vegetable oil during the transesterification process, which produces biodiesel. Methyl esters and glycerin are the byproducts of the procedure. Vegetable oil undergoes transesterification, which creates biodiesel and glycerin, by adding methanol and sodium hydroxide as a catalyst. Mono-alkyl esters of long-chain fatty acids generated from vegetable oils or animal fats are what are referred to as biodiesel.

KEYWORDS:

Biofuel, Environment, Energy, Oil, Vehicle.

INTRODUCTION

While they do emit greenhouse gases, biofuels have the potential to be a transportation solution to the challenge of declining oil resources. Moreover, there would be minimal to no greenhouse gas decrease since maize, soybeans, and other crops would fight for fertilizer and arable land. Algae might be bioengineered to create a liquid fuel and can potentially absorb CO2. The transportation industry will have to decide between technological options including the development of rechargeable batteries vs liquid gasoline [1]–[3]. In the United States and Europe, soybean oil is used principally in the production of biodiesel. Between one-third and fifty percent of all vehicles in Europe are diesel-powered. Diesel engines force air into a cylinder where it is compressed and heated to the point where fuel ignites upon contact with the air. They have superior fuel efficiency and are more effective than spark plug versions. Soybean oil has a 20% efficiency rate, compared to 40% for canola and 50% for algae. According to the National Biodiesel Board, the amount of fuel sold in the United States increased from 25 million gallons in 2004 to 75 million in 2005, 250 million in 2006, and 450 million in 2007. The capacity was doubled by 2008, and a new one-billion-gallon facility was being built.

A 1998 research on the lifetime of biodiesel, sponsored jointly by the U.S. Compared to petroleum diesel, biodiesel decreases net CO2 emissions by 78%, according to the Departments of Energy and Agriculture. Biodiesel produces 3.2 times as much energy as it takes to make it. Biodiesel produces 47% less particles and no sulfur, however it may also release 10% more NOx. Biodiesel may gel in cold temperatures, necessitating safety measures or, in really cold conditions, fuel warmers. Although though starch and cellulose are more difficult to break down into glucose, enzymes are the most effective way to accomplish it. The yeast Saccharomyces cerevisiae may

then ferment the glucose, assisting in the conversion of glucose into two equivalents of ethanol, however this process is sluggish. There has been a lot of chemical study done on this process; for instance, enzymes can change glucose into fructose, which can then be used to make dimethyl furan, a low-oxygen fuel. The genomes of higher termites have been sequenced, and many carbohydrate-active enzymes have been discovered that could be used in these industrial processes3. In contrast to the degradation of lignocellulose biomass, which is made up of hemicellulose, which primarily produces hexoses, this process also produces significant amounts of the pentose sugars D-xylose and L-arabinose. Pentose sugars, in contrast to hexose sugars, cannot be fermented by wild-type S. cerevisiae. A majority of fermenting organisms, including S. The product must next be concentrated by distillation since cerevisiae cannot tolerate ethanol concentrations beyond 25%. Escherichia coli, a typical intestine bacterium, may be genetically modified to process algae into jet fuel and commercial biodiesel. E. Moreover, since it is less hygroscopic and more closely mimics petroleum, butanol and isobutanol, which are preferable to ethanol as a fuel, may be produced by genetically engineering coli.

Algae

Scientists have created isobutanol-producing yeast and cyanobacteria, two types of blue-green algae that can perform photosynthesis. As many kinds of algae can thrive in brackish or saltwater, they don't compete with food crops for land or even freshwater. They are far more prolific than terrestrial plants and may reproduce within hours. Oils produced by algae naturally have 50% more energy than ethanol. ExxonMobil, for instance, spent $600 million, or half of that amount, in Synthetic Genomics, Inc. to reengineer certain strains of algae so that they exude hydro- carbons from their cells. A large number of start-up firms are studying the generation of hydro- carbons from algae. Increasing productivity in closed reactors or even opening conventional agricultural practices utilizing shallow ponds would be difficult. Waste CO2 must be bubbled through Al- gae in order to boost photosynthesis, creating a market for the millions of tons of waste CO2 [4]–[6].

Jatropha

Growing in marginal regions across Asia, particularly in India, jatropha may be processed into biodiesel. It belongs to the euphorbia family and is a native of Central America. Lamp oil and soap have long been made from the seeds of this plant. Jatropha shrubs may survive up to fifty years, provide fruit continuously for more than thirty years, and cope well with droughts. A liter of oil is produced from around 4 kilos of seeds, and the price of biodiesel is comparable to that of petroleum-based diesel. After pressing, the nutrient-rich seed cake may be given back to the farmers as fertilizer. The quality standards for soy bean, rapeseed, and sunflower oils are exceeded by jatropha seed biodiesel. The development of demonstration transesterification plants is underway, but little is known about the economics of commercial jatropha cultivation.

Peanut Oil

11% of the remaining tropical forests on earth are found in Southeast Asia, and the planting and harvesting of palm oil has recently increased dramatically. In addition to being a biofuel, palm oil is also useful as a cooking oil, a food ingredient, a lubricant for machinery, and a cosmetic. There are now 21 million tons produced annually, and by 2010 there will be more than 30 million. India and China are the two biggest users, largely utilizing it for cooking, whereas Indonesia and Malaysia are the two biggest producers. The orangutan's survival is under jeopardy due to the logging of virgin forest in Indonesia, notably Borneo, and its replacement with palm oil plantations. To balance things out, money from the palm oil industry might be used to create private

nature reserves, preserve forest ecosystems, and save threatened and endangered species. Primary forests make up around 25% of Indonesia and 11% of Malaysia, with protective covenants covering 20% of Indonesia's and 10% of Malaysia's total forested areas. Nongovernmental groups may buy palm oil plantations, pay off the acquisition expenses in roughly six years, and then direct following revenues into buying forest for private reserves. This is one strategy for enhancing land protection. These private reserves may save endemic species while also giving the neighborhood's residents work in ecotourism or selective resource extraction. Plantations that employ damaged land will be certified by the Roundtable for Sustainable Palm Oil, which will also promote best practices for harvests that are sustainable.

By releasing 17 to 420 times more CO2 than the annual GHG reductions these biofuels provide by replacing fossil fuels, the conversion of rainforests, peatlands, savannas, or grasslands to produce food-based biofuels creates a biofuel carbon debt. In contrast, biofuels made from waste biomass or from biomass grown on abandoned agricultural lands planted with perennials incur little to no carbon debt and offer immediate and sustainable energy.

Ethanol

In the United States, where we generated 5.4 billion gallons of ethanol in 2008, ethanol is the de facto biofuel. The Midwest is the region with the most ethanol production facilities, and corn is used as the main feedstock. Due to its increased sugar content, sugar cane makes ethanol 10 times more effectively than maize. Brazil generates 4 billion gallons of gasohol per year, which contains 23% ethanol. This may cut 26 million tons of CO2 from the atmosphere. Biodiesel decreases CO2 by 41%, compared to ethanol's 12% reduction6. By 2022, the Energy Act sets a target of 36 billion gallons of ethanol, 15 billion of which must be produced from maize by 2015. 16 billion gallons of cellulosic biofuels and 5 billion gallons of other renewable fuels, such biodiesel, are expected to be produced annually. A powerful Midwest lobby favors using corn as the feedstock for ethanol production, while high import tariffs prevent the use of Brazilian sugar cane as a feedstock in order to safeguard the U.S. sugar industry's more modest size. Although there aren't many or any ethanol refineries in Louisiana, Florida, northwestern Minnesota, or California, these states are home to the nation's sugar beet and sugar cane industries.

It takes a lot of energy to fertilize, harvest, and refine maize into fuel, and most of the plant's biomass, principally cellulose, is lost during the sugar conversion process. The most appropriate use of ethanol would be as an oxygenate at 10%–20% since lead has been removed from gasoline and methyl tert-butyl ether, the original oxygenate, was found to contaminate ground water after leaking from underground gasoline storage tanks. However, switching all U.S. corn and soybean to ethanol and biodiesel would only offset 12% of U.S. gasoline and 6% of diesel. Around one-third of the entire farmland now used for cereal, oilseed, and sugar crops would need to be converted to biofuels in order to replace 10% of the country's motor fuel. The most effective kind of cellulosic ethanol is made from switch grass or agricultural waste. This might provide as much as half of the 135 billion gallons of gasoline that the US uses annually [7].

When one factors in land clearing, farming, and other costs, the debt repayment for biofuels varies greatly: the best biofuel is Brazilian sugarcane, which can be harvested in 17 years, followed by corn grown on fallow land, which can be harvested in 48 years, and palm oil, which is grown in tropical peatlands, which can be harvested in 420 years. Most of these calculations indicate that preserving and restoring forests, rather than switching to biofuels, is the best way to reduce carbon emissions.7 In order to replace 10% of gasoline and diesel with biofuels, it is estimated that the

United States and Europe would need 43% and 38% of their current cropland, respectively. In order to calculate the emissions caused by land use change, Searchinger and colleagues used a global agricultural model. They discovered that, instead of producing a 20% savings, corn-based ethanol nearly doubles GHG emissions over thirty years and increases GHG for 167 years.8 Switchgrass biofuels, if grown on U.S. corn lands, increase emissions by 50%. Miscanthus x giganteus, a sterile hybrid grass, can convert 1% of solar energy into biomass that can be collected and used to produce cellulosic ethanol. On the same area of land, switchgrass may produce three times as much harvestable biomass, exceeding the typical 0.1% efficiency claimed for plants by a factor of ten. In addition to switchgrass monocultures, mixes of up to fifteen prairie grasses have also shown such large increases in biomass. As a boost to this business, the 2007 Energy Act mandates that refiners produce an estimated 61 billion liters of cellulosic biofuels by 2022.

The United States has a 54 cents per gallon tariff on imported ethanol and a 51 cents per gallon tax allowance for blenders that combine ethanol with gasoline, both of which mainly serve to keep cheap Brazilian ethanol made from sugar cane out of the nation. E85, a commercial fuel that is 85% ethanol and 15% gasoline, is the product that advertises ethanol biofuel. Of of the 169,000 gas stations in the country, E85 is offered at 850. The fact that an E85 storage tank costs $200,000 in capital expenditures and only provides three-fourths the energy of gasoline are two factors contributing to its lack of popularity.

Nuclear

20% of the power in the US is generated by nuclear energy. There are 104 nuclear energy facilities that are now in operation, and 27 more are being considered. There are 439 nuclear reactors in the globe, each having a 370 gigawatt capacity, and between 2011 and 2030, 20–30% of these reactors will be shut down. More than 80% of the nuclear industry in the United States was established before to 1990, and 25% were constructed in the 1960s and 1970s. Thirty nuclear facilities are being built, 19 of which are in Asia, 6 in Russia, 5 in Europe, and 0 in the United States. The majority of the technologies used are pressurized water reactors, which produce steam to power turbines. These are light water reactors that use regular water to cool the reactor and slow neutrons. The fuel is uranium, but 99% of it is not consumed, and long-lived nuclear wastes like plutonium, americium, and curium are created. These wastes need to be isolated by geology. Nuclear progress may be accelerated by new technologies [8], [9].

In order to keep neutrons moving quickly, integrated fast reactors have been developed and tested at U.S. national labs. These reactors can burn nuclear waste as well as extra weapons-grade uranium and plutonium to produce electricity. Integral refers to the fact that all fuel reprocessing takes place within the reactor building. The Liquid-Fluoride Thorium Reactor is an alternative design that employs a chemically stable fluoride salt as the medium for nuclear reactions. IFR and LFTR both operate at lower pressures than LWR and have 100–300 times greater fuel efficiency. The pebble bed reactor, commonly known as a high-temperature gas reactor, is a graphite-moderated, gas-cooled nuclear reactor. Tennis ball-sized pebbles known as PBRs are constructed of pyrolytic graphite that contains thousands of fuel particles made of fissile 235U and are covered in SiC to provide structural stability. The PBR uses 360,000 pebbles to generate a reactor, which is cooled using an inert gas such helium, nitrogen, or CO2. Breeder reactors may produce more fuel than they use by converting uranium isotopes that are not inherently suitable for energy generation into plutonium. With breeder reactors, every kilogram of naturally occurring uranium that is put in might yield 60 times more energy.

DISCUSSION

Accidents, radioactive waste, terrorist attacks, and financial concerns are all actual dangers associated with nuclear power. To lessen this danger, there is federal insurance available. The Price-Anderson Nuclear Industry Indemnity Act protects the public from harm while partly insuring the nuclear industry against liability claims resulting from nuclear mishaps. Operator licenses for nuclear power plants are given by the Nuclear Regulatory Commission. For energy businesses prepared to construct nuclear power plants, cellulosic ethanol plants, coal sequestration facilities, or other low-polluting technologies, the 2005 Energy Policy Act gives loan guarantees of up to 80%. Pennsylvania saw the three Mile Island nuclear catastrophe in 1979. Any building of additional plants has been put on hold because of a core meltdown at one of its reactors and the political fallout that followed. For this accident, Price-Anderson awarded payouts of $70,000,000. Years were needed to disassemble the partly melted core, load radioactive waste into containment containers, and transport everything to storage facilities in Idaho.

The severely polluted towns of Pripyat and Chernobyl were abandoned as a result of the far worse catastrophe at the Chernobyl reactor in the Ukraine in 1986, which claimed the lives of more than fifty people. A reactor 4 explosion and failed safety test released 6.7 tons of radioactive isotopes over 200,000 kilometers of Europe. Above the damaged reactor, a sarcophagus was built, and 3,500 people are working to stop any further emissions. To disassemble the reactor, engineers plan to build a containment arch, which will be the biggest transportable structure in the world and take until 2065 to entirely disassemble the sarcophagus and sections of the reactor. Those who were youngsters at the time of the catastrophe and resided in polluted regions of the former Soviet Union have been diagnosed with more than 5,000 instances of thyroid cancer. This is 10 times more than anticipated, and the majority of cases were brought on by consuming radioiodine-tainted milk. After nuclear accidents, a public health approach that involves giving out potassium iodide, keeping indoors, and prohibiting the sale of food and milk close to the facility is important.

On March 11, 2011, a 9.1-magnitude earthquake and a tsunami wreaked havoc on 200 miles of coastal communities in northeastern Japan, including Sendai. Almost 20,000 persons were reported missing or lost. The Fukushima Daiichi nuclear power station, which has six reactors, sustained significant damage, including fractures in multiple reactors' containment vessels. Moreover, floods on the bottom level flooded the diesel engine backup for the pumps that circulate the cooling water. The nuclear rods eventually overheated due to the consequent lack of cooling water, which led to hydrogen gas buildups that erupted in many reactors. To keep the reactors cold, sea water was poured into them and directed there. Within a 15-mile radius, everyone was evacuated, and many more were instructed to remain in their houses. Cesium-137, which has a half-life of thirty years, and iodine-131 have both been found, pointing to a partial meltdown. New technologies are being developed in the United States, such as sealed pumps that need no maintenance for 60 years and passive gravity or convection to bypass valves and improve the safety of water cooling.

It is anticipated that the distant Nevada desert Yucca Mountain nuclear waste storage facility would open in 2017. In power plants all around the country, 56 000 tons of highly radioactive waste have already accumulated. A set of three previously recognized prospective disposal sites was narrowed down to Yucca Mountain in 1987 by Congress, who did so by amending the Nuclear Waste Policy Act of 1982. Before choosing a finalist, a thorough examination of each of the three sites was required under the 1982 statute. The U.S. courts have gotten engaged as well. Court of Appeals for Washington, D.C. Court decided in 2004 that the EPA should update its Yucca Mountain guideline for allowable radioactive leaks to the environment to include a time span extending from tens of

thousands to a million years. Computer simulations of all the geochemical, hydrogeologic, and other geologic processes that are thought to interact to control the release of radionuclides into the environment over the next many tens of thousands of years have been created in order to show compliance. In solidified volcanic strata 300 meters above the water table, the Yucca Mountain site will be built, providing a natural environment that makes it easier to retrieve and monitor high-level wastes. While the present storage at nuclear reactors is sufficient for a century's worth of use, the Obama administration is recommending finding a new location. France, in contrast, has chosen to reprocess nuclear waste since spent fuel rods still contain 95% uranium and 1% plutonium, both of which may be processed again and enriched for use as fuel. Reprocessing plutonium poses a risk since it might be used as nuclear weapon fuel. Using the money obtained from nuclear utilities to hasten the construction of fast and thorium reactors is an alternative to the Yucca Mountain Repository.

Health risks associated with uranium mining include roof collapses underground, accidents involving the transportation of heavy machinery, and cancer and lung ailments brought on by dust. Silicosis, a pneumoconiosis brought on by inhaling silica-containing dusts, is one of the lung conditions brought on by dust. Alveolar macrophages phagocytose silica, which they then activate to generate harmful reactive oxygen species, fibrous growth factors, cytokines, and chemokines. Acute silicosis, which is characterized by fast progression, has been linked to very high exposures to fine-particle dust. Uranium miners inhaled radon gas containing alpha particles that released high energy for the bronchial epithelium, leading to an increased risk of lung cancer. Advanced silicosis is caused by heavy dust exposures, typically over many decades. It is also known as "complicated pneumoconiosis" or "progressive massive fibrosis." There was a synergistic interaction between smoking and radon daughters early in the development of underground uranium mining with poor ventilation, with mostly small cell lung cancer arising. The first International Thermonuclear Fusion Project at Cadarche, France, with subcontracts to Japan and other producing nations, is scheduled to be online in 2015. Nuclear fusion is an experimental process. The first fusion experiment to produce more energy than it consumes will be this one. The $500 Megawatt facility will cost $9 billion. Hot plasma used in fusion is constrained by superconducting magnets into the form of a floating doughnut.

Wind

The prospects for wind as a source of clean, renewable energy are highly positive. Advanced wind turbines have a rotating output of 3 MW. The energy produced by a 1.5 MW wind turbine can power around 500 dwellings. In the Great Plains, installing 100,000 MW of wind turbines might cost 5.4 cents/kWh, or approximately the same as coal. According to the American Wind Energy Association, the potential for wind-generated power is 10 trillion kWh, which is double the amount of electricity now produced in the US. In the United States, there are now 40,181 MW available, and 5,116 MW were installed in 2010. Second only to natural gas in the United States during the previous four years, wind energy made up 35% of all energy installed. More than 20% of the installed wind power in the globe comes from the United States.

Since there is no direct current transmission from the Great Plains to the east coast, it is challenging to increase the usage of wind energy. By 2020, the United States must generate 5% of its power from wind, which will cost $60 billion in investment, including $1.2 billion for farmer leases. Despite this, the wind energy sector is expected to generate 80,000 employment. An annual lease for property with a wind turbine costs around $2,000 on average. Today, 300,000 MW of wind energy projects are being considered, but they are unable to proceed owing to a lack of available

transmission infrastructure for this power. This quantity of wind energy would provide 20% of the country's electricity requirements. Since wind energy is intermittent, it is more difficult to use transmission lines to their maximum capacity. In regard to coastal projects, such as the abandoned 140 MW wind farm off Jones Beach, New York, there is also the issue of the "Not in My Backyard" attitude. 130 wind turbines would be part of the Cape Wind in Nantucket Sound, which would generate 420 MW of renewable energy and cut annual greenhouse gas emissions by 734,000 tons. Interior Secretary Ken Salazar authorized the $2 billion Cape Wind project after hearing objections from locals about losing their views and the Aquinnah Wampanoag Tribe on Martha's Vineyard about the project interfering with cultural rites. Wind power growth and the nation's energy dilemma might be greatly aided by resolving siting concerns. With 41,800 MW at the end of 2010, China is the world's leader in the development of wind power. The European Union is governed by Germany and Spain. Ireland and Denmark were among the first countries in Europe to install wind energy, but their electrical systems were unable to handle the sudden spikes in demand; at the moment, Denmark exports its wind energy to Norway and Sweden. By pumping subsurface water into upstream reservoirs, Norway and Sweden are able to generate additional electricity.

As wind turbines typically only produce 20% of their capacity, the necessity for backup energy sources is another crucial factor to take into account when using wind energy. Around 40,000 American birds each year are killed by wind turbines, which is a far smaller number than the millions killed by domestic cats. Windmills have also killed migratory bats, which has sparked an increase in studies to understand migratory bats. Since the industry's founding in 1992, the federal tax credit for the generation of renewable energy has served as its main driver. Nevertheless, the tax credit has been periodically renewed for one or two years. A strategy that establishes firm goals for renewable energy in the short and long term to diversify the power supply, lower pollution, and advance the wind and solar businesses is known as a renewable electricity standard or a renewable portfolio standard. Seven states have renewable energy targets, and 29 states have renewable power requirements as of 2011, however there is no federal renewable portfolio standard.

Geothermal and hydroelectric electricity

Geothermal Power

With 46 power facilities spread over seven locations in California, including the 1,000 MW Geysers, geothermal energy generates 2,800 MW. This contributes 0.3% of the country's power but 17% of its renewable energy. The present plants stop the emission of 22 million tons of CO2. When 300°F rock is present, geothermal energy may be harnessed by drilling three or more miles under the surface and then forcing high water pressures through exposed rock fissures. Next, injection wells are dug to pump water through the artificial reservoir and draw steam up to the surface to power electric turbines. Over 2,000 times as much power as the US now uses annually could be produced from only 2% of the geothermal resource base; for instance, 100,000 MW of energy could be produced in 50 years. According to estimates from the U.S. Geologic Survey, geothermal areas dispersed throughout thirteen states are capable of continuously producing 9,000 MW of power. Hydro-fracking would need to be tested to make sure it doesn't cause any of the envisioned geo-thermal energy to be released as local earth tremors. Demonstrating the commercial viability of geo-thermal plants would need venture money and government collaboration; undoubtedly, this would cut CO2 emissions.

By employing closed circuits and liquids with lower boiling temperatures, geothermal power may now be harvested at lower temperatures than are necessary to boil water. For instance, Chena Hot

Springs in Alaska, which is 65 miles from the power grid, utilizes a geothermal closed circuit to produce 500 kilowatts of geothermal energy each day to heat the resort's 44 buildings, operate a greenhouse, and power a café built of carved ice. 21 geothermal research projects received cost-sharing funds totaling $43 million from the DOE in October 2008. Around the same time, the Department of the Interior started the process of allowing geothermal production on 200 million acres of federal lands. Several of these projects have been put on hold as a result of potential earthquakes and earth tremors brought on by deep drilling close to tectonic plates. It is necessary to do further investigation on this possible negative.

Hydropower

According to the World Energy Council, there are 45,000 major dams with a combined producing capacity of 800 gigawatts, and they now provide one-fifth of the power used globally. With a total capacity of 18 gigawatts, the Three Gorges Dam in China is capable of producing twice as much energy as all the solar cells combined. Over 1.8 gigawatts of energy may be generated by the Hoover Dam in the United States on the Colorado River. Almost 160 nations utilize hydropower in some capacity. More than half of the hydropower used in the globe is now produced in Brazil, Canada, China, Russia, and the United States. 75% of Europe's practicable hydropower has been used, whereas Africa and Asia still have significant untapped potential.

While there are negative environmental repercussions, millions of people have had to migrate in China and India over the last several decades due to floods caused by dams upstream. Dams hinder fish migration and have an impact on the ecology both upstream and downstream. Sediment accumulation may make dams less functional and prevent downstream communities from receiving sediment. Methane and carbon dioxide are released as biomass breaks down in reservoirs. Due to changes in the volume and timing of yearly flow from sources like the Tibetan glaciers, climate change may itself be able to reduce certain dams' capacity. In order to safeguard these critically endangered species of salmon and enable them to breed, it is now planned to decommission dams on the Klamath and Columbia rivers. Hydropower is already being used to its fullest potential in the United States.

Loss of natural rivers, flooding of picturesque places like Lake Powell in southern Utah's Red Rock Country, or towns and cultural landmarks like the Three Gorges on the Yangtze River in China, as well as impacts on migrating spawning salmon, are all negative consequences of hydropower. Water levels must be sufficient for hydropower to function. In this sense, Northern Canada has lost some outstanding wildness. Nelson River was dammed by Manitoba Hydro to provide Winnipeg with electricity. But in order to accommodate future expansion, they later dammed the Churchill River at Southern Indian Lake, turning the lake into a reservoir and draining it in a southerly direction to the Nelson River to boost the Nelson River Hydroelectric Project's supply of water. The fiercest rapids on the North American Continent were eliminated when the bottom 500 miles of the Churchill River largely dried up.

The East Main and Great Whale rivers, which originally served as untamed canoe routes from Quebec's interior to the coast, were dammed by Quebec Hydro in a similar manner on the opposite side of Hudson Bay. With the loss of their traditional hunting grounds and a significant portion of their local culture, the Cree in Quebec and at Southern Indian Lake forced to relocate. By constructing a dam on the Bio Bio River, Chile committed the same error once again, resulting in the loss of another portion of a natural river for rafting.

Hut Lung and bioenergy

Three billion people cook their food using biomass, which accounts for 10% of the world's energy use. Branches from trees and bushes, wood, dung that is often cured on the outside walls of homes, and charcoal make up biomass. Branches burn extremely inefficiently, as does wood and manure. While coal and charcoal are more effective, all types of biomass produce a lot of smoke when burned in the simple stoves used in millions of households. It is mostly due to this why indoor air pollution is a problem across Asia, Africa, and South America. In India, 80% of home energy consumption is made up of biomass. According to the World Health Organization, indoor pollution from burning biomass is responsible for 1.6 million preventable deaths per year. The burden of illness in emerging nations places it at number four. Women, who may spend 6–8 hours a day using biomass to cook inside, and their preschool-aged kids, who were carried about in papoose-style carry-alls as newborns or toddlers, are the main casualties. Women who inhale particles develop "hut lung," which manifests as small, rounded, and irregular opacities on chest X-rays and increased chronic bronchitis with cough, phlegm, and dyspnea.9 Their children are more likely to develop lower respiratory tract infections, which are associated with higher mortality. Moreover, long-term exposure to biomass smoke may harm your genes and increase your risk of stroke and cardiovascular disease. In communities where biomass is the main source of energy, the incidence of chronic bronchitis varies from 22% in Bolivia to 8% in Guatemala to 18% in Nepal. In Bolivia and South Africa, particle counts have been recorded as up to 30,000 mg/m3 per hour. WHO predicts 9.8 million deaths from biomass burning by 2030. These women also have an elevated risk of lung cancer.

This issue may be solved by converting to propane or kerosene or by purchasing efficient cooktops for around $25. By 2020, the Global Alliance for Clean Cookstoves, a public-private collaboration supported by the UN Foundation, aims to provide clean cookstoves to 100 million people. In September 2010 at the UN Foundation, Secretary of State Hillary Rodham Clinton said, "Now we can finally picture a future in which open flames and filthy stoves are replaced with clean, efficient, and economical stoves and fuels all around the world stoves that still cost as little as $25." Millions of lives might be improved and saved by updating these filthy stoves. The National Institutes of Health and Centers for Disease Control, the U.S. Department of State, the U.S. Department of Health and Human Services, the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the U.S. With a financial commitment of $50.82 million over the next five years, Agency for International Development will deploy top expertise, significant financial resources, and research and development capabilities to assist the alliance.

Black carbon, which absorbs all visible light spectrums, is produced by burning biomass, fuel, and other materials outdoors. Its impact on global warming is over a million times greater than that of CO2. Sulfate and organic carbon, on the other hand, reflect light and significantly reduce the warming impact of black carbon. Black carbon is emitted by developing nations at a rate of 77%, whereas diesel is emitted by North America and Europe and accumulates on Greenland and Arctic ice, respectively. From 1989 to 2008, black carbon emissions decreased by 50%, according to the 22 California black carbon monitoring sites. This most likely reflects diesel emissions regulations. California is spending $2.2 billion over the period of 2012 to 2025 to upgrade its pre-2007 diesel heavy-duty vehicles and buses.

Solar

As of 2007, solar energy generated 8,775 MW, and this number is anticipated to rise sharply in the near future. Government initiatives like research and incentives have a significant impact on the installation of solar energy. In 2012, solar panels will be a standard feature for new house owners in California. For solar panels, the federal government offers homeowners a $2,000 tax credit, and additional benefits are available at the state level but only for main homes. Recent remarkable policy-driven development in the form of financial refunds has benefitted the solar business. For instance, shipments of photovoltaic modules surged twelvefold from 1999 to 2006 as a result of these policy-driven growth incentives. The business would greatly benefit from additional stimulus that would include second houses or holiday homes.

High-purity polycrystalline-grade silicon, the primary raw material used to create photovoltaic solar cells, is one of the supply bottlenecks for solar energy; current refineries have limited capacity, and rapid expansion may be followed by harsh downturns that force conservative business planning. Other solar energy conversion methods are becoming more popular as a result of the lack of polysilicon, most notably thin films formed of amorphous silicon and/or materials like gallium arsenide, cadmium telluride, copper indium diselenide, and copper indium gallium diselenide. President Carter, who thought highly of the United States, founded the Solar Energy Research Institute. Energy Crisis was described as the "moral equivalent of war," and SERI received a $100 million budget with the hiring of 1,000 experts. Under President Ronald Reagan, this was downsized to $30 million and 435 scientists, and reformed as the National Renewable Energy Laboratory. In 1979, the government budget for total energy research and development was $7.7 billion; by 2008, it had dropped to $3 billion.

Entrepreneurs from Silicon Valley have joined the photovoltaic panel sector to develop innovative strategies for using solar energy. On top of its Mountain View, California, headquarters, Google constructed a 1.6 Megawatt solar plant. By investing in cutting-edge batteries for plug-in hybrid cars that would harness this green power surge, Google is attempting to build a market for solar and wind power that runs on windy and bright days. This program is known by Google as "REC," which stands for "renewable energy more affordable than coal." Particularly in the deserts of southern California, concentrated solar electricity, such that produced by the parabolic trough, could be cost-competitive with other energy sources. Saharan solar thermal power projects that can provide electricity to Europe are being considered. Solar thermal power generates electricity by using solar energy that has been captured and stored in a specific fluid that retains heat [10].

CONCLUSION

The potential and implications of reducing climate change will be assessed from the viewpoint of the business sector; for instance, the investment company Alliance Bernstein, which manages more than $800 billion in institutional assets, examined strategic shift in relation to climate by 2030. In 2010, 150 stationary sources produced as much carbon dioxide (CO2) as all of the world's automobiles combined, making up 8,000 sources that produced 45% of total CO2 emissions. Geographically, these sources were mostly in the United States, Europe, China, South Africa, and Japan. According to Alliance Bernstein, owners of enterprises and power plants will spend around $5 trillion by 2030 to decrease CO2. Increasing the motor efficiency of cars, industrial motor systems, and major consumer appliances like refrigerators and washing machines will cost additional billions of dollars. They predicted a decrease in CO2 emissions to 26 million metric tons and assessed an increase in power consumption from 18 trillion kilowatt hours to 30 trillion

at a conservative annual growth rate of 2.2%. Since 1971, the average annual increase in the world's demand for electricity has been 3.6%, more than twice the 1.7% increase in demand for all energy sources combined. They forecast a 40% rise in coal use, a nearly tripling of nuclear power, a doubling of renewable energy, and a marginal growth in natural gas. If atmospheric CO2 levels are to climb no higher than 450 ppm, CO2 from fossil fuel production, particularly coal power, must be captured and stored. New industries will be developed via the capture, compression, and transportation of CO2 from coal and natural gas power plants as well as certain companies. Depleted oil and gas areas with geological potential for CO2 storage will benefit.

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CHAPTER 17

A STUDY ON CLIMATE CHANGE POLICY OPTIONS

Gandharve Kumar, Assistant Professor
Department of Mechanical Engineering, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email id-gandharv.tmu@gmail.com

ABSTRACT:

Long-term changes in temperature and weather patterns are referred to as climate change. These changes might be caused by natural processes, such oscillations in the solar cycle. Climate change has mostly been caused by human actions, particularly the combustion of fossil fuels like coal, oil, and gas. In this chapter author is discusses the efforts to prevent climate change.

KEYWORDS:

Climate, Credit, Environment, Government, Pollution.

INTRODUCTION

We will need a majority of the public's opinion in order to implement a national "cap and trade" scheme to regulate CO2 emissions. Government-driven cap and trade programs have a maximum ceiling on greenhouse gas emissions that gradually decreases over time. Polluting sources that are subject to regulation must obtain licenses permitting restrictions on their GHG emissions in order to comply with these limits. As these permit levels decrease over time, the polluter must make plans to minimize GHG emissions, such as shutting down an outdated facility or installing pollution controls. The requirement gives the polluter the freedom to choose the safeguards and technological tools that rely on the free market [1], [2].

While executive regulatory action may be taken in accordance with an administration's objectives, public support for carbon restrictions is important for legislative action. In this regard, the Obama administration has made it clear that it prefers congressional action to control GHG and advance strategies for renewable energy sources, but in the absence of such action, it will allow the Environmental Protection Agency to proceed with its regulatory actions to reduce CO2. In addition, Vice President Al Gore testified before a joint House Energy and Commerce Committee and Senate Environment and Public Works Committee stating that we needed to freeze CO2 emissions, use the tax code to help renewables and tax polluters, and assist low-income groups. His book An Inconvenient Truth was made into a movie that won Oscars in 2007 for Best Documentary and Best Song for its theme, "I Need to Wake Up."

Regarding the human cause of climate change and the degree of scientific consensus supporting it, the American people shows strong skepticism. In June 2010, Anderegg and colleagues published in the Proceedings of the National Academy of Sciences an extensive dataset of 1,372 climate researchers and about there publications and citation data showing that 97%-98% of the climate researchers most active in publishing in climate science support the principles of anthropogenic climate change outlined by the Intergovernmental Panel on Climate Change, and the relative scientific prominence and expertise of climate deniers were shown to be lower. The public is being

subjected to a multifaceted disinformation campaign that has been funded by some in the fossil fuels industry through "think tanks," "political action committees," and "balanced" media coverage of scientists who are not persuaded by the scientific evidence as well as those who are [3], [4].

Global Climate Change Prevention Efforts

Climate Pact of Kyoto

The United States and 170 other countries agreed to reduce greenhouse emissions to 1990 levels by the year 2000 at the Rio de Janeiro Earth Summit in 1992. This was one of the earliest attempts at a worldwide agreement to take the impacts of greenhouse gases into account. George H. W. Bush, the president, was present. The Kyoto Protocol was discussed with the US in 1997. Vice President Al Gore was there, and thanks to his influence, a consensual accord was reached. There were three points of contention: the required quantity and types of greenhouse gas reductions, the inclusion of developing nations in the GHG reduction requirements, and the decision to incorporate carbon trading and cooperative implementation. On December 11, 1997, the Kyoto Protocol to the United Nations Framework Convention on Climate Change was ratified. For the years 2008 to 2012, the United States was to reduce CO2 by 7% below 1990 levels. The European Union had an 8% cut, whereas Canada, Japan, and Poland agreed to a 6% reduction. 38 countries had decreases, while underdeveloped countries merely had to voluntarily establish limitations.

The Kyoto Protocol aimed to increase energy efficiency, safeguard carbon dioxide (GHG) sinks and afforestation, support sustainable agricultural practices, advance research on renewable energy sources and CO2 sequestration, phase out subsidies for GHG-emitting industries, promote GHG emission reduction reforms, and cap CH4 emissions from waste management. In 1990, databases were to be set up to calculate carbon stocks and build sinks using data from forestry and agriculture. Yearly progress reports that included a calculation of total CO2 emissions were needed. The protocol was signed by 82 nations, including the United States, and was approved by 142 legislatures by February 16, 2005, the day the Kyoto Climate Treaty came into force. 187 countries have ratified the treaty as of 2009. 64% of the emissions in 1990 came from the nations setting objectives in 2005.4 The Byrd-Hagel Resolution in the U.S. Before the United States would sign the pact, the Senate demanded that poor nations must be included, and this was supported by 95 senators. Since it would fall short of the required two-thirds majority, the Senate has not been asked to ratify the Kyoto Protocol.

As they are regarded as developing nations, China, India, Brazil, and other emerging nations already produce half of the world's greenhouse gas emissions and are thus exempt from Kyoto reduction requirements. Compared to a CO2-only strategy, a multi-gas approach could significantly lower the costs of fulfilling the Kyoto Protocol's requirements, making it more agreeable to conservative U.S. senators.5 Including sinks and abatement opportunities for gases other than CO2 could cut the cost of complying with Kyoto requirements by 60%. Australia was the only other Western nation that did not join the pact, but after a change of administration, it did so right away, leaving just the United States to do so. With a 9% provision for reforestation, the United States would need to cut carbon emissions by 550 million tons below the reference number.

Environmental Change and the European Union

In 2005, the European Union implemented a compulsory carbon trading mechanism. Companies with a surplus of emissions might sell credits to corporations with a carbon appetite. With the clean development mechanism, rich nations received credits to support reforestation or alternative

energy projects in developing nations. By 2012, 4,000 CDM projects that are either underway or in the works may save 2.2 billion tons of carbon dioxide, which is seven times the amount of CO2 the EU has to cut by that time. The joint implementation method, which also known as CDM, is another option for financing green initiatives in Central and Eastern European industrialized nations. Coastal locations with exposure to rising sea levels, exposure to the urban heat island effect, high levels of indoor and outdoor pollution, high population density, and poor sanitation are all factors that will contribute to a significant lack of equity in environmental health in developing-country cities.6 Laggards were Japan and Canada. Canada is the first country to acknowledge that it won't reach the 2012 goal. Russia and Ukraine both have carbon credits for sale. Governments who don't meet their objectives would lose access to the carbon market and be required to make up the difference in addition to a 30% fine during the second commitment term after 2012. In Copenhagen in 2009, discussions to create a post-Kyoto Treaty started in earnest. The CDM Adaptation Fund, carbon markets, and compliance procedures are permanent components of the Kyoto Protocol.

COP15 in Copenhagen

The UN Framework Convention on Climate Change's fifteenth Conference of Parties took place in Copenhagen in 2009. To negotiate a new climate accord, 195 parties came together. Two-thirds of the biggest emitting countries the United States, China, India, and Brazil are not covered by Kyoto when its second phase begins in 2013, necessitating quick action. Important concerns become more pressing as the globe descended into a severe recession in 2008. China, India, and Brazil were instructed to limit their emissions, and the group of seventy-seven developing countries negotiated for financing to address their climate catastrophe. Large industrialized nations were also pressured to decrease emissions. The European Union committed just 20% with a chance of 30%, and the United States gave only 3%-4%, while the Group of 77 called for a 40% reduction in emissions by major industrialized countries, using 1990 as a baseline. Legislative legislation requiring a 17% reduction by 2020 from a 2005 baseline and an 80% reduction by 2050 from the Waxman-Markey bill restrained the United States. In order to address the effects of global warming and develop green energy, coming from both private and public sources, starting in 2020, the commitment to the poorer countries was only $10 billion per year for three years. However, Secretary of State Hillary Clinton increased this commitment to $100 billion per year, given that meaningful reductions in emissions committed to could be measured, reported, and verified in a transparent manner.

Developing nations maintained that since they did not contribute to climate change and lack the means to address it, they must address social concerns like poverty reduction right now and should get assistance with mitigation measures. Reducing emissions from deforestation and degradation via a program might result in carbon credits. Although oil-producing governments tried to prolong talks and pursue less ambitious initiatives, the Least Developed Countries and Association of Small Island Developing States urged rapid action and postponed the discussions for several days, wasting crucial time. The most challenging difficulties, particularly for China, were those involving measurements, cut verification, and the legal framework.

The summit's closing days were attended by President Barack Obama, Secretaries Hillary Clinton, Steven Chu, Alphonso Jackson, Tom Vilsak, and Ken Salazar, as well as several other American dignitaries and officials from other nations. In his opening comments, President Obama stressed mitigation, openness, and funding as the simple recipe for agreement. Secretary Chu spoke about Climate REDI, a $350 million initiative that would accelerate the development of technologies to

cut emissions by helping low-income nations buy high-efficiency appliances and LED lanterns. China vowed to lower its carbon intensity by 45% going ahead, Brazil promised to cut its deforestation-related emissions by 80%, and India offered to cut its carbon intensity emissions by 25%. China's emissions will surpass those of the United States by 40% by 2020. President Obama struck a political pact with China, Brazil, India, and South Africa in the last hours of Copenhagen to pursue each country's particular aims to exacerbate climate change. The delegates had envisioned a non-binding international agreement with clear short- and long-term goals. It did call for hundreds of billions of dollars to be transferred from wealthier countries to those that are most susceptible to climate change, and it did provide a mechanism for tracking and reporting progress toward national pollution reduction objectives. By 2050, it aimed to keep the increase in world temperature to 2°C. President Obama described this as simply a hesitant beginning of a long journey; many delegates were quite dissatisfied with the scanty result. This first phase would be further discussed in Cancun in November 2010 since the agreement won't take effect until 2015. The participants at Cancun mostly agreed on goals for preserving forests and continuing to pursue sustainable energy sources.

State, City, and Private Actions on Global Warming

State and Regional Actions

State and local governments have a chance to take action on decreasing GHG emissions since the George W. Bush administration suggested a voluntary initiative to cut CO2 emissions by 18% by 2012. The provinces, towns, and regional governments stepped in to fill this leadership void at the federal level. The CO2 from autos is regulated in eleven states. 30% of the vehicle market is made up of these states. California approved SB 1493 in 2002, requiring new cars sold after 2009 to reduce their CO2 emissions by 30% by the year 2016. Due to the fact that CAFE is a component of the National Energy and Conservation Act, which does not provide California any special status, auto industry executives claim that this was a backdoor CAFE regulation and have sued California. California was denied the power to control CO2 on December 20, 1997, by the EPA, who claimed that a national solution was necessary; this decision was overturned by the Obama administration [5].

A mandate that 10%–20% of power originate from renewable sources has been implemented by 18 states. They included wind, sun, biomass, hydroelectricity, and geothermal as examples of renewable energy. By 2020, California and Minnesota will want 25%. The California Global Warming Solutions Act establishes CO2 limitations for all significant industries, calls for a reduction of GHG emissions of 25% by 2020, and imposes fines for disobedience. A New Mexico executive order was issued by Governor Bill Richardson to decrease CO2 by 10% below 2000 levels by 2020 and by 75% by 2050. Arnold Schwarzenegger, the governor of California, issued executive orders committing to reduce GHG emissions by 80% by 2050 from 1990 levels and to 2000 levels by 2010. Thirty-five million people in California provide 13% of the nation's GDP. As manufacturers prefer to develop one product for the national market rather than targeting one state, California rules and regulations often set the standard for the country.

Governments have not only collaborated with one another to fight global warming, but there have also been regional efforts by coalitions of nations to advance GHG concepts. By 2020, the Northeastern States' Regional Greenhouse Gas Initiative promises to reduce greenhouse gas emissions by 10% from 1990 levels. Connecticut, Maine, Massachusetts, New Hampshire, Delaware, Rhode Island, Vermont, New Jersey, Maryland, and New York are among the states that

provide 10.7% of the nation's emissions. The Kyoto clean development mechanism-certified projects' offset credits may be purchased via this regional greenhouse gas initiative. The governors of California, Arizona, Washington, New Mexico, and Oregon have all endorsed their own cap and trade programs as part of the Western Regional Climate Action Initiative. The caps will vary per state. They emit CO2 at a rate of 11.2%. According to Governor Schwarzenegger, this agreement demonstrated the ability of states to take the lead in tackling climate change at the federal level. Lack of enforcement measures is the main issue with regional climate change projects.

City Activities

The mayors of the United States have created their own climate protection accords. 2005 saw the U.S. The Climate Protection Accord, which meets the Kyoto Protocol's target of bringing global warming pollution down by 7% below 1990 levels by 2020, was approved by the Conference of Mayors with a unanimous vote. There are 1,183 cities from all 50 states represented at the conference. 1 049 cities have ratified the agreement as of July 2011. 140 municipalities had approved global warming resolutions before the 2008 New Hampshire primary, delivering a loud and obvious message to Congress and the White House that fast action was required to reduce global warming emissions. The vast majority of American towns have programs to promote the use of alternative fuels in their fleets and regulations to make buildings more energy-efficient. Seattle's greenhouse gas emissions have decreased by 8% since 1990, meeting its goal reduction in CO2 in 2005, according to a study on October 29, 2007. Cities are energy hogs; they produce three-fourths of the world's greenhouse gas emissions, of which 40% come from buildings. 15 cities agreed to a $5 billion program to upgrade older structures' energy efficiency during the 2007 G-8 Summit. The distribution of rooftop rain barrels in Chicago, which channel 55 million gallons of precipitation annually into Lake Michigan, and congestion charges in London are two further initiatives.

Personal Acts

Green efforts have also been led by businesses. The U.S. Green Building Council is an association of business leaders that awards points to new construction based on site planning, water conservation, energy efficiency, building materials, interior environmental quality, and design. With the development and use of broadly understood and recognized methodologies and performance standards, the Leadership in Energy and Environmental Design Green Building Rating System promotes and accelerates the adoption of sustainable green building development practices on a worldwide scale. The industry standard for high-performance green building design, construction, and operation is LEED, a third-party certification program. There are now LEED projects being worked on in 41 nations, including Canada, Brazil, Mexico, and India.

Power company actions may be influenced by private collaborations with charitable organizations. When a New York investment firm and Pacific Group, which had a former EPA administrator on its board, bought Texas' TXU Energy, which had planned to build eleven pulverized coal power plants, they contacted the Natural Resources Defense Council and Environmental Defense to negotiate a $400 million renewable energy investment and to build only three modern coal-fired power plants instead. Many financial institutions, such as Citigroup and Bank of America, have committed to linking GHG emissions to the loan application process for power plants and other GHG emitters.

The U.S. was established by the Pew Center on Climate Change. Alcoa, BP, Caterpillar, Duke Energy, DuPont, FPL Group, General Electric, PG&E Corporation, PNM Resources,

Environmental Defense, Natural Resources Defense Council, and World Resources Institute are just a few of the multinational corporations and nonprofits involved in the climate action partnership. The Corporate Environmental Leadership Council of Pew has 42 members. In order to limit, halt, and reverse the increase of GHG emissions during the shortest amount of time practically practicable, the U.S. Climate Action Partnership advises the adoption of national legislation in the United States. These businesses think that climate change will lead to business possibilities that call for ingenuity and efficiency as well as the emergence of new markets. Its strategy to achieving environmental objectives was market-driven, applied to the whole economy, and included a cap and trade system that set definite limitations on GHG emissions.

The EPA, greenhouse gases, and the Supreme Court When the Bush administration's EPA declined to regulate CO2 as a principal pollutant under the Clean Air Act, displeased parties took legal action. An individual who joins a nonprofit environmental organization may then have legal standing to sue, and a state's attorney general may sue on behalf of a state that is an aggrieved party for a U.S. government decision regarding federal legislation and its enforcement. Angry parties must have legal standing in order to file a lawsuit. For instance, a private citizen cannot likely claim to represent the public interest. The EPA's general council determined in 1998 that CO2 and other GHGs were air pollutants under the CAA, but during the Bush administration, the EPA overturned its decision in 2003 and has stubbornly denied having such jurisdiction ever since. The State of Massachusetts filed a lawsuit against the EPA, claiming that the agency had misread the CAA, that CO2 was in fact a main pollution, and that the EPA had the power to regulate CO2. Due to the threat posed by increased storm damage and flooding along its northern coast, Massachusetts claimed it had "standing" to file the action. This is because Boston Harbor and Cape Cod are both at danger of rising water levels [6]–[8].

The states of California, Connecticut, the District of Columbia, Illinois, Maine, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont, and Washington, as well as Samoa, participated in amicus curiae briefs. Cities like New York and Baltimore are present. Aspen Skiing Company, Environmental Defense, Friends of the Earth, Greenpeace, National Environmental Trust, National Wildlife Federation, Sierra Club, USPIRG, Union of Concerned Scientists, Center for Biological Diversity, Center for Food Safety, Conservation Law Foundation, Natural Resources Defense Council, International Center for Technological Assessment, and scientists James Hansen and Sherwood Rowland were among the additional groups. Four previous EPA administrators were also represented.

Madeleine Albright, a former U.S. The Secretary of State refuted the claim made by the EPA that if the United States cuts CO2, it has no leverage to negotiate lower emissions from other nations. A pollutant is defined by the CAA as "any air pollution agent, including any physical, chemical, biological, radioactive substance or matter which would be emitted into or otherwise enters into the ambient air." The U.S. Supreme Court sided with the plaintiffs in a 5-4 decision on April 2, 2007. Justice John Paul Stevens wrote for the majority that the petitioners had standing because Massachusetts owned a sizable portion of the territory allegedly affected, that EPA's actions were reasonable, and that the court should The Act requires the EPA to make a "judgment" before taking any action, but this "judgment" must address whether a given air pollutant causes or contributes to air pollution that may reasonably be expected to damage public health or welfare. Only if it decides that GHG do not contribute to climate change may EPA avoid promulgating rules, according to the act's explicit language.

Regulations on Automobiles in California

The Air Resources Board of California proposed a rule that would limit CO2 emissions from vehicles and trucks by reducing them by 30% by 2016. The EPA received a request for a waiver of this requirement under the Clean Air Act. The EPA, according to automakers, is the only agency with the power to control CO2, and California is not an exception. California often gets exceptions to impose stricter requirements to comply with the CAA, and sought one in 2005. However, the EPA declined this request for GHG emissions in 2008. Governor Schwarzenegger said that doing so would boost the developing green sector in his state, bring in new employment, and give Californians the automobiles they desire while lowering GHG emissions. Nevertheless, this was overturned by President Obama's EPA in June 2009. The EPA determined that California had distinct air pollution issues and that the opponents of the waiver had not sufficiently shown that the state no longer required its motor vehicle emission program or that the effects of climate change were compelling or unusual. In addition, the EPA found that California's GHG emission regulations were justified in light of the lack of applicable federal rules. Thus, the rules in California weren't arbitrary or capricious. California and thirteen other states agreed with automakers that their GHG regulations would be met if cars met President Obama's CAFE target for 2012-2016, which is 35.5 miles per gallon and was announced in 2009 [9], [10].

CONCLUSION

Sustainable development is increasingly threatened by climate change. The anticipated impacts of climate change might gravely jeopardize agriculture's capacity to feed the globe and considerably impede efforts to end hunger, malnutrition, and poverty. Regional climate changes, notably temperature increases, are having an impact on natural systems all over the globe, and it is very probable that human-caused greenhouse gas emissions are to blame for these temperature rises. It's impossible for climate change to be positive. So let's be honest, work together to solve the problem, and step up our efforts. Humans have convincingly shown that they can alter the climate during the last 200 years, and we have done so in a negative way by making the wrong decisions.

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CHAPTER 18

GLOBAL WARMING AND THE ENDANGERED SPECIES ACT

Jaivindra Singh, Assistant Professor
Department Of Mechanical Engineering, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email Id-Jainvindra321@Gmail.Com

ABSTRACT:

A species is considered endangered if it faces extinction in all or a substantial part of its range. A species is considered to be threatened when it is likely to become extinct in the near future. In this chapter author discusses the endangered species due to global warming. In a different case, the Center for Biological Diversity, the National Defense Resources Council, and Others v. Dirk Kempthorne, former secretary of the interior, the plaintiffs are suing under the Endangered Species Act and insisting that the government limit the threats posed by CO2 emissions to species like polar bears and corals. After the United States agreed to assess the condition of polar bears, this dispute was resolved in the summer of 2006. After nine months and a 90-day comment period, the U.S. Fish and Wildlife Service decided to label polar bears as "threatened." The Interior Department then published a regulation stating that CO2 could not be regulated via the back door as in this litigation using the Endangered Species Act.

KEYWORDS:

Endangered, Environment, Emission, Global Warming, Species.

INTRODUCTION

The New York Second Circuit Court of Appeals declared in September 2009 that governments and property trusts may bring legal action against power providers for CO2 emissions. Six states and three land trusts sued American Electric Power, Southern Corporation, TVA, Xcel, and Cin- ergy Corporation in 2004 for generating CO2 and harming their ecosystems and assets, which they said resulted in a "public nuisance." They produce 650 million tons of CO2 annually, about 10% of the total in the United States. The Second U.S. Circuit Court reinstated the case after finding that the plaintiffs had standing and that the interstate commerce clause of the constitution allowed for the regulation of public nuisances under the Clean Air Act. The U.S. district court had dismissed the case after finding that it was a political matter for the executive or legislative branch. The Clean Air Act and the EPA's implementation of the act supersede any federal common-law authority to seek reductions in carbon dioxide emissions from fossil fuel-fired power plants, the U.S. Supreme Court held on June 20, 2011, by a majority of 8-0 [1]–[3].

U.S. Program for Research on Global Change. The express objective of the CCSP was to link climate change research with technology development. Nevertheless, the budget was unable to fully fund all of the strategic plan's initiatives. Particularly neglected were the impacts of climate change on ecosystems and people. In order to educate state and regional decision-makers on increasing coastal sea levels, droughts, and choices about GHG reduction programs, the CCSP planned to issue synthesis and assessment reports. Independent monitoring was required for the CCSP to prevent the program from being tarnished by political pressure. Also, stakeholders need feedback on scientific reports.

The National Research Council of the National Academy of Sciences and the CCSP collaborate well and function on a ten-year time scale. A comprehensive Earth monitoring program is coordinated by CCSP and includes NASA airplanes, 30 orbiting satellites with more than 120 key sensors, ocean buoys, and terrestrial stations. The National Polar-Orbiting Operational Environmental Satellite System, which will contain weather, climate, and space weather sensors on four bus-sized satellites, is being developed by the US government to create a more permanent system.

The Obama Administration's changes

In order to integrate climate change strategies with his economic team, legislative legislation, EPA strategies, foreign diplomacy, and climate change research in the White House, President Obama appointed Carol Browner, the EPA administrator under President Bill Clinton. Moreover, the Obama EPA has said that it would publish regulations for reporting greenhouse gases for organizations that emit >25,000 tons annually, which account for close to 70% of greenhouse gas emissions in the US. According to the EPA, CO2 pollution threatens the public's health and welfare. The EPA has also said that it plans to regulate CO2 emissions under the Clean Air Act beginning in 2011. The executive agencies are used by various political parties to implement policies in very different ways. Political appointees run the executive agencies, which implement elected politicians' policies with the help of civil service staffs from either political party. When the Republican party won the 2010 midterm elections and gained control of the House, many proposals were proposed to repeal the EPA's regulation of greenhouse gases. The climate change czar position was eliminated in the 2011 budget, but President Obama stated in the language that accompanied his signature on the bill that he was committed to providing executive leadership in coordinating policy among federal agencies with jurisdiction over climate change, meaning that he would continue to have a czar position as needed [4], [5].

Act on Climate Stewardship

A climate and energy measure should be passed by Congress, according to the affected industries and environmentalists. This would provide companies and electricity utilities planning long-term investments legal and regulatory clarity. However, there are restrictions and local political considerations that limit the ability to move forward. For instance, Republicans do not want to increase business costs or taxes, oil- and gas-producing states do not want to harm their fossil fuel industries, industry subsidies are discouraged during a time of deficit spending, and Midwestern interests want to protect their interests. The 108th Congress' S was the first measure to be discussed on the Senate floor. 139 The McCain-Lieberman bill, also known as the Climate Stewardship Act of 2003. Dick Durbin, Daniel Akaka, Dianne Feinstein, Olympia Snowe, Patty Murray, Frank Lautenberg, and Bill Nelson were the bill's cosponsors.

Federal Climate Change Research was covered under Title I. With this designation, National Science Foundation fellowships would be available to research climate change under mentorship. The commerce secretary would oversee the transfer of technology from government labs to private business owners. The effect of ratifying the Kyoto Protocol on US industry was to be the subject of a report. International collaboration on scientific research and climate change mitigation would be encouraged. There would be a program of study on climate change, particularly sudden change, at the National Science Foundation. GHG measurements would be given by the National Institute of Standards.

A national GHG database and registry were established under Title II. The database would be created under the direction of the secretaries of business, energy, and agriculture. For utilities that are covered, the EPA administrator would gather GHG emissions. Reduced GHG emissions would be driven by the market under Title III. The primary organization was chosen to be the EPA. Every electrical, industrial, commercial, and petroleum-related business had to submit one tradable allowance to the EPA for every ton of GHG by the year 2010. While the trans- port was independent, it had the ability to sell credits if the average MPG surpassed By 20%, CAFE standards. A nonprofit organization without equity called a Climate Change Credit Corporation would be created. Over the years 2009 through 2016, the EPA would set up tradeable permits for 5,896 million tons of CO2 decreased by the quantity of GHG in 2000. The reductions would be applied in two stages, with a 2010 emissions limit based on the 2000 emissions from the affected facilities and a 2016 further reduction cap based on the 1990 emissions from the same facilities.

As of 2010, S. While Phase 2 would entail a decrease down to 1990 levels, 139 would still leave GHG emissions 27.7% over 1990 levels despite a 5% reduction in comparison to business as usual. If the 1990 quantity were subtracted, there would be 5,123 million tons in 2015. The U.S. Senate only passed only one legislation related to climate change. 44 senators voted in favor of it in the Senate, where it will be discussed in the fall of 2003. This was a promising start, and most observers believed that the tide had turned in favor of passage in the Congress of the following year. Before agreement is achieved and a measure passes both houses of Congress and a conference committee that irons out differences between the two chambers, it often takes many years and several hundred iterations.

The 109th Congress saw the introduction of many cap and trade legislation, including the Sanders-Boxer Bill, the New McCain-Lieberman Bill, and the Kerry-Snowe-Kennedy Bills. In that they included titles for government research, a GHG database, and a cap-and-trade system for CO2, which often used the EPA as the lead agency, they adhered to the basic design of the original McCain-Lieberman bill. The 2020 deadline was used in the Sanders-Boxer bill, the New McCain-Lieberman bill, and the Bingaman bill as a benchmark for growth restriction or a return of CO2 emissions to 1990 levels. Only Sanders-Boxer lowered emissions by 80% or more below 1990 levels by 2050, stabilizing GHG at 450 ppm.

The Sanders-Boxer bill mandated that the EPA implement global climate change standards and procedures study as well as create a competitive grant program for CO2 sequestration. According to the measure, the Senate would support funding for clean, low-carbon energy research and development, and it should increase by a factor of two per year for 10 years. Sanders-Boxer Act, S. The Secretary of Agriculture is required to establish standards for accrediting certified reductions in CO2 through biological sequestration activities. The EPA is required to receive reports on GHG emissions from major stationary sources. The EPA is also required to establish market-based programs to achieve GHG milestones reduction. Each federal agency is required to comply with these requirements.

The S. In contrast, the 280 Lieberman-McCain Climate Stewardship and Innovation Act created a business for the sale of climate change credits, through which the EPA would allocate the amount of tradable allowances for each industry. With loans for up to three integrated gasification combined cycle with sequestration, three advanced nuclear reactors, three cellulosic biomass biofuels plants, and three concentrated solar facilities, a climate technology financing board would create joint venture partnerships in the reduction of GHG. The S. In order to help the economy transition to new clean energy technologies and to protect businesses and consumers from

significant increases in energy costs, the 485 Kerry-Snowe-Kennedy Global Warming Reduction Act of 2007 would amend the Clean Air Act. It would establish a program that would cap and trade emissions of global warming pollution across the entire economy. In order to reduce CO2 emissions to 1990 levels by 2020, another 25% by 2030, and 3.5% annually between 2030 and 2050, the EPA administrator was required to issue rules. Then trade would be permitted, there would be market-based limits [6], [7].

Making compromises on climate change policy

Sen. Barbara Boxer chose a compromise measure that would have the best chance of receiving support from both parties across the board from the whole Senate as head of the Environment and Public Works Committee. She enlisted Sen. Joseph Lieberman and Sen. John Warner, two well-known conservative senators, to work on a compromise plan in order to win Republican support while retaining Democratic support. The Lieberman-Warner Climate Security Act of 2007 S was what came about. 2191. Senators Tom Harkin of Iowa, Norm Coleman of Minnesota, Elizabeth Dole, Susan Collins, Ben Cardin, Amy Klobuchar, and Charles Schumer all cosponsored the bill.

, Robert Casey, and Ron Wyden. Six gases CO2, CH4, N2O, SF6, HFC, and perfluorocarbon were included as its definition of GHG. The EPA administrator was instructed to create a GHG Registry with quarterly reporting from facilities, as well as an electronic format and uniform policies for computing carbon content and GHG emissions. CO2 emission allowances were set at 5,200 million tons in 2012, 4,912 million in 2015, 4,432 in 2020, 3,952 in 2025, and 1,560 million in 2050. By 2020 and 70% by 2050, the electric utility, transportation, and industrial sectors would each cut CO2 by 15% below 2005 levels. They make up 80% of Americans. emissions of GHG. Every plant would submit an emission allowance to the EPA. An operating permit would be contingent upon their reducing emissions. If there are excessive emissions and assessments for new projects, there would be deductions from allowances in the future. A seven-member Carbon Market Efficiency Board with supervisory responsibilities would be established. For forestry, agricultural, and CO2 sequestration projects, there would be a bonus allowance of 5%, as well as a 3% bonus allowance for international forest projects. For newly established covered industrial facilities as well as newly established covered electric power sector facilities, an emissions allowance would be set aside annually.

A climate change credit company would also be in charge of auctioning the carbon credits up to the emission allowance. There would be a climate change worker training fund and an energy assistance fund for low-income people. An adaptation money would be given to the Fish and Wildlife Service of the Department of Interior. The majority of the money would be used to implement energy technology, with 45% going to low-carbon technologies, 28% to improved coal and sequestration technologies, 7% to cellulose biomass ethanol, and 20% to high-tech cars.

The Departments of State and Defense, the EPA, and National Intelligence would be members of an Interagency Climate Change and National Security Council, which would also report on possible conflicts and how other nations are lowering their GHG emissions. Residential boilers, regional standards for space heating and air conditioning equipment, and building energy regulations would all be used to improve energy efficiency. A U.S./UN Framework Convention on Climate Change would be organized by State and the EPA in order to create legally enforceable commitments from all major GHG generating countries to contribute fairly to the reduction of GHG emissions. It would change the Safe Drinking Water Act to make it mandatory for the administrator to approve large-scale CO2 underground injection for geo-logical sequestration.

Every three years, the National Academy of Sciences would conduct a review that would include information on the extent to which emission reductions are being made, the contributions made by other nations, the anticipated degree of warming, the anticipated changes in ocean levels, the state of the science surrounding the reduction of GHG emissions, the success of the auction, and the effects on people with low and moderate incomes. The EPA would provide reports on programs pertaining to transportation. The secretary of energy would research CO2 transit pipes and CO2 sequestration facilities. The EPA administrator was given the go-ahead to form a task group to investigate the financial effects of any prospective government assumption of liability with regard to closed geological storage sites. It gave the president the power to suspend the act's obligations in the event of a national security crisis. Finally, it mandated that securities issuers notify investors of significant risks associated to climate change, as directed by the Securities and Exchange Commission.

S. 2191 would result in significant cutbacks in the U.S. GHG reductions over a period of over 40 years, starting in 2012 and ending in 2050, with reductions throughout the whole U.S. GHG emissions as much as 66% below 2005 levels. A significant amount of funds has been provided to aid governments and industries in their transition to a low-carbon future; a $800 billion tax relief fund through 2050 will benefit those who need help paying for energy prices. According to estimates from the World Resources Institute and Natural Resources Defense Council, the law would cut emissions by up to 60% by 2050 and up to 13% below 1990 levels by 2020. Furthermore, S. In order to encourage the quick development and commercialization of clean energy, energy-saving, and other GHG emission-reducing technologies that will result in a significant increase in domestic green collar jobs, 2191 would raise significant resources from the industries responsible for GHG emissions, including electric utilities as well as other businesses, and recycle those resources, largely to the private sector. It would also help communities, people, and companies that could be affluent.

The cap and trade architecture of the GHG reduction scheme is a significant component. Cap and trade allowed S. By 2191, the expected reductions in GHG emissions would have been realized. The scheme would also allow GHG sources to participate in emissions trading, giving participating companies complete flexibility and fostering a vibrant market for GHG emission reductions. A comparable comprehensive program for promoting the research and commercialization of innovative, clean technology, with an emphasis on the energy and transportation sectors, is coupled with the Climate Security Act's comprehensive GHG emissions reduction program. The legislation establishes the Energy Technology Deployment Program and the Energy Transformation Acceleration Fund, both of which would be administered by the Department of Energy's Advanced Research Projects Agency. These subsidies would function as financial incentives to hasten the research and commercialization of advanced biofuels, such as cellulosic ethanol, CO2 capture and storage systems, electric and plug-in hybrid electric cars, and high-efficiency consumer goods [8], [9].

Despite the fact that this law was written with bipartisan support, there was still resistance, and the committee voted to adopt it by a margin of 11-9, with Sen. Warner being the lone Republican to do so. According to the EPA and S., the global CO2 concentration in 2095 will be less than 491 ppm. 2191 would see considerable cost-effective reductions in global warming pollutants. The 61 gigawatts of renewable energy—equivalent to 120 new 500 MW power plants encouraged by this bill—will generate tens of thousands of clean energy jobs, according to the EPA research. S. Carbon capture and sequestration were necessary in 2191; this would only result in a 0.04% yearly

average GDP decrease from 2010 to 2050. No rise in power prices was predicted by the EPA until 2020, followed by a one-fifth increase until 2040. Electricity tariffs were affected by the CAA Acid Rain program at a cost of 8.1 cents per kilowatt-hour in 1990, 7.5 cents per kilowatt-hour in 1995, and 7.6 cents per kilowatt-hour in 2000, all in 2000 dollars. Industry estimated that CO2 allowances would cost $55 per ton in 2020, whereas the EPA predicted that the cost would be $26 per ton. The Congressional Budget Office anticipated that from 2012 to 2016, the measure will cost $90 billion annually. The Unfunded Mandates Reform Act assessed the intergovernmental mandate expenses for 2008 at $136 million.

The Warner-Lieberman measure was sent to Senate Majority Leader Harry Reid, but it was unable to secure the sixty votes needed to end a Republican filibuster and allow for floor discussion and voting. The economic interests, who had been unified against the expenses of addressing global climate change, notably cap and trade, had won the argument by claiming that this constituted a tax. S. To address cli- mate change in a fresh legislative way, 2191 structured the whole complement of executive agencies. Yet to pass legislation, political compromise and popular backing are necessary. Environmentalists and the many other different organizations, each with its own goal and dozens of impacted industries, contribute to the complexity of climate change. The economics of climate change, whether a tax could accomplish the required GHG reductions, and if indirect costs from GHG pollution would increase to the point where legislative compromise could be obtained are crucial components of reaching an agreement.

Global Warming Economic Factors and Possible Solutions

Stern's Report

Nicholas Stern, a former vice president of the World Bank, calculated the financial costs of addressing global warming about the same period. He predicted that to reduce CO2 by 60% to 80% below 1990 levels would cost 1% of the world economy in 2050. If we didn't take action now, the expenses would be five to twenty times greater. At a maximum reduction of 20%, the worst consequences of climate change might be averted by 4% of gross domestic product. Most individuals place less importance on the future than the present and would only invest if the expected return was sufficiently high. The Stern Report gave equal treatment to the present and coming generations. If we don't slow down global warming within a decade, he predicted expenses of $7 trillion. According to him, "the risks of significant disruption to economic and social activity later this century and in the next, on a scale similar to those associated with both the great wars and the economic depression of the first half of the 20th century, could be created by our actions over the coming few decades."

Cap and trade economics

For 12,000 industrial facilities, the European Union has a system of CO2 caps.7 The EU has committed to operating 10% of its vehicles and trucks on biofuels and sourcing 20% of its energy from renewable sources by 2020. The value of the worldwide carbon market increased from $11 billion in 2005 to $30 billion in 2006. As of 2013, the EU will require power facilities to acquire licenses to release CO2, making carbon one of the largest commodities markets in the world. The eight states and territories of Australia have suggested a scheme that would require energy firms to obtain tradable licenses to release GHGs beginning in 2010. The American Gas Association, the AFL-CIO, and the Edison Electric Institute support enforcing obligatory limits on CO2 and other GHGs. The Edison Electric Institute, whose members provide 60% of the nation's power, is made up of 200 utilities represented by the AGA, whose board includes 50 chief executive officers.

According to the IPCC Fourth Report, the energy sector will be responsible for two-thirds of emissions by 2030 and there will be a 60% rise in energy consumption.

Economic Analysis of Climate Change Solutions

There is a portfolio available to avoid the doubling of CO2; this portfolio was split into seven equal wedges. Pacala and Socolow have written on the scientific, technological, and industrial know-how to address the carbon and climate crisis over the next fifty years. The following fifteen choices must be completed by 2050, except for seven. Efficiency and conservation, the first category, offered four potential wedge options:

Boost the fuel efficiency of two billion vehicles from 30 to 60 miles per gallon. Lower the 10,000 mile yearly average distance travelled by the 2 billion autos to 5,000 miles. Building CO2 emissions should be cut in half by the year 2050. Improve coal-fired power plants' efficiency from 40% to 60% while allowing for a doubling of the amount of coal-based energy produced. Prospects for Climate Change Legislation Going Forward

Waxman-Markey

On June 26, 2009, a Friday, the U.S. H.R. 1, the first legislation addressing climate change, was approved by the House. 2454 with a 219–212 vote. Representatives Edward Markey, chairman of the Select Committee on Global Warming, and Henry Waxman, leader of the Energy and Commerce Committee, wrote the bill. Earlier, Speaker Nancy Pelosi appointed Edward Markey to lead a Select Committee on Global Warming to draft a climate change bill after Henry Waxman had defeated John Dingell, the former chair of the committee who lacked enthusiasm for moving forward with climate change legislation, in the Democratic Caucus. Just eight Republicans and forty-four Democrats voted in favor of the measure. Since controlling GHG was seen as a levy on the fossil fuel industry, the division was mostly one-sided. Due to multiple last-minute concessions, the American Clean Energy and Security Act of 2009 bill increased in size from more than 600 pages to more than 1,400 pages. The final measure was based on cap and trade, with the aim of bringing GHG emissions down by 83% by 2050 and 17% below 2005 levels by 2020.

A permit to release one ton of CO2 was forecast to cost around $13 and was expected to grow rapidly when emission limits were lowered when the cap and trade scheme was set to begin in 2012. In order to keep expenses down at the beginning of the program, the law would provide the bulk of permits gratis. This clause also took into account geographical variations: while some states had advanced solar and wind technologies and did not need permits, others were more dependent on coal and coal-fired power facilities. While praising the legislation, President Obama opposed a last-minute amendment made by lawmakers from Rust Belt States that would have forced the president to impose tariffs on certain imports from nations that failed to take action to reduce their greenhouse gas emissions by the year 2020 and barred the EPA from regulating GHG under the Clean Air Act.

A number of Senate committees have authority over certain provisions of climate change legislation. A measure that includes a national renewable power standard was first authorized by the Energy and Natural Resources Committee, and the committees for finance, commerce, agriculture, and international relations intend to participate. Senators Boxer and Kerry of the Environment and Public Works Committee unveiled their 800-page measure S on September 30, 2009. 1733. It would be similar to the House version but with a 20% CO2 reduction reduction objective for 2020 as opposed to 2005. The "Clean Energy Jobs and American Power Act"

suggested a method for investing in and reducing pollution that specifically targeted companies that produce carbon. Almost three-fourths of the carbon pollution in the United States is produced by these 7,500 enterprises. The bill's supporters wanted to shift the discussion away from cap and trade and toward pollution control. With all Republicans abstaining from the final markup and committee vote, the measure was approved by the EPW Committee 11-1. Hence, the U.S. cap and trade system's future. The Senate was called into question, but the EPA is prepared and eager to control the main greenhouse gas emitters[10]–[12] .

CONCLUSION

A sad failure was the outcome of the 2009 Copenhagen conference to draft a new worldwide treaty to limit GHG emissions. Yet, there was consensus to keep the increase in global temperature to 2°C. With a global economy based on fossil fuels that powers contemporary life, getting there will need a radical shift in adaptability, lifestyle modification, technology, and international collaboration. overcoming the American legislative barrier. The Senate has proven to be a significant obstacle for climate change in the US. On cap and trade or a carbon tax and its impacts on business in a downturn, senators continue to disagree. House Democrats' straightforward plan for a carbon fee hasn't received any support. The 2010 Gulf oil disaster has presented further difficulties for legislators in regards to safety issues, the Department of Interior's regulatory function, environmental licenses, the design of fail-safe systems on deep sea drilling, clean-up authority, responsibility, and other issues. It has not been decided whether or not this should be included in an energy law that also addresses climate change. There are more justifications for executive leadership in developing a solution. In reaction to the oil disaster, President Obama has called for a green energy revolution and the creation of employment. Despite this, the Energy Department is moving forward with renewable energy research and demonstration projects while encouraging the construction of nuclear power plants; the Interior Department is moving forward with regulatory reform; Senators Kerry and Lieberman are still working to reach an understanding with the few Republican senators who are open to finding a creative legislative solution; and the EPA is moving forward with a regulatory framework for GHGs.

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CHAPTER 19

WILDERNESS PROTECTION

Sunkulp Goel, Associate Professor
Department of Mechanical Engineering, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email id-sunkulp2006@gmail.com

ABSTRACT:

A wilderness is a region of land that has not undergone significant contemporary human habitation. Typically, roads, buildings, and other man-made structures are absent from wilderness regions. They provide a natural habitat for many plant and animal species and enable the study of thriving ecosystems. In this chapter author is discusses the history of wilderness protection. Humans need access to wilderness as a way to unwind from the strains of modern life. We can have clean drinking water because wilderness preserves the lakes, rivers, streams, forests, and soils that are crucial for water filtration. The variety and genetic diversity of organisms are preserved by wilderness. With opportunities for adventure, intellectual nourishment from studying nature, and emotional consolation from seeing the beauty of nature, wilderness has an impact on human health.

KEYWORDS:

Adventure, Environment, Forest, Policy, Species.

INTRODUCTION

Adventure travel in remote locations include following hiking routes, scaling high peaks, rock climbing, rafting, and canoeing all with the aim of reaching a destination. The payoff is sufficient to accomplish the objective. Many people choose to watch animals or birds, identify plants, look for new species, research flora and fauna, or conduct scientific research. After a week away from computers, job stress, social contact, and multitasking, the mind is refreshed. It also helps to take photos of sunrises, sunsets, morning mists, and sunsets with a wilderness lake that is quiet as glass in the background. These recollections might linger for a very long time [1], [2].

Environmental policy is best shown by the legislative formation of wilderness, the role of executive agencies in managing and safeguarding wilderness values, and legal actions to preserve land. As we know from the carbon sinks linked to climate change, protecting land will have both indirect and direct effects on public health, including the very oxygen we breathe. When a city park has a greater variety of trees, study participants who spend time in the park score higher on various measures of psychological well-being, at least when compared to parks that are less biodiverse. This link between the psychological benefits of green space and the diversity of its plant life was demonstrated by Richard Fuller, an ecologist at the University of Queensland. We are really concerned about how urbanization may affect other animals, adds Fuller. Yet it also has an impact on us. Investment in the areas that provide us some respite is crucial for this reason.

What we refer to as wilderness is supported by a number of arguments, including the following: it protects ecosystems and landscapes at a large scale, it gives the public ownership and use of natural resources hunting, fishing, and recreation it settles and provides certainty in fundamental land use disputes, such as protection versus exploitation, and there is no ambiguity; it preserves a natural

and cultural heritage. Nevertheless, wilderness designation has drawbacks and problems, including what constitutes public access, what kind of access is or should be allowed, and which user groups are prioritized.

The History of Wilderness Protection

By capturing the wilderness spirit with the establishment of national parks as a unique concept for Yellowstone and Yosemite in 1872, the United States has been a pioneer in the preservation of wilderness. In the Gila Mountains of New Mexico, Aldo Leopold created the nation's first wilderness area in 1924. Millions of acres of roadless territory were under the guardianship of the U.S. Forest Service (USFS). The original protection of USFS wilderness was by administrative fiat, and it might be altered by a later Forest Service head. Wilderness, according to Leopold, "is the very substance America is composed of." In 1929, U.S. A "primitive area" policy was introduced by Forest Service Chief William Greeley to safeguard untamed regions and minimize the use of highways. A statute that might safeguard wilderness areas from the hazards posed by logging, roads, construction, motorized vehicles, aircraft, snowmobiles, and a variety of other incursions was required. There is no doubt that many of the characteristics that make America and Americans unique are the impression of wilderness and the life that accompanied it, according to Aldo Leopold, who believed that wildness served as the essential foundation of American culture. Leopold encapsulated the essence of wilderness values to public health practice: a healthy lifestyle and a healthy mind. If there is such a thing as an American culture, its distinguishing characteristics are a certain vigorous individualism, a certain intellectual curiosity bent to practical ends, a lack of subservience to old social forms, as well as an intolerance of drones, all of which are the distinctive characteristics of successful pioneers [3], [4].

Law governing wilderness

The National Forest System was founded in 1907 by President Theodore Roosevelt. His first chief was designated as Gifford Pinchot. The Wilderness Society, established in 1935 by Bob Marshall, Aldo Leopold, Harvey Broome, Ernest Oberholtzer, Benton Mackaye, Harold Anderson, Bernard Frank, and Robert Sterling Yard, played a significant role in this initiative. Robert Marshall, a native of New York, and Aldo Leopold founded the American Wilderness Movement and served as its effective leaders from World War I to World War II. Marshall was the epitome of the wilderness in the United States; he explored the Brooks Range in Alaska and wrote the book Arctic Wilderness about his experiences there; he founded The Wilderness Society; and he canoed through the Superior Wilderness along the Boundary W.

Marshall, who oversaw the USFS's roadless lands and wilderness policy, pushed for the creation of a Wilderness Planning Board in the 1930s to identify wilderness regions and ensure their complete preservation. A congressional act would designate these chosen locations. Marshall made the following claim in his 1930 Scientific Monthly article: "The population which covets wilderness recreation is rapidly enlarging and because the higher living standards may be anticipated should give millions the eco- nomic power to gratify what is today merely a pathetic yearning." Marshall argued for a study to ascertain the wilderness needs of the country and stated that it ought to be a radical calculation. After the estimate is made, quick action should be done to create enough tracts to guarantee that everyone who desires it has a generous chance to experience wilderness solitude.

Bob Marshall rose to fame as a result of his extraordinary hiking feats, which included ascending fourteen Adirondack peaks in nineteen hours for a total elevation gain of 13,600 feet; his

unwavering dedication to wilderness; and his tireless writing and lobbying on its behalf. While exploring Wisconsin's forests, Aldo Leopold came upon the wilderness ethic and helped to create the Gila Wilderness in the 1920s. In 1949, he penned the famous A Sand County Almanac as a guide to the outdoors. The land ethic just broadens the definition of the community to encompass soils, waterways, plants, and animals or, collectively, the land, as Leopold put it.

Harvey Broome went for a trek in the Smokies. At the boundary between Minnesota and Ontario, Ernest Oberholtzer envisioned the Quetico-Superior Wilderness as a magnificent international park. He battled against a hydropower and logging proposal that would have devastated this magnificent wilderness canoe country while residing on Rainy Lake. Bernard Frank created and protected Rock Creek Park in Washington, D.C., Benton Mackaye established the Appalachian Trail, and Robert Sterling Yard collaborated with Stephen Mather to establish the National Parks Service in 1916. He also founded the National Parks Conservation Association and assisted the USFS in developing the idea of "primitive areas"; however, Yard fervently believed that wilderness should be preserved in its most untamed state and detested the roads and opulent lodges that Mather was advocating.

DISCUSSION

The Political Background of the Wilderness Act In the 1930s, there was a great deal of conflict between Harold Ickes' National Park Service and the U.S. Forest Service of the Department of Agriculture. Ickes wanted to move the U.S. To conserve the 11 million acres of Primitive Areas in particular, the Forest Service provided advice to the Department of the Interior. Comparatively, the U.S. The Forest Service objected, claiming that the National Park Service would build lodges and roads that would violate their concept of a "primitive" wilderness. Olympic National Park and Kings Canyon National Park were indeed taken up by the National Park Service. Robert Marshall passed away unexpectedly in 1939, but the Forest Service began work in these regions in 1938 and 1940. Just 14.2 million acres of wilderness were managed by the U.S. Forest Service at the time, and this amount remained constant until the 1964 passage of the Wilderness Act [5], [6].

Early in the 1950s, Howard Zahniser had spent years convincing conservation organizations that their first aim should be a workable and politically feasible measure to create a wilderness preservation program with a legislative mandate. Rep. Wayne Aspinall opposed Zahniser's affirmative action plan, which called for conservation group leaders to consult with agencies about wilderness designation and an executive order subject to congressional veto. Instead, Aspinall insisted that each wilderness area be established through a congressional act. In 1956, the conservation movement organized to stop the construction of the Echo Park Dam on the Yampa River in Dinosaur National Monument. Congressman. Aspinall supported a dam proposal from the Bureau of Recreation on the Colorado Plateau. Throughout a five-year period, the environmentalists successfully petitioned Congress and educated the public.

Losing this conflict would set a dangerous precedent that industrial development might take place within a National Park System unit. The conservation community realized that, rather than battling each danger separately, a statute was required to permanently conserve wilderness throughout this conservation conflict. In order to write a wilderness law, Zahniser had to overcome agency resistance; the agencies wanted to be in charge of choosing, overseeing, and providing wilderness management. He was saved by House stalwarts who said that wildness designated by a law passed by the legislature would guard against politicization of the agencies and shield them from excessive influence in boundary changes or management choices that favored a single large group.

Last but not least, Zahniser had to make room for Rep. Aspinall, who fought hard for the final House version of the measure and represented mining interests, grazing projects, and water projects.

Sen. Hubert Humphrey and Rep. John Saylor proposed the Wilderness Bill in 1956 after Zahniser's 1955 draft. The law includes 54 national forest areas, totalling 9.1 million acres, that were classified as wilderness, primitive, or canoe regions. After numerous revisions by Howard Zahniser, The Wilderness Society ultimately won the public's support, and David Brower of the Sierra Club was left to enjoy this success alone since Zahniser did not survive to attend the signing ceremony. The American wilderness movement, according to historian Howard Nash, saw its pinnacle. The Wilderness Act, which was approved in 1964 after eight years, 18 hearings, and 16 iterations, established the standard for safeguarding federal lands in the United States and served as a model for other countries. On July 30, 1964, the Senate voted 73-12 and the House 374-1. On September 3, 1964, President Lyndon B. Johnson signed the legislation into law. A bill to establish a wilderness area or a presidential proposal must now be made into a law by an act of Congress. In regard to logging, roads, mining, commercial development, and administrative decisions to remove lands from protection, this was the greatest degree of protection.

The statute gave the definition of wilderness. In contrast to those locations where people and their works predominated the landscape, wilderness is understood to be a place where humans are just transient visitors who do not permanently alter the Earth's ecosystem. A wilderness area is a section of federally owned undeveloped land that has not undergone any permanent alterations or human occupation and has retained its original character and effect. According to the Wilderness Act, the proposed property must: offers excellent options for isolation or primitive forms of enjoyment. Or "sufficient size of unimpaired circumstances" of 5,000 acres. Has ecological, geological, or other characteristics that are valuable for science, aesthetics, or history

The Wilderness Act required an act of Congress to designate wilderness, giving both agencies the opportunity to suggest wilderness areas and their boundaries and citizens acting alone or in groups the opportunity to initiate and lobby for wilderness designation. Secretary of the Interior Stewart Udall told senators that the wilderness bill ranked with the Homestead Act of 1862 and the National Parks of 1916 as a "great landmark conservation decision." Local community organizations, ranging from chambers of commerce to environmental groups, could all contribute to supporting a proposal. If there had been a prior human disturbance within a boundary, a nonconforming use, like grazing, or a nearby contrasting use, like a ski area, controversy would need to be settled among competing parties beforehand.

A national strategy to protect "an enduring resource of wilderness" was declared by the Wilderness Act. The National Wilderness Preservation System now has 9.1 million acres of statutory wilderness areas. The federal agencies were required to conduct a ten-year evaluation process on hundreds of possible wilderness sites and submit a report to Congress at the end of that time. By requiring an act for any new wilderness designations or border changes, it transferred control of deciding which places to conserve from the agencies to Congress. It declared that all designated wilderness areas on federal lands must uphold a consistent standard of wilderness care in order to maintain "the wilderness character" of each region.

Ronald Reagan signed more legislation protecting wilderness than any previous president, according to the National Wilderness Preservation System. Jimmy Carter authorized 66.3 million acres of wilderness, largely in Alaska, more than any previous president. The Campaign for

America's Wilderness combed through the remaining USFS and Bureau of Land Management areas and found 319 million acres that were still wild, undeveloped, and had parcels larger than 1,000 acres that qualified for wilderness classification.

As of 2010, there were 109.5 million acres of wilderness in the National Wilderness Preservation System, or 5% of all the country's acreage. Out of the 84.4 million acres in 58 national parks, there are about 44 million acres in national parks; 192 million acres in 155 national forests; 100 million acres in 547 national wildlife refuges; 34.7 million acres in national forests; 20.7 million acres in national forests; and 6.5 million acres in the Bureau of Land Management. Alaska accounts for more than half, or 57 million acres, while the eleven westernmost contiguous states account for more than one-third. Fewer than 5% are in the East, and of them, 50% are in Minnesota's Boundary Waters Canoe Area Wilderness and the Everglades National Park in Florida.

The continuous 12.7 million acres of Noatak and Gates of the Arctic Wilderness National Park in Alaska make up the biggest wilderness complex in the country. The Wrangell-Saint Elias Wilderness in Alaska is the largest wilderness area. 756 wilderness areas exist. Since national parks are already protected from development, the National Park Service is behind in designating its properties as wilderness. Each park must create a plan for consideration by the general public and submit it to Congress for adoption. The National Parks Service has been encouraged by the Wilderness Society to pursue wilderness classification for its parks more aggressively. Congress has performed its duty, as shown by the Omnibus Wilderness Act of 2009, which protects Rocky Mountain National Park.

The importance of local citizen groups in preserving wilderness led to the creation of several local conservation groups, such as the Friends of the Boundary Waters Canoe Area Wilderness. Regional offices were created by national groups like the Sierra Club and The Wilderness Society. Local organizations had access to local legislators and hearings to voice their opinions and results, and they were best positioned to define the limits of wilderness in their jurisdictions. As its members were canoe guides and locals who paddled the lakes, they understood where borders might be established and also knew the opposition, thus they could argue for the Boundary Waters Canoe Area Wilderness far better than the Sierra Club or The Wilderness Society.

When the population was asked if they supported conserving additional wilderness areas inside their own states, 69.8% said yes, with just 12.4% disagreeing. According to Zogby Polls, 75% of Democrats, 66% of Independents, and 54% of Republicans favored more wilderness in their own states. Members of both parties have backed wilderness, despite opposition from those who want less government or development. Wilderness is really nonpartisan. As wilderness is preserved, rules from the leading land agency become crucial, necessitating ongoing watchfulness from local or national environmental organizations. Access roads and lax rules that can result in the loss of the authentic wilderness experience need to be avoided as part of wilderness management. Like they did with California's Ventana Wilderness, which began as a 55,000-acre primitive region but after four expansions is now a quarter-million acres, Congress may repeatedly extend wilderness areas.

The Evolution of Wilderness Preservation in History: Influence of New York State

The majority of the property in the eastern United States is either privately or state-owned, which restricts the federal government's ability to conserve wilderness. Yet, Maine and New York each have sizable state wilderness areas. In addition, the disastrous impacts of logging 200–300 years ago on the Northern For- est have been mostly reversed. Due to the fact that large private sections

are now being offered for sale, protecting this forest has become more difficult. Unprecedented opportunities exist for states and private organizations to acquire and preserve these areas. The Catskill Preserve supplies safe, clean drinking water to more than 10 million residents of New York City and Westchester County, making them very important to public health. The Adirondacks, Catskills, and Appalachian Mountains provide convenient access to some of America's best wilderness areas for the main population centers along the east coast.

Increased obesity and chronic illnesses, such as high blood pressure, diabetes, congestive heart failure, cancer, and stroke, are caused by sedentary lifestyles. More playgrounds and parks are one option suggested by the Centers for Disease Control and Prevention. Whether or not New York was wilderness—defined as the state of nature that exists without the hand of man—or simply wild before European colonization, the state was heavily forested, with about 90% of its land covered in conifers and hemlock at higher elevations and mixed hardwoods at lower elevations. It is sufficient to state that there was a human impact well before the seventeenth century, but it was little, undoubtedly sustainable, and unextrac- tive. To facilitate travel, hunting, and cultivation, Native Americans are known to have often set fire to the trees or allowed others to do so.

After two conflicts, there was calm, which led to increased land development, settlement, and severe intrusion into the largely intact forest. In place of salary, Continental Army veterans were granted land, often the holdings of exiled Tories, as well as "virgin land" in uncharted areas. The Crown had previously safeguarded the white pines, which were used by the British Navy as masts and spars. Throughout the Hudson Valley, the Mohawk Valley, and up into the Catskill and Adirondack foothills, lumbering was especially widespread. New York was the nation's leading producer of lumber and timber-related products from the Erie Canal's construction in 1825 through the Civil War and its immediate aftermath. The result was a degraded environment that was littered with tree trimmings, debris that served as tinder for later wildfires, and depleted soils, ecosystems, and fauna.

In "Man and Nature," George Perkins Marsh noted in the 1860s the significance of forests and their preservation, especially in relation to the wellbeing and upkeep of watersheds and riparian systems. When New York completely transitioned to an industrial economy during the next decades, there were contending groups disputing how to exploit and protect natural resources like water and woods. Since the 1860s, New York has evaluated the natural capital and ecosystem services of its public and private estate in an effort to define the role of government in conserving natural resources. There is debate over whether the preservation of forests, access to clean drinking water, the use of water for transportation and energy, or as in the romantic and naturalist schools of virginal nature the meditative and transformative powers of nature and wilderness had more historical significance. Leading philosophers, scientists, and authors of the time started to connect a condition of grace with nature and untamed territories.

Ralph Waldo Emerson and Henry David Thoreau, among others, criticized business more and more in the 1840s and 1850s and extolled nature as the ideal condition of existence. In 1858–1860, members of their Boston–based Metaphysical School traveled to the Adirondacks in search of the most complete extant example of wildness in the east. Together with other intellectual and cultural giants like Louis Aggas-Sidney, Oliver Wendell Holmes, Thomas Cole, Robert Lowell, and William Lloyd Garrison, they shared a physical and intellectual bond. The writings of the metaphysical philosophers and the paintings of the Hudson River School all emerged within the same time period, which is the second quarter of the nineteenth century. The Mohawk Valley, the

Catskills, the Adirondacks, and the Hudson Valley were the natural world's centers in New York and were best characterized in superlatives for their untamed beauty and virtues.

It wasn't until the Adirondacks which weren't given their official name until 1837 saw three events take place that determined both the loss and recovery of their wilderness status: railroads and a nation in need of wood. Congress forbade the logging of southern forests until the end of Reconstruction as a means of punishing southerners and rewarding northern landowners; however, as America's industrialization progressed from the 1860s to the early 1900s, the Northern Forests from Maine to Wisconsin underwent extensive expansion and clear-cutting. New York State hired the intrepid surveyor Verplanck Van Colvin to measure the land. He observed how the land had been devastated and abused throughout the years he spent compiling the survey, and as a result, he became an advocate for both public and private protection.

William Henry Harrison Murray, a preacher from Boston, published a travelogue on the delights of pristine wilderness and its natural bounty: fish leaping into his boat; deer wandering into his blind; colorful and entertaining guides; nature in all its grandeur. Emerson and the Metaphysical Club had before articulated it in more intellectual terms, but Murray popularized it. Many others followed Adirondack Murray's example once he started the outdoor movement and published the first hunting magazine. Hundreds of hunting and fishing camps were created in the Adirondacks within a few years after his articles. The evidence of logging showed that paradise was being destroyed. In the latter part of the nineteenth century, as cities grew geometrically, they were also worried about their future drinking water demands. They were concerned that the Hudson River economy and New York City's public health would suffer if the Adirondacks watershed failed. The interaction of land, natural resources, and growing geography gave birth to a political conversation about how the government should manage development restrictions, maybe for the first time in America.

The Catskills, regarded as the Adirondacks' stepsister, experienced comparable problems and strain. However, the Catskills' deforestation was less abrupt and drastic than that of the Adirondacks for three main reasons: they were closer to towns, making transportation much simpler; agriculture was more viable in and around the Catskills because it was less rugged and steep; and it was much smaller, making access to the interior of the Catskills much simpler. Due to these factors, the Catskills were already being exploited and gradually occupied by the time of the Declaration of Independence, and the natural capital had already been damaged. In the end, almost every acre of land had been used in some form. About 5% to 10% of the area was first growth or virgin wood; the remainder was used for tanning, mining bluestone, manufacturing furniture, mining for charcoal, and subsistence farming.

Early in the 20th century, John Burroughs emerged as a prominent natural philosopher and the Catskills as a popular tourist destination for naturalists. Burroughs advocated a mixed-use setting over previous naturalist schools or Adirondack wilderness supporters. He preferred the secluded sights and simple lifestyle of a Catskills farm over the Adirondacks' wooded wildness or the Hudson River's intimidating force and impersonal character.

Always Wild

The Adirondack Park and Catskill State Park, the first wilderness parks in the country, were created by the government in 1892 and 1904, respectively. Prior to being further protected by President Theodore Roosevelt, Yellowstone, which was established by President Ulysses Grant as a preserve, was neither a wilderness area nor a park. A very unusual occurrence occurred in 1894 when the

New York state assembly called for a convention to explore altering the state constitution. The convention adopted an amendment that called for the creation of a forest preserve in the Catskills and Adirondacks where the public lands would be kept "forever wild" and not subject to any kind of commercial exploitation. This amendment was spearheaded by legislators and delegates from New York City. The blue line, which closely approximates the topographic footprint of the ADK and Catskill uplift, was used to delineate the park's limits. Beyond the bounds of the designated park were the greatest agricultural lands. The Catskill and Adirondack Park had "rocks and ice" and had limited arable land, same as other parks around the country. What made up the first wilderness park that New York had established?

Only the state-owned areas, which were not very many, were preserved by the ADK and Catskills Forest Preserve and Park. In reality, the state had been selling property it had acquired or reacquired from tax liens to forestry corporations and business owners previous to Article XIV. It eventually held those tax lien properties selectively, then generally, traded for other lands, and then started to buy land and interest in property. The Catskills Park expanded from its original 34,000 acres to 300,000 acres. ADK formerly numbered 550,000 and currently numbers nearly 3 million. The mountains and upland areas inside the parks—much like in the American West—came under governmental control. The private properties are often found in river corridors, valleys, and lower-lying areas that are easier to reach.

President Roosevelt established the Palisades Interstate Park Commission (PIPC) in 1902, the first bi-state park commission in the country. Roosevelt had spent summers as a boy hiking among the high peaks of the Adirondacks. The decision to preserve and protect the Palisades was made in response to its desecration, as is the case with most forms of preservation. Business interests destroyed and dug the Palisades' rock face on the west bank and in the Hudson Highlands as New York City expanded and created inexpensive homes for immigrants from Europe and the American South. Excavated from the recognizable cliffs that mark the Hudson River, the Palisades became the source of charming village brownstones. The robber baron neighbors, who normally lived on expansive estates across the river, protested that their viewsheds were being damaged. For the first time in the country and the world, they purchased the Palisades and gave it to a park—a bi-state park. The acquisition and preservation came too late to preserve some important and historic places, but it sparked a movement that changed how parks and wilderness were grouped, established, and viewed during the first half of the 20th century. The first linear or greenbelt park in the US was also built by PIPC. It extends north of West Point, beyond the Tappan Zee Bridge, past the Bear Mountain Bridge, and nearly to the Mid-Hudson Bridge from the George Washington Bridge. It left behind a spectacular legacy and a wilderness area that tens of millions of city dwellers could explore.

Protecting land and natural resources was one of the main tenets of the Progressive movement in American politics. Nowhere is it more clear than in the actions of a string of New York governors, legislators, and American presidents at the beginning of the twentieth century. Theodore Roosevelt, Al Smith, Franklin Delano Roosevelt, Herbert Lehman, Averell Harriman, Nelson Rockefeller, and George Pataki were just a few of the people that helped lead this effort. All of them significantly strengthened the physical and political pillars of New York's parks, wilderness, and environmental protection. The contemporary environmental movement was born in New York during another dam debate. The northernmost section of the PIPC greenway, the north gate of the Hudson Highlands, is where Storm King Mountain is located. Con Edison suggested a pump storage plant and hydropower facility at the start of the 1960s. At periods of high or peak energy demand, the top of

Storm King would be removed, a lake would be made, and water would be pushed up the mountain's slope in substantial penstocks and flushed back down. Similar to the Palisades sixty years earlier, rich neighbors first spearheaded and funded the resistance to Storm King, forming a citizen organization that filed a claim for standing. As a result of this conflict, the courts confirmed that individuals have the legal right to bring claims on behalf of the environment. As a result of the battle, which resulted in the preservation of Storm King, organizations like Earth Day, the Natural Resources Defense Council, Sce-nic Hudson, and finally the Open Space Institute were born.

Under the ever-sensitive political sensibilities and sincere beliefs of the governor at the time in the late 1960s. Nelson Rockefeller, New York enacted a flurry of significant environmental laws that often anticipated or followed analogous federal legislation. The Federal Wilderness Act, the Wild and Scenic Rivers Act, the National Environmental Policy Act or State Environmental Quality Assessment, clean air and water legislation, and more are all applicable in New York. With the purpose of acquiring and establishing parks and wilderness areas, Rockefeller enacted multiple environmental bond acts. He founded an environmental organization. A movement for environmental conservation that went beyond merely parks or land and waters was spurred by him, and he also helped to push its agenda. In hindsight, the 1960s were a tremendously progressive decade, and the law that was approved at that time 50 years ago still establishes the fundamental legal principles governing environmental and wilderness protection. Together, President Lyndon Johnson and Governor Nelson Rockefeller fought over who could use the environment as his platform to develop and build a more advantageous government and a more progressive state on a state level [7].

The Temporary Study Commission on the Future of the Adirondacks was established by Rockefeller on the theory that by designating and enforcing restrictions on both public and private lands within the park, one could obtain all the benefits of a natural wilderness park while avoiding any disadvantages. It may be argued that the issue over land conservation sparked a countermovement that fought for more local autonomy and private property rights. The Adirondack Park Act of 1971, the county's most comprehensive regional zoning and land use regulation, was not powerful enough to be obstructed by the so-called Smart Use movement, which rose to prominence in the mid-1990s. The highest category of public land use, wilderness, was given to all of the park's holdings under the Act. There were many types of private land use, the highest of which, resource management, produced huge lots and had few alternatives for development. Local interests, particularly those in favor of resource development on public lands, made up the Wise Use movement, which gave birth to the Sagebrush Rebellion in the West. Throughout the 1980s and 1990s, this Rebellion resisted more wilderness designation on federal lands, and wilderness studies were carried out.

Conservation easements were then used to safeguard the Adirondacks. A landowner voluntarily agrees to sell or donate certain rights attached to his or her property often the right to subdivide or develop and a private organization or public agency agrees to hold the right to enforce the landowner's promise not to exercise those rights. This is known as a conservation easement. A conservation easement may be eligible for considerable tax advantages and is legally enforceable regardless of whether the land is sold or handed on to heirs. Land consists of a variety of rights that may be divided, including ownership of buildings like houses and other structures, wood, water, minerals, and recreational uses. Fee Simple refers to the full package. However, the fee may be owned and retained independently from other rights, most notably from development rights,

but also from timber, agricultural, recreational, and public access rights. If you own the actual property, this is referred to as "ownership in fee." As previously said, Diamond International sold all of its assets, including its mills, stores, and actually auctioned them off. The total of those components was more than its open market worth. This strategy raised concerns since northeastern woods are close to a major market, have a high real estate value, and are not very productive. The Nature Conservancy, one of the biggest conservation groups in the US, preserves 15.4 million acres, and more than 2 million acres have been conserved via easements given to the conservancy. On an extra 1.3 million acres, the conservancy has helped governmental agencies and other U.S. land trusts with conservation easements.

In the Northern Forest, which stretches from Maine to New York, 6 million acres of land have been set aside for protection. More than 90% of the property that is preserved is covered by a conservation easement. A little more than ten years ago, industrial timber firms, headed by International Paper with around 13 million acres, 5% of which were in the Adirondacks, were the biggest landowners in the United States. Practically speaking, International Paper has sold all of its acreage in the US, with the majority going to Wall Street-affiliated organizations that handle investments in forestry. Tax reasons, international markets, the separation of mills from forests, and more effective use of capital/balance sheet manipulations all contributed to this widespread sell-off. Like our houses, our forest areas were turned into commodities, commodityized, and auctioned off. Although there have been some encouraging developments when properties have changed hands, almost every transaction has led to the parcelization of ownership and management on around 50% of the lands sold in the Northern Forest. Parcelization is especially harmful if the goal of wilderness protection is to protect at scale.

The preservation of riparian zones and corridors is crucial, in addition to parcelization. Waterways, water courses, and riparian corridors are crucial for gathering, storing, replenishing, and transporting water for humans as well as other animals and vegetative life. The Great Lakes' humid air is cooled by the Adirondack Mountains, resulting in rain and the formation of the St. Lawrence and Hudson rivers' headwaters as well as many of its important tributaries, including the Mohawk, Racquette, Black, Moose, Saranac, and Sacandaga. The riparian corridors must be safeguarded first, followed by their vital watersheds. As people desire to construct houses on properties that are next to water, they are the costliest lands for a variety of reasons.

Terrestrial corridors for migratory species, in addition to riparian corridors, are essential for the long-term health and survival of intact ecosystems. Discrete land corridors often run in valleys or bottomlands, however there is clearly a lot of overlap with riparian corridors. Once again, these properties often face greater demands for competing land uses, are more valuable, and are politically more sensitive. These utility corridors are all detrimental to the environment and animals since here is where people want to live, farm, develop shops, and go on vacation. Now, the only effective methods for resolving land use conflicts are acquisition, which is costly, or zoning, which is localized.

Scale is the antithesis of parcelization, corridor protection, or even easements. Protecting vast ecosystems, like the Northern Forest in New England, is one illustration of scale. Scale, according to the idea, ultimately resolves all other problems. As the only way we now reach scale is by partial protection through easements, it is an expensive solution and it begs all the other land use problems described. Again, we may reach scale if zoning were an option in the northeastern United States, but at the cost of having to confront and compromise opposing economic and lifestyle options. The animals and plants do not have voting rights, as many naturalists have pointed out [8], [9].

CONCLUSION

The protection of wildlife is crucial for preserving the ecosystem's equilibrium. Animals of rare and extinct species must be protected. Since forests are a crucial component of our ecosystem, it is our duty to maintain and preserve them for present and future generations, as well as for various animal species and human quality of life. When there aren't many of a species left and it faces extinction, an animal is said to be in danger of becoming extinct (when an animal species dies off). More than ten species every day are extinct, therefore we must start aiding and safeguarding them. The protection of wildlife is crucial for preserving the ecosystem's equilibrium. Animals of rare and extinct species must be protected.

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CHAPTER 20

A STUDY ON CURRENT WILDERNESS LEGISLATION

Dr. Varalakshmi S, Associate Professor,
Department of Management, JAIN (Deemed-to-be University), Bangalore, India,
Email Id- varalakshmi@cms.ac.in

ABSTRACT:

The goal of the Wilderness Act was to ensure "that an expanding population, along with growing settlement and growing mechanization, does not occupy and change all areas within in the United States and its possessions, leaving no areas of land designated for preservation and protection throughout their natural condition. In this chapter author is discusses the logging and protection in wilderness. Since practically the entire United States had previously been logged, roads may enter small portions of pristine areas, mines may have existed in the past, homesteads may be discovered, and other factors, there is considerable debate over what might constitute eligible wilderness for protections. These factors have led to delicate compromises on the boundaries of wilderness areas. As roads had been built in many national parks and some now-pristine forest regions had previously been logged, the NPS and USFS both faced issues with their "purity hypothesis" of what lands constituted wilderness. The exclusion of logged areas and buffers near roadways were hotly contested topics.

KEYWORDS:

Act, Legislation, Environment, Forest, Pollution.

INTRODUCTION

The creation of wilder- ness areas may require diversity in terms of size and degree of wildness, according to Aldo Leopold in A Sand County Almanac. The purity theory would exclude many of the wild lands in the eastern United States that are being supported by numerous citizen advocates of wilderness. This issue was raised on the floor of Congress in 1973 when Rep. Diane Saynor and Sen. Henry "Scoop" Jackson sponsored the Eastern Wilderness Bill. Sen. James Buckley said, "Less than exacting requirements would be essential for practical implementation if we are to have a nationwide system of wilderness areas, as the drafters of the Wilderness Act evidently intended. I think it would be incorrect to presume that the Wilderness Act cannot apply to previously disturbed areas as the foundation for public policy [1]–[3]. Sen. Frank Church instructed the USFS commander to present the proposals to the Senate panel. What belongs in a wilderness and what doesn't would then be decided by the senator! In 1975, President Gerald Ford signed the Eastern Wilderness Act, giving fifteen eastern wilderness areas in national forests legal protection and demanding investigations of an additional seventeen de facto regions. This put an end to the controversy around the purity idea since these locations had logging and logging roads up to a century or more before.

Example of Mixed Land Use: Wilderness in the Boundary Waters Canoe Area

The subject of numerous land uses came up next. This forestry theory permitted a variety of management techniques in the national forests, including logging, the use of motorized vehicles, access to roads, and the preservation of wildness and watersheds. Multi-use was opposed by

conservationists. Not every use belongs on every acre was their catchphrase, and this issue came to a head during the discussion of Minnesota's Boundary Waters. The canoe country was first protected in 1926 as a million-acre, undeveloped region. The Little Sioux River area of the Boundary Waters Canoe Area was cut off by the Echo Trail, and the Fernberg Road and Gunflint Trail were added from the west and the east, respectively, to satisfy residents' need for roadways to serve the growing resort industry. Much effort was expended to stop the construction of a road that would have connected the Fernberg Road and the Gunflint Trail and devastated the central region of the roadless area.

E. W. Backus, the local businessman who had constructed the International Falls paper and pulp factory, suggested damming all of the border lakes for a massive hydroelectric project and logging operation. From his lodge on Rainy Lake, Ernest Oberholtzer, a founder of The Wilderness Society and an early canoeist in the Boundary Waters, convinced the Quetico-Superior Council to reject Backus' plan. He was successful in getting Congress to pass the Shipstead-Newton-Nolan Act, which forbade logging within 400 feet of the coastline and maintained the shorelines in their natural state. More than 400 seaplanes flew into the more than 1,000 lakes of the Boundary Waters from Ely, Minnesota, after World War II to serve fisherman and the several resorts that had been constructed on private land holdings in the Superior National Forest. Sigurd Olson and colleagues asked President Harry S. Truman to impose an air ban on seaplanes from landing in the Superior Roadless Area after witnessing them land in wilderness lakes after several days of portaging into the interior lakes. Truman did so in 1949 and mandated that private planes fly at a height of 4,000 feet over the Superior Roadless Area. All the way to the US, the pilots filed an appeal. But, the Supreme Court declined to take the case.

Information from The Field

I took Dr. Clayton Rudd, the editor of the journal Naturalist, deep into the Kawishiwi River canoe region, and we climbed to a tiny lake nearby to see logging happening right along the coastline. He published images of the logging violations of the Shipstead-Newton-Nolan Law, which prompted a federal USFS commission headed by Minnesota's renowned conservationist, George Selke, to consider the issues and recommend logging restrictions. The commission was appointed by Secretary of Agriculture Orville Freeman. Being a local canoe guide, I had the opportunity to appear before the Selke Commission in 1964 to call for the conservation of wildlands and an end to logging. Sigurd Olson spoke after me, stating, "Wilderness carries within itself all the wonder of the cosmos, the tale of development, of growth and change, and of beauty from the origins of time. More than simply lakes, rivers, and trees along the beaches, wilderness also includes things like fishing and camping. It's the sensation of the primordial, of empty space, solitary isolation, quiet, and eternal mystery. I was astonished when Ely Mayor Dr. J. P. Grahek approached Sigurd after his presentation and scolded him, saying, "How dare you raise your children in the town of Ely." The mayor has always been in league with the development interests. The Selke Commission suggested a no-cut zone of 600,000 acres, but left a 400,000-acre zone open to logging with no limitations on engines. After constructing logging roads into the wilderness as part of its multiple use strategy, the USFS changed the name of the Superior Roadless Area to the Boundary Waters Canoe Area. Sen. Hubert Humphrey managed to keep these encroachments out of the Boundary Waters Canoe Area with the enactment of the Wilderness Act in 1964. He didn't want the strife around the Boundary Waters to hurt his prospects of getting The Wilderness Bill passed [4], [5].

DISCUSSION

Logging and Protection in Wilderness: The BWCA Again. The Thye-Blatynik Act provided financing for the acquisition of the inland resorts throughout the 1950s and 1960s. When the USFS decided that the second-growth woods on the edges of the Superior Roadless Area were ready for timber harvesting for the burgeoning paper and pulp mills, the next conflict arose. To get the logs to market, they created For- est Center, a village on the border of Lake Isabella, as well as a railroad. To collect wood on many tens of thousands of acres, roads were built miles into the formerly uninhabited region.

Vehicles: The BWCA becomes the BWCA Wilderness. Mechanized vehicles, such as snowmobiles and motorboats, posed the next danger. Huge motorboats sailed on the lakes at the end of the routes, and trucks transported these motorboats into the border lakes, which are located deep into the BWCA, using portage roads. Snowmobiles might travel quickly to remote lakes for lake trout fishing at the start of the winter season. With all the preservation efforts, the BWCA's wildness was gradually disappearing. The Boundary Waters Canoe Area's wilderness designation was the only thing holding out hope. In the US, two opposing measures were presented. Representatives' House. The first was a plan put out by local lawmaker James Oberstar to turn the border lakes into a national recreation area that would only conserve the inner lakes as wilderness and allow motorboats. The second was a proposal to safeguard the whole wilderness and limit watercraft use by Twin Cities Representative Bruce Vento. Bud Heinselman, a former USFS researcher who retired to advocate full-time, led the aggressive lobbying campaign [6], [7].

Information from The Field

I was given the task by the Friends of the Boundary Waters Wilderness to persuade the western lawmakers since I was a member of the faculty at the University of Utah Medical School and had served as a guide in the BWCA and Quetico for eight years. I spent several days on Capitol Hill visiting the congressman offices of 20 western states and requesting meetings with the staff members who dealt with environmental legislation and wilderness issues. I would get out the map of Quetico-Superior, talk about the wilderness characteristics, and talk about all the lakes and portages that I was familiar with. I emphasized the importance of supporting the Vento amendment to the BWCA Wilderness measure.

Congressman Phillip Burton, who was California's leading advocate for wilderness conservation, asked Representatives Vento and Oberstar to form a negotiation team to combine both legislation as the 1978 Congress drew to a close. With the competent assistance of Miron "Bud" Heinselman, Chuck Dayton, a lawyer who had spent many years paddling out of Ely, supported Congressman. Vento. The borders on Murphy and Big Moose Lakes would be moved to prevent seaplane landings and access. Outboard motors would be prohibited, with the exception of motorboats up to 25 horsepower being allowed on access lakes and motorboats being allowed on select border lakes, including Basswood, Lac La Croix, Saganaga, and Fowl Lakes. The BWCA would be protected as a wilderness area throughout. In 1978, President Carter approved, passed, and signed this measure after it had been approved by both houses of Congress. One of The Wilderness Act's biggest successes was this one!

With 1,000 more lakes and another million acres, Ontario's Quetico Provincial Park adopted a similar wilderness management strategy. In order to satisfy their Ojibway tribe on Lake La Croix, who had been granted motorized access to numerous western Quetico lakes as part of their guiding service, they did have one significant variation. Moreover, Quetico hired members of the Lac La

Croix band as park rangers. On the western boundary, Voyageur's National Park was created, adding 365,000 acres and resulting in a cohesive wilderness of more than 2.5 million acres. The La Verendrye Provincial Park was established by Ontario to safeguard the voyageur streams east of Quetico.

The National Wilderness Preservation System's BWCA Wilderness has seen the greatest conflict. This is the most beautiful lake country on the continent, according to Sigurd Olson in 1977. We have the means to cherish and safeguard it. Since they satiate human needs for comfort, community, and perspective, certain areas need to be protected from growth and exploitation. Ultimately, in a maddeningly chaotic world, we turn to nature in search of stillness, unity, and wholeness—spiritual escape.

Issues with Wilderness Act Implementation

The Wilderness Act mandated a ten-year review process for the federal agencies to inventory their holdings and propose wilderness status. A National Wilderness Preservation System was established under Section 3 with properties owned by the National Park Service, USFS, Fish and Wildlife Service, and Bureau of Land Management to be taken into consideration for wilderness designation over the course of the next 10 years. Sierra Club v. Butz was filed after the USFS Roadless Area Review and Evaluation was deemed insufficient. In 1977, President Carter ordered RARE II, which included 62 million acres but was again deemed insufficient, leading to California v. Block. For each national forest, the USFS created a forest management plan that took into account potential wilderness areas. In the East, there were no qualifying roadless locations. With its wilderness designs, the NPS hesitated as well, often putting limits well inland from park highways. Sen. Frank Church delivered a speech to the NPS before the Senate Committee on Interior and Insular Affairs in 1972 as a result of this. He argued that the NPS had de facto underprotected certain wild areas by putting "buffer" and "threshold" zones of varied lengths between the intended wilderness units and the border of highways, developed areas, and park boundaries. The Wilderness Act makes no mention of such condition. As no other organization establishes wilderness limits in this manner, the crucial margin of wilderness is not fully protected by statute. The borders of wilderness areas in national parks should include all wild land unless there are compelling, valid reasons to the contrary, as well as particular, individual reasons for each instance.

The Sawtooth Wilderness in Idaho was primarily supported by Sen. Church, and in March 1984 the 2.36 million acres of Frank Church River of No Return Wilderness were dedicated in his honor. Landing strips that were in constant use at the time the Central Idaho Wilderness Act was passed permitted. National Park Service (NPS) apathy has caused the wilderness requests from Glacier, Yellowstone, Big Bend, and Rocky Mountain National Parks to stagnate. In certain instances, people filled up the gaps left by the federal government. As an example, the Scapecoat Wilderness Area in Montana is recognized for being the first wilderness created by a citizen. The Endangered American Wilderness Act, passed in 1978 and protecting seventeen citizen-initiated wilderness areas totaling 1.3 million acres, was a reward for their efforts. According to the Endangered American Wilderness Act of 1978, sites cannot be excluded from protection because there are "sights and sounds" of civilization beyond the boundaries.

For grazing operations in wilderness areas, the Colorado Wilderness Act created rules that were applicable to all USFS wilderness areas. Any actions required to manage disease, bug outbreaks, and fire in wilderness regions are permitted under the Wilderness Act. The Wilderness Act permits

the improvement of fisheries via the use of fish traps, stream barriers, aerial stocking, and the preservation and propagation of endangered species. Shelters along the path, however, shouldn't be provided until absolutely required.

Snowmobiles are difficult barriers to protecting wildness. After 65,000 public responses, the majority of which said that snowmobiles had no business in a national park, it was decided to phase out snowmobile use in Yellowstone in 2000 by 2003–2004. Because the Bush administration prevented implementation, more than 70,000 visits are now permitted each season. The Bureau of Land Management was the least effective at conserving wilderness among government agencies. Since much of the BLM's territory was desert, it lacked the allure of imposing woods, lakes, or mountains, which caused it to fall behind. The Federal Lands Policy and Management Act, which gave legislative direction for the BLM in the Department of the Interior, was passed in 1976 thanks to the efforts of Rep. Wayne Aspinall. A provision for BLM to list its roadless regions for designation as wilderness areas was included in the bill.

The National Forest Management Act, which Congress also approved in 1976, mandated that the Department of Agriculture's 155 forest supervisors create fifteen-year management plans with public input and consideration. The plan's environmental effect had to be thoroughly evaluated, and the forest supervisors had to take particular actions to monitor and safeguard species. This statute resulted from the Izaac Walton League of America's successful legal battle against clear-cut logging techniques in West Virginia and Montana. For more than 25 years, the bulk of the federal lands have been managed in accordance with these two organic statutes. The California Desert Preservation Act, approved by Congress in 1994, established 69 BLM wilderness areas covering 3.5 million acres. In eight wilderness study zones, it set aside 326,000 acres. Also, it elevated Death Valley and Joshua Tree National Monuments to the status of national parks and preserved a significant amount of wilderness in each.

Presidential Orders for the Preservation of Wilderness

To safeguard wildness, executive orders may be quite effective. In order to reserve 58.5 million acres of USFS property for Congress to designate as wilderness, President Clinton established the Roadless Rule. 2.5 million people commented on this regulation, and 70% of them were in favor. The Roadless Regulation declares 0.25% of the country's timber production to be off-limits. President George W. Bush revoked this executive order and mandated that western state governors submit a petition in order to maintain the Roadless Rule's protection of unprotected federal lands. This serves as an example of the value of securing wilderness via congressional measures so that wilderness regions become a matter of national law.

Just 28,000 acres of Utah's 23 million acres of BLM property are designated as wilderness, despite calls from citizens for 9 million acres to be conserved. The process of recommending wilderness areas may be sped up by political appointees to the Department of the Interior and the BLM, slowed to a crawl, or completely stopped. Utah filed a lawsuit challenging BLM wilderness idea, and Secretary of the Interior Gale Norton worked to settle it by promising to severely limit any future BLM wilderness actions in Utah. The federal government may be deeply resented in rural areas, and wilderness conservation may be seen as an effort to lock up land and keep residents from exploiting it. The Wilderness Society and nearby environmental groups must persuade the villagers who like the beauty and wildness of their backyard that doing so will probably need passing legislation to safeguard it.

Information from the Field

I reported in The Wilderness Society's News in December 2003 that a small wilderness in the Caribbean National Forest in Puerto Rico had been proposed inside the House and passed, but no one had introduced a companion bill in the United States. At the time, I was on sabbatical working for Sen. Hillary Rodham Clinton in Washington, D.C. for nine months. Senate. I asked Sen. Clinton at the customary Christmas dinner if I might draft a companion measure for the Caribbean Wilderness in Puerto Rico. She inquired with a perplexed expression on her face. Why was there? I informed her that there were 800,000 Puerto Ricans living in New York City, and she agreed that the proposal was excellent!

Both the 1997 plan modification and the first management plan for the Caribbean National Forest had proposed the classification. The El Toro Wilderness Area was planned for the Caribbean National Forest and covers around 10,000 acres. The sole tropical wilderness in the United States would be called El Toro, after the tallest mountain in the forest. System of National Forest Wilderness. Most of the present Caribbean National Forest was declared a forest reserve by the Spanish Crown in 1824, and President Theodore Roosevelt established it as a national forest. It is situated on the western slope of the Luquillo Mountain Range, 25 miles east of San Juan. The forest is also a biosphere reserve, a controlled protected area with an international designation that serves to highlight conservation principles [8], [9].

The forest has the most native tree species of the USFS, as well as 50 different kinds of orchids and more than 150 different kinds of ferns. Many of Puerto Rican residents also get their water from the forest, which is a precious resource. More than 100 species of animals, including the critically endangered Puerto Rican parrot, may be found in the region, which is also rich in biodiversity. The region boasts breathtaking landscape, and peaks within and outside of the region allow you to take in the splendor of the tropical flora. Sailors sailing in the North Atlantic Ocean and the Caribbean Sea, as well as residents of adjacent islands, may see El Toro from several viewpoints around the island. The region has thick vegetation and a mixed evergreen forest that ranges in height from 1,000 meters on the highest points to 30 meters at lower levels. There are cultural or historical elements, such as Taino petroglyphs from Native America.

Abibel Acevedo Vila, the resident commissioner for Puerto Rico, presented a corresponding House measure. The USFS had expressed support for the creation of the El Toro Wilderness Area during a Congressional hearing the previous summer. 24 people co-sponsored the House measure, which also got the Hispanic Caucus' support. The Wilderness Society, Sierra Club, National Wildlife Federation, and the National Hispanic Coalition Council all supported the legislation. A resolution supporting the wilderness region was approved by the Puerto Rico Senate, demonstrating the area's local political backing. Rep. Nydia Velasquez of New York co-sponsored the bill. Rep. Jose Serrano said he will vote yes. In the wilderness, there were no private inholdings and no competing or conflicting interests.

I worked on the congressional drafting of the bill, met with legislative assistants from the House, and got Sen. Clinton's legislative director and assistant, Dan Utech, to approve it. Charles Schumer, the senior senator from New York, was offered as a co-sponsor, and we were able to get his support. The delivery to the Senate cloakroom came next. Yet once the Senate adjourned, the next Congress had to begin from scratch. In the autumn of 2004, the measure was reintroduced and approved. President Bush approved the El Toro Wilderness Act in December 2005.

In the spring of 2005, I traveled to Puerto Rico and trekked through a wet tropical jungle to the peak of El Toro. Despite the gorgeous foggy scenery, I failed to see any Puerto Rican parrots. Remarkably, throughout the three-mile trip, I didn't see a single person! The Caribbean National Forest attracts around 850,000 people annually, many of whom stay close to El Yunque Mountain and associated hiking routes. Sen. Clinton gave me a framed copy of the bill's front cover as a present!

The goal of wilderness stewardship is to keep the wilderness as pure as possible while remaining within the bounds of the law. Administrators must preserve wildness' unique characteristics, according to the Wilderness Act. Maintaining the quality of the air and water is crucial. Protecting solitude is necessary. Favoring activities that rely on the wilderness ought to be given precedence. Specific management goals must be created in collaboration with the public. The Wilderness Act's author, Howard Zahniser, highlighted the "wilderness idea" of conserving regions at their borders and attempting to let natural processes to work inside the wilderness unimpeded by man."

Whatever the biological "purity" of a region was when it was classified, the nondegradation principle inherent in the legislation mandates that it be administered going forward toward the wilderness ideal. The Arthur Carhart National Wilderness Training Center and the Aldo Leopold Wilderness Research Institute were founded in Missoula, Montana, in 1993 to provide management training for all four federal wilderness management agencies. Environmentalists often advocate buffer zones outside of wilderness areas to safeguard it, but government administrators drew the buffers within to guard against highways on the edge. While creating wilderness, Congress emphasized its opposition to buffer zones; instead, they extended the borders all the way to the boundary of a road or development to replace them. Private land holdings within wilderness regions raise the possibility of conflict since people need to have access to their properties. The impacted agency may bargain for a land exchange or a purchase from those with an interest. In 1992, the Wilderness Land Trust was established only for the purpose of acquiring inholdings until the impacted agency had the money to buy it. The Nature Conservancy and the Trust for Public Land both serve comparable national purposes.

Wilderness Regulations at the Present

The Omnibus Public Lands Management Act of 2009, sponsored by Sen. Jeff Bingaman, featured sixteen individual wilderness legislation totalling more than 2 million acres spread over nine states. To avoid being hobbled by a feared filibuster, the Senate convened in a special session on Sunday. The National Landscape Conservation System, a 26 million-acre network of national monuments, wilderness areas, picturesque rivers, trails, and historic sites managed by the Bureau of Land Management, was also formalized by this legislation. The Western landscapes with historical artifacts in their natural surroundings are the main goal of the conservation system.

The Forest Legacy Initiative as well as the Land and Water Conservation Fund

In order to provide funding for the acquisition of at-risk locations inside or near to national forests, parks, and other public areas, the Land and Water Conservation Fund was established in 1964. Offshore oil and gas royalties were to provide $900 million of the funding. For 40,000 projects over 4.7 million acres, the fund has granted $3.5 billion. It has given crucial assistance to the acquisition of inholdings by Redwoods National Park, Everglades National Park, Denali National Park, and the Appalachian Trail. Yet, funding has decreased by 72% over the last 10 years, and only twice in the organization's four decades of existence has the entire sum been granted. The 2008 budget only called for 6% of the $900 million, and just 16% of that amount is moving toward

the stated goal. August 2010 saw the U.S. House approved H.R. Consolidated Land, Energy and Aquatic Resources Act (PL 3534), which contained $900 million in full financing for the Land and Water Conservation Fund. Several provisions were inserted in the law to make it easier to clean up after the Deepwater Horizon oil spill and restore the Gulf of Mexico [10].

The Forest Legacy Program was established to assist states in protecting private forest lands from development, much like the Land and Water Conservation Fund. It does this primarily through the purchase of conservation easements, and to date it has provided funding of $221.7 million for the protection of 1 million acres in national forests. Nevertheless, with just $57.3 million authorized in 2007 and $29 million planned in 2008, it has also had financial difficulties. At the time of its creation, the program had a $100 million annual budget [11].

CONCLUSION

The advantages of wildness are many. There is so much more to wilderness than just a place to camp, trek, or fish. Our water and air are purified by wilderness. It serves as both a habitat for animals and a source of income for nearby towns. A wilderness is a region of land that has not undergone significant contemporary human habitation. Typically, roads, buildings, and other man-made structures are absent from wilderness regions. They provide a natural habitat for many plant and animal species and enable the study of thriving ecosystems by experts. A significant tract of unaltered or little altered land or water that retains its natural character and impact and is preserved and maintained to keep it in that state.

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CHAPTER 21

NATIONAL WILD AND SCENIC RIVERS ACT

Dr. Kiran L Maney, Associate Professor,
Department of Management, JAIN (Deemed-to-be University), Bangalore, India,
Email Id-kiran@cms.ac.in

ABSTRACT:

When the Act was established, the State recognized that many of Maryland's rivers or portions of them and the surrounding land areas have exceptional scenic, geology, ecologic, historic, recreational, agricultural, fish, wildlife, cultural, and other equivalent resource values. In this chapter author is discusses the environmental policy and advocacy groups. To protect the nation's rivers, the National Wild and Scenic Rivers Act of 1968 was enacted. The act states that designated free-flowing rivers with "outstanding remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, and other similar values" "shall be preserved in the free-flowing condition, and that they and their immediate enviro- ments shall be protected for the benefit and enjoyment of present and future generations."

KEYWORDS:

Act, Environment, Endangered, Species, Wild.

INTRODUCTION

As of 2008, the national system protected more than 11,000 miles of 166 rivers in 38 states and the Commonwealth of Puerto Rico; this amounts to less than a quarter of one percent of all rivers in the nation. In contrast, more than 75,000 large dams throughout the country have impacted at least 600,000 miles, or around 17% of U.S. rivers. If certain requirements are met, Congress or the Secretary of the Interior may designate rivers. Each river is managed by state or federal entities. There is no need that the river be separated into several sections, some of which may have tributaries. In the lower forty-eight states, established boundaries for federally regulated rivers normally average one-quarter mile on either bank, and one-half mile on rivers outside national parks in Alaska, in order to protect river-related assets [1], [2].

There are three types of rivers: beautiful, wild, and recreational. In naturally occurring river ecosystems, watersheds or shorelines are those that are mostly undeveloped, devoid of impoundments, often inaccessible unless by road, and feature pure, unpolluted streams. These are traces of ancient America. Scenic river areas are defined as rivers or parts of rivers that lack impoundments, have watersheds that are still mostly undeveloped, and shorelines that are largely undeveloped yet accessible in certain locations by roadways. When a river or a portion of a river is classified as a recreational river area, it must be readily accessible by road or rail, have some development along its coastline, and maybe have experienced some impoundment or diversion in the past. This regulation does not prohibit development on private property inside the designated wild or beautiful river.

Act on Preserving Species

The Endangered Species Act of 1973 created a program for the protection of fragile and endangered plants, animals, and the habitats in which they are located. It is illegal to "take" an endangered or listed species or to carry out any activity that endangers the habitat of the species. Critical habitat is defined for the spotted owl or the snail darter as sufficiently large areas of old growth forest or adequate water flow in the Little Tennessee River, both of which might adversely affect plans for a dam. The law mandated that every department and agency of the federal government work diligently to protect endangered and vulnerable species. In order to preserve international accords with the aim of protecting endangered species, it required the federal government to collaborate with state governments and the United States. Important habitat cannot be destroyed, not even on private land, according to the law. The act's Safe Harbor clause enables landowners to protect habitat in exchange for assurances that stricter regulations won't be imposed on their property.

The principal government body in responsibility of carrying out this legislation is the United States. Fish and wildlife service. This organization has recognized 1,370 endangered species, as required by law. There have only been 39 species removed off the list of vulnerable or endangered species, nine of which have gone extinct. Just fourteen have made enough progress toward delisting; sixteen were removed off the list once it became clear they weren't really in danger. These dismal numbers most likely reflect the political and economic apathy that has surrounded the law. Recent delistings include the grizzly bears of Yellowstone and the Western Great Lakes gray wolves. Polar bears are among the 309 species that have been identified as being in danger of becoming extinct soon. Just 520 species have been designated as having critical habitat [3]. A species that is being considered for listing must go through a scientific assessment and an open comment phase. an examination of U.S. Fish and Wildlife Service and Marine Fisheries Service listings showed that species were more likely to be improving and less likely to be deteriorating the longer they were listed9. As compared to species without crucial habitat, those with it seemed to have a higher likelihood of improving and a lower likelihood of deteriorating.

The Endangered Species Act's emblem, the bald eagle, was the flag of the United States. As the bald eagle has recovered so much from its status as an endangered species, delisting is now being looked at. In 1963, there were only 417 breeding pairs because to the chemical DDT's impact on egg thinning. 6,471 breeding pairs were found in the lowest forty-eight states in 2000. Eventually, in 2007, when there were around 10,000 breeding pairs, the bald eagle was delisted. The Fish and Wildlife Service developed rules detailing what counts as a disturbance in order to implement the 1940 Eagle Act. As defining disrupt did not qualify as a substantial government action, they produced a draft environmental assessment as opposed to an environmental impact statement.

The FWS is required to provide biannual reports under the Endangered Species Act, and the most recent report categorized 1,095 species as still in decline, stable, or improving. Strategies for rehabilitation are crucial. In the final weeks of the Bush administration, the Department of the Interior issued a rule that, in large part, absolved federal organizations like the Army Corps of Engineers as well as the Federal Highway Administration from their obligation to consult independent wildlife biologists or fisheries specialists before building dams or highways, approving the construction of transmission towers, housing developments, or other projects that might harm wildlife that is federally protected. Environmental organizations immediately challenged this decision in court.

DISCUSSION

Environmental Policy and Advocacy Groups

One may say that the undesirable elements of President Franklin Delano Roosevelt's New Deal gave birth to the wilderness movement. Despite the fact that many of the public works projects the New Deal began were successful in their intended fields, others ruined the environment by pushing new roadways through rural places. The Wilderness Organization was founded in 1935 by eight individuals, three of whom were skilled foresters, in order to fight the looming threat of roads and machines entering the last remaining undeveloped regions.

One of the group's founders was the fierce hiker and ardent proponent of land preservation, Bob Marshall. This spirit of informed action continues to motivate the Wilderness Society as it accomplishes its purpose to safeguard wilderness and encourage Americans to care for their nation's rapidly disappearing wild areas, as he once stated that "there is only one prospect of repulsing the totalitarian goal of civilisation to seize every niche of the whole globe." The hope is that group of motivated people who will fight for the wilderness' liberation.

Public lands and national parks: The Wilderness Society has played a unique and important part in the history and maintenance of the federal public lands, a rich and extensive system spanning 623 million acres of deserts, mountains, forests, rivers, and wetlands. This system includes all of the country's national parks, national forests, wild and scenic rivers, and national wildlife refuges in addition to the vast Western territories overseen by the Bureau of Land Management. Some of the wildest, undeveloped regions of these federal property holdings are found under the National Wilderness Preservation System, which boasts a total of 109 million acres of designated wilderness.

The world's highest degree of land protection is wilderness. Just temporary visitors who do not tamper with nature are present here as humans. The establishment of wilderness areas by specific acts of Congress requires that they always be devoid of all human-made structures, including roads and equipment. The designation procedure adds an extra layer of protection to a piece of land, ensuring that its values endure forever. The Wilderness Society is driven by the fundamental conviction that the United States needs both new wilderness areas that have been officially designated for the benefit of its citizens and a well-managed system of public lands. As a result, it is continuously torn between deciding what deserves wilderness protection and what may benefit from other types of protection. Also, it is in charge of making sure that nothing harms the nation's most pristine wild places before Congress has a chance to act to add them to the NWPS.

For more than 70 years, The Wilderness Society has been a leader in conservation, influencing government decisions regarding the types of activities that are allowed on federal public lands, keeping an eye on the policies and practices that have an impact on those decisions, and lobbying Congress to pass legislation protecting wilderness and other types of protected areas. By nature, conservationists take a long-term view of the environment and are always searching for ways to bring politicians, the general public, and policy together in favor of the objective of achieving a healthy and sustainable planet.

Public lands and wildness have a tremendous impact on the health of local communities and the country as a whole, even though this impact is often imperceptible. Although though the bulk of the ecosystem services offered by US public lands are uncounted national assets, the taxpayers who own them nevertheless directly benefit from them. Natural filtering processes clean the

headwaters, which in turn provide drinking water to towns downstream. The importance of federal landscapes in combating the consequences of global warming and providing the nation with renewable energy will increase.

The only complex and diverse land base that the US manages is the National Forest System. The 193 million acres of natural grasslands and forests that the Forest Service oversees are under the Department of Agriculture's supervision. Because of the oxygen they emit and the carbon dioxide they take in and hold, national forests are a vital and active component of the country's "lungs."

When the idea of creating the first national parks was originally put out at the end of the nineteenth century, parklands were appreciated for their intrinsic beauty and were not expected to have any economic relevance. Instead, the cost would be paid by the paying public as parks were beneficial to the general population. From that hopeful beginning, the United States has, however, historically devalued the bulk of the contributions our public lands provide to the wellbeing and economy of the country [4], [5].

The National Wilderness Preservation System's wilderness areas on our public lands serve another purpose. These extraordinary places continue to serve as havens for a diversity of species and, in some instances, as the last untouched environments on Earth that have not been influenced by human activity. Because of this, they act as biological archives and provide a wide range of chances for fresh scientific investigation. It is important to consider the health benefits of just having natural locations around the country where families may enjoy time outside. The easily accessible federal public lands provide a desired alternative to the sedentary American lifestyle and one possible answer for how the nation may begin tackling its mounting obesity epidemic. The spiritual importance of wildness also cannot be overstated in our tense, highly mechanical twenty-first century world. Famous author Wallace Stegner argued that wildness was important only because it existed in his famous "Wilderness Letter." Even if we only visit it once every ten years, he said, "the reminder and consolation that it is still there" is good for our spiritual well-being. He called it the "geogra- phy of hope."

One might begin to understand the allure of wild areas on people and the innate ability of the soil to nurture the human spirit by considering the enormous impact Central Park, a little patch of greenery, has on the city of New York. One seems to feel a shift in energy from the hustle of the urban jungle just by going a few steps off the pavement and into the park's lush meadows. From the Rock and Islands Wilderness in Northern California, which has the smallest wilderness area, to the Wrangell-St. On a bigger, national scale, wilderness areas like Elias Wilderness provide this same kind of relaxation. The Elias Wilderness is made up of 9,078,675 acres.

Political Structure

The federal public lands system is managed and controlled on a daily basis by a number of congressional committees, federal agencies, laws, and administrative regulations. The United States has four major land management organizations. Interior and Agricultural Departments are both cabinet-level agencies. Forest Service, the U.S. the Fish and Wildlife Service, the National Park Service, and the Bureau of Land Management. Each agency is governed by an organic act or analogous piece of law that specifies its objectives and legal responsibilities. Each of these organizations has a main office in Washington, D.C., as well as separate regional, district, or state structures.

The Wilderness Society and other non-governmental organizations need to be aware of all the many tiers of authority and prepared to influence decisions at any level. If activities on any rung of this ladder have the potential to adversely affect a specific wild area or the public lands system as a whole, we must be ready to intervene. The finest and most effective advocate in the fast-paced political climate is fully aware of the steps needed in creating excellent policy and is qualified to oversee some of its implementation. Both producing convincing information to bolster the case for land conservation and establishing solid, nonpartisan relationships with government leaders are crucial steps in the advocacy process. Effective communication with state and local governments, federal agencies at all levels, members of Congress and their staffs on Capitol Hill, even the military, is necessary for conservationists to influence decisions about land use issues. When creating policies that would benefit the greatest number of people while yet being considerate of specific persons and interest groups, a conflict might occur in a democracy. The Wilderness Society's role is to help these people act as reliable mediators in conflicts affecting public lands and wilderness.

The management of public lands in general, especially those whose landscapes are under U.S. The Forest Service has adopted the multiple use and sustainable yield guiding principles. There is continuous discussion over the specifics of what will be permissible on the ground under these rules. The lumber, mining, oil and gas, motorized leisure, and other industries see the public lands as a potential source of expansion and profitability. Hunters, fishermen, hikers, and campers all want privacy, the ability to appreciate nature, and the preservation of species. In many of the same areas where the extractive industries are engaged, supporters of wildness also want to conserve more land in its natural condition. Hence, for both the present and the future, what is the best use of the nation's natural areas? It is up to legislators and administrative rule makers to decide whether to prioritize the land's economic value above its ecological and more spiritual attributes.

Due to the disproportionate power and influence held by groups with access to corporate money in the past, local citizens often had little control over the activities that occurred on their public lands. In order to effect broad change, advocacy organizations joined forces with citizen activists in the 1970s, beginning to modify this equation. They did so on the grounds that every choice on land use must carefully take conservation principles into account. Thousands of like-minded individuals are represented by several organizations from throughout the nation, such as the Environmental Defense Fund, Natural Resources Defense Council, Sierra Club, and Wilderness Society. The members have charged these organizations with keeping the government accountable from the perspective of conservation. By providing expertise and resources in this field, these organizations also support the "green" philosophy and contribute to its legal codification. Stuart Brandborg, who served as the president of The Wilderness Society from 1964 to 1976, described this phenomenon as relying on the "strength of determined individuals who have realized their own power."

Policy and the Wilderness Society

The Wilderness Society engages in public policy on three levels: the legislative branch, where laws are drafted and funds are appropriated; the executive branch, which includes the White House, the four federal land management organizations, and the Council on Environmental Quality; and the judicial branch.

Congress

Today, it is unthinkable for a single person to write the majority of the language for a potential piece of legislation; in fact, under the administration of President George W. Bush, emails were discovered that revealed the content of a piece of legislation had been authored by industry, setting up a muddle. In addition, there were no "sunshine" laws in place at the time, which were established in the 1970s in response to the Watergate scandal and were intended to improve public transparency of governmental institutions. In Zahniser's day, policymaking was significantly less complicated and involved far fewer interest groups. On Capitol Hill, he had immediate access to a less formal style of doing business.

When Capitol Hill is under pressure, laws are created and policies are modified. However, before anyone will pay attention to us, we must establish our credentials. Today's national conservation organizations can claim of a tremendous amount of professional know-how, in part because many who work in legislative offices and government agencies are professionals in their own right. Achieving good national policy at the legislative level depends on finding a core group of congressional supporters who will push an issue. They in turn heavily depend on their staffs, who need to be informed about the wide range of issues at hand and persuaded that the expense of supporting a specific piece of legislation would be worthwhile in terms of political capital invested.

Today, it is abundantly clear that a surprising number of policy issues, spanning a bewildering array of topics, are being debated on Capitol Hill at any given time, making it practically impossible for any one member of Congress to have a thorough understanding of every issue and be able to make informed decisions regarding complex policy issues. For example, a senator or congressman would frequently lack knowledge of the specific location, distinctive ecosystem, or long-term effects of the issue.

Regulation of Governmental Land

The Wilderness Society continuously monitors what is occurring within the boundaries of the public land system, challenges improper behavior, and offers workable solutions to problems with land usage. Many significant statutes provide the framework for the four federal land management agencies' missions, as well as defining what may and should happen on public lands in the United States. The Federal Land Policy and Management Act, passed in 1976, replaced the antiquated public land disposal laws and established the rules for the millions of acres of Western wild areas that the Bureau of Land Management is responsible for managing. The legislation made the process of land use planning the cornerstone of the manner in which the agency administered the property and specified that these properties were to be kept for the long-term use of the American people unless "it is judicious" to do otherwise.

Which geographic areas actually constitute a major environmental threat? How much resource extraction should be authorized before it adversely influences how the American people use the land in the long run? The law may be read in a wide range of ways, which might lead to some puzzling concerns. Doing scientific research and submitting data for inclusion in the public record are both duties associated with the position, but it is equally important to mobilize the public by highlighting problems of concern when those plans change. The public procedures created by FLPMA serve as the foundation for the stewardship of all 258 million acres of BLM property, and personnel from the Wilderness Society frequently comment on each level of the agency's land use planning process to highlight problems of concern when those plans change.

Since the values of wilderness are easily jeopardized by activities like off-road vehicle abuse, oil and gas drilling, hard rock mining, road construction, logging, and other types of development, establishing such interim protection is a crucial step in the process of official wild land designation. The Wilderness Society is particularly concerned about how much of the BLM's property it will reserve in the plans to save as potential wilderness before Congress may move to designate it [6]–[8]. The BLM granted more licenses for oil and gas drilling and exploration between 2001 and 2007 than at any other time in its history, with many of the potential leases located in sensitive, wilderness areas, so monitoring the BLM's responses to an expanding range of requests for access to the land made by industry as well as other interest groups and made outside of the land use planning process makes up a significant portion of the Wilderness Society's conservation portfolio. Off-road vehicle misuse by all-terrain vehicles and dirt motorcycles has likely emerged as the single biggest threat to the survival of wild lands in places like Utah and across the West in general. This issue raises the question of how much, what sort, where and recreation should be permitted on our public lands. Enhancement to the National Wildlife Refuge System Act For more than a century, the U.S. Fish and Wildlife Service operated the 150 million-acre National Wildlife Refuge System under a number of statutes. However, that legislative gap was closed in October 1997. To ensure that the refuge system would be managed as a nation, a comprehensive piece of legislation known as a "organic act" was passed.

The legislation also established a new process for determining the activities that would be regarded as "compatible uses" for refuge areas. The refuge organic act gives the nation's wildlife refuges a clear and focused wildlife conservation objective and directs the Secretary of the Interior to preserve the system's biological integrity, variety, and environmental health. NWRSIA provides direction and legal boundaries for the Fish and Wildlife Service and outside interest groups promoting a particular viewpoint on how refuge landscapes should be maintained. For example, the key question in the current debate over whether to build a road through the Izembek National Wildlife Refuge throughout Alaska to connect the small settlements of Kings Cove and Cold Bay is one of compatible usage [9].

It was created in 1976, in part as a result of the uncertainty surrounding the policies that were then in control of America's national forests, and its stated goal was to provide forest management strategies that the public and the wood business could both understand. The National Forest Management Act was the most comprehensive piece of forest law passed since the Forest Service was founded in 1905. Although the NFMA did not expressly forbid clear-cutting, it severely limited its use and directed the Forest Service to conserve species variety rather than merely maximizing the development of trees that are advantageous for commercial purposes. The legislation also required that, if all multiple use goals are met, the sale of wood from each forest be restricted to an amount that is equal to or lower than that of the amount of timber that the forest could sustainably produce [10], [11].

CONCLUSION

There are inherent inconsistencies between the federal departments of interior and agriculture and both organizations are involved in wilderness environmental policy. For example, forestry practices aim to increase the sustained production and varied uses of forests, which makes it harder to safeguard wildness, however the National Park Service's main goal is to preserve the environment. Of the government agencies, the Bureau of Land Management is the least skilled at ensuring environmental protection.

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CHAPTER 22

A BRIEF STUDY ON ADMINISTRATIVE ACTIONS

Dr. Seema Sambargi, Professor, Department of Management,
JAIN (Deemed-to-be University), Bangalore, India,
Email Id-dr.seema_sambargi@cms.ac.in

ABSTRACT:

A legal action involving the behavior of a public administrative body is known as an administrative action. For instance, this kind of action may result in the overturning of specific decisions made by public organizations or may require an authority to adopt a certain step. In this chapter author is discusses the administrative appeals and the courts. The four federal land management agencies are entrusted with carrying out the laws that Congress enacts on public lands. These organizations are in charge of carrying out the law locally, and they put forward the rules and regulations that specify how a particular law will be carried out on the ground. An agency's daily choices and operations will be governed by the limitations and guidelines created via the rule-making process.

KEYWORDS:

Agency, Administrative, Environment, Legislation, Rule.

INTRODUCTION

Environmental groups like the Wilderness Society must now possess significant knowledge of how to negotiate the complicated regulatory system as required by law. It is no longer sufficient for them to comprehend the most minute aspects of a specific problem. Interest groups must acknowledge the limitations that government agencies must operate within and appreciate the discretion they have when designing solutions if they are to effectively influence land use practices and sustain the health of the land [1], [2].

Law Making

The Forest Service, Fish and Wildlife Agency, Park Service, or Bureau of Land Management are not the only agencies that create regulations that apply to federal public lands. Other federal agencies may also have rules that they make and apply that have an effect on the land. For instance, the Environmental Protection Agency was in charge of a strong regulation in 1999 that was supported strongly by the general people and focused on the impact of air pollution on natural regions that may be hundreds of miles from the source of the pollution. The EPA released the Regional Haze Regulation on the grounds that it had a duty under the law to safeguard Class 1 natural sites in response to the fast deterioration of air quality and rising loss of "viewsheds" inside several famous parks. The law requires 156 national parks and wilderness areas, including the Grand Canyon, Yosemite, the Great Smoky Mountains, and Shenandoah, to work together to increase visibility. Regulation of industrial emissions into the atmosphere for their longer-term environmental impact downwind was one of its many effects. For the first time, the new standard required industry to take into account both the health of the nation's natural resources as a whole and the consequences of its emissions on city people who live close to a chimney.

The opposite side of rule-making is shown by a last-minute regulation that was passed in the last weeks of President George W. Bush's administration. The regulation gave federal agencies the freedom to make their own decisions on whether roads, dams, mines, and other construction projects would jeopardize threatened or endangered species without taking into account the opinions of government scientists. The mandated, impartial evaluations that government scientists had conducted for 35 years were effectively removed under the new approach. The rule also forbade federal agencies from determining whether a development project contributed to global warming while analyzing the project's impact on species. The conservation community took a severe hit from this judgment, and any species on the verge of extinction may have died as a result.

A land management agency is required by the Administrative Procedures Act's formal federal rule-making procedure to consider public opinion before any proposed rule becomes the government's official policy. This directive gives the conservation community an exceptional chance to add substance to the official record and provide a voice to their members and other important stakeholders before the final decision is reached. It compels agencies to solicit and take into account public opinions. These same stakeholders have the option to challenge a decision via the process if it seems the agency overlooked important facts or would break the law if it continued on the path it has set with the new regulation [3]. The regulatory framework does not totally dictate how the federal agencies act. During the 1990s, it has been customary for government representatives to attempt to alter the method of land management by using other, less formal administrative methods. The Secretaries of the Interior and Agriculture, for instance, are permitted to provide "instructional memos" to their staffs outlining how an agency would handle certain circumstances moving forward.

These internal measures, practically by fiat, may be some of the most effective weapons an administration has at its disposal for implementing changes to public policy without consulting the American people, even if they are not as well known as legislation or rulemaking. The director of a federal agency may, with a single stroke of a pen, order his or her employees to modify the way they do business on the ground, unlike new rules, which must be implemented via an open public process, or establishing a law, which requires legislative approval and action. Because of the potential for abuse, part of our responsibility is to ensure that the regulatory process isn't unlawfully replaced by the secretaries' ability to act.

When then-Secretary of the Interior Gale Norton released a new instructional memo to field employees in 2003 based on her analysis of the FLPMA Act, the Wilderness Society first saw the effects of such a document. The message instructed them to cease inventorying and safeguarding more areas with wilderness-like qualities. The conservation community didn't have many options for challenging the decision, short of persuading Congress to pass legislation that would overturn her instructions. The property was protected from a variety of possible dangers throughout the course of the next five years by wilderness advocates in an effort to prevent invasions from oil and gas development or unrestrained misuse by off-road vehicles.

Administrative Appeals and the Courts

Making an appeal to a higher authority when a federal agency breaches environmental laws or its own rules, activities that may cause harm to the land, is another part of the public policy approach. Congress made it possible for the public to comment on proposed plans and actions of an agency, challenge its decisions if necessary, and have them subjected to judicial scrutiny via land use planning procedures and statutes like the National Environmental Policy Act [4], [5].

DISCUSSION

A federal agency's impartial personnel often makes up appeals review board, which is typically where an administrative appeal would be addressed. Their task is to examine the conflict from a different angle. It could be required to take the matter before a federal court for resolution if an internal appeal is unsuccessful and there is no higher authority to step in. Once the court finds that the injured party has legal standing in the action, a lawsuit with written papers and a hearing may go forward. What is frequently overlooked is the crucial watchdog role the community plays in ensuring that the government abides by the rules that the public helped create and the laws established by elected members of Congress. Over time, the environmental community has developed a reputation for causing "too many lawsuits" and "tying things up in court." Federal authorities must always abide by the law, even if it is undoubtedly very difficult for them to achieve the right, very delicate balance among conflicting interest groups. Administrative and judicial appeals provide all parties the opportunity to argue in favor of or against official decisions [6].

Local activism

Above all, advocacy groups need to have credibility, and a big element of credibility is understanding that there are local and national answers to land use issues. The National Wilderness Preservation System has expanded over almost 50 years as a direct consequence of locally focused grassroots effort, despite the fact that the Wilderness Act of 1964 constituted a national legislation. Most wilderness legislation are successful when local stakeholders, such as minor conservation advocacy organizations and local residents who live close to a proposed wilderness region, agree that its designation will be advantageous to their community.

Before signing on to support a wilderness bill, members of the House or Senate want to make sure that a significant portion of the people who live in their districts are in favor of it. Much better if local media, state, and county leaders support the measure. On occasion, the state's governor will also come out in favor of wildness. Most wilderness legislation is nonpartisan. Senators and representatives from other states often support wilderness designation if the delegation from the state where the new region is situated requests it during the horse-trading on Capitol Hill. Wilderness law does not call for spending money to increase the public estate since designation concerns properties that are already in the public domain. These legislations just increase the protection provided to a section of it.

It is not simple to reach the tipping point, the ideal degree of support from all relevant parties. Every time conservation organizations wish to increase public support for a piece of legislation or have an impact on choices made by government agencies about what occurs on the land, they have a difficult task ahead of them. Public education on a large scale is a process that takes time, knowledge, and persistence. Yet on occasion, it has taken decades of labor to raise public awareness and support for very divisive and sensitive causes like preventing oil and gas development in the Arctic National Wildlife Refuge. The conservation community must build a strong argument before telling people what they want or need in their backyards. To provide the scientific foundation for a proposal, the procedure may include doing original research or conducting library searches. To gauge public opinion, it could also be necessary to invest in local, regional, and national polls. Communications professionals will present the topic to conventional and internet media once the facts are in place in the hopes that the media will find the problems fascinating and relevant enough to cover. While this is going on, other staff members need to be out in the community, attending neighborhood gatherings, interacting with local leaders like

mayors and county commissioners, and fostering relationships and discourse with neighborhood clubs, business associations, and faith-based organizations. The worth of their cause must be made clear to these groups in order for conservationists to persuade them to listen to them. Also, environmentalists encounter resistance. The same type of effort is often made by opponents to attempt to persuade local stakeholders that wildness is not the best use for the property. The problem could start to gain traction if and when the "noise"' around a specific land use argument from the grassroots and the media grows loud enough for Congress or a government agency to take attention. When people band together to effect change, whether they are members of a national conservation group or a rural town located close to the boundary of a parcel of federal property, political power geometrically rises.

Future of the Wild

The approaching global warming catastrophe may be the most important of the many reasons to keep reserving more undeveloped wilderness in the twenty-first century.

Areas Without Road

The conflict over national forest roadless areas possibly the most well-known forest problem of the twentieth century has not yet been chronicled in its entirety. Yet if it were documented, the drama would describe a protracted journey through administrative procedures, the legal system, and land use planning. A second significant shift in forest policy began to emerge in the 1980s about the same time the new national forest planning process got underway, this time on the front of wildness. On national forest holdings in twenty states, the House declared 6.8 million acres of additional wilderness in 1984. The properties they decided to designate had been a part of the RARE II process, which the Forest Service had started ten years earlier. Once Congress took action, the remaining 58.5 million unroaded acres of the RARE II lands that were not included in its wilderness package were left in limbo and released back into individual forest planning procedures. What would happen to these pristine regions was a significant question that remained unresolved. In the future, how would the agency handle them?

The Wilderness Society invested significant organizational resources to find ways to protect the roadless areas until Congress could take a second look at them as potential wilderness candidates. This was done because they did not want to lose so much potential wilderness either by direct encroachment or default. We pushed the Forest Service to preserve each area's wilderness character and sent ecologists and economists to undertake studies to show how important these areas are to plant and animal species as well as human communities as well as to show how expensive resource exploitation is. The environmental movement as a whole was also increasing public anxiety about their potential loss by increasing public understanding of the considerable advantages that the country derived from its roadless woods.

With a system that includes 144 national forests and grasslands, the fight to protect the last remaining undeveloped forest areas has lasted for more than 20 years, often forest by forest. Years after these lands were first identified through the RARE II process, the Clinton administration finally issued the Roadless Area Conser- vation Rule, which was adopted in January 2001, in response to growing public concern and concerns about the economic justification for having taxpayers subsidize new logging roads into pristine forests. The Roadless Rule, which broadly forbade road construction and logging in all 58.5 million acres of inventoried roadless regions, garnered 1.7 million public comments, making it the most thorough public engagement process in the annals of federal rulemaking.

Despite the evident and historically high level of popular support for the Roadless Rule, it encountered significant difficulties once President George W. Bush assumed office. The Clinton-era regulation was hindered by the new administration's persistent undermining of its provisions and failure to defend it in court because it did not respect the rule. In an effort to give states more control over what occurred to roadless areas on federal property, the Bush administration tried to replace the national regulation in 2005 with a state petition process. Conflicting rulings and recommendations Alaska's coastlines are eroding quickly; birds have started migrating further north for the winter; the spread of insect infestations is destroying trees and causing devastating wildfires; and iconic wildlife species are changing their migration patterns or going extinct. America's public lands are the country's biggest and most extensive system of wild lands, and wilderness areas are some of the country's few remaining huge, complete habitats. As the climate continues to change, no one is yet certain what will be required for species adaptability. Maintaining the untamed areas that we all share gives us the most freedom during turbulent times. If we don't provide them ample room to travel and develop, where will native animals go when their habitats become smaller or disappear altogether?

According to some estimates, the lower forty-eight states and Alaska have at least 200 million more acres of potential wilderness. The Wilderness Society is aiming for those potential acres in order to realize the long-term vision our founders had for the United States. As significant as these landscapes are, the Wilderness Society nevertheless acknowledges that only federally declared wilderness will ever be able to conserve the complete range of varied species and life-sustaining processes required to maintain our country in the post-industrial period. Politicians and the general public must start thinking more widely and coming up with fresh approaches to the climate crisis. The solution may entail creating more migration routes by joining state and private properties to the federal estate. It could entail spending much more money on the federal land management organizations in order to provide them the resources they need to manage the land for global warming and protect vital ecosystems and watersheds. We must all remove the mental barriers that were erected by humans to prevent us from experiencing nature's activities in their whole and unity.

Our ability to usher in this new age of greenhouse gas reduction and environmentally responsible use of renewable energy sources is the secondary problem. By building the infrastructure for renewable energy—transmission lines, wind turbines, and other facilities—in a manner that harms delicate, untamed landscapes, we would be making a serious error that would exchange one environmental issue for another.

A new land ethic must make sustainability its guiding concept and show itself in our policies, laws, and everyday actions. If we stay committed, wise, and prepared to treat the natural world with respect and care, our wildest places have a bright future.

The Clean Water Act and Water Ecosystems

The obvious contamination of lakes and streams in the 1960s gave rise to concerns about clean water, which culminated in a surface fire of oil and organic pollutants on the Cuyahoga River, which flowed into Lake Erie and Cleveland, Ohio. The Federal Water Pollution Control Act of 1948 was the first significant U.S. statute to combat water pollution, but it was approved long earlier. Wide-ranging revisions to the legislation, known as the Clean Water Act, were made in 1972 and again in 1977 as a result of growing public knowledge of and concern about water pollution prevention.

Clear Water Act

The foundational framework for controlling pollution releases into American waterways was created by the Clean Water Act. It maintained existing requirements to set water quality standards for all contaminants in surface waters, gave the Environmental Protection Agency authority to implement pollution control programs, such as setting wastewater standards for industry, and made it illegal for anyone to discharge any pollutant from a point source for example, a factory site into navigable waters without a permit. It forbade the release of pollutants in dangerous concentrations, provided funding for the development of sewage treatment facilities via the construction grants program, and created the technology required to stop the release of pollutants into navigable waterways. The Clean Water State Revolving Fund was developed to address water quality concerns by expanding on EPA-state cooperation. The Clean Water Act also acknowledged the need for planning to address the serious problems presented by non-point source contamination. It offers loans and subsidies for estuary preservation, non-point source pollution reduction, and sewage treatment.

The preservation of surface water quality in the US is based on the Clean Water Act. The law makes use of a range of regulatory and nonregulatory mechanisms to regulate contaminated runoff, fund municipal wastewater treatment facilities, and drastically limit direct pollution discharges into waterways. With the help of these instruments, the nation's waterways are being restored and kept in good condition so that they can sustain enjoyment in and around the water as well as the preservation and growth of fish, shellfish, and other animals. The EPA, states, and Native American tribes primarily concentrated on the chemical parts of the integrity aim for many years after the CWA's enactment in 1972.

Yet, during the last 10 years, physical and biological integrity have received increased focus. Chemicals include things like PCBs, phosphates, and hydrocarbons, and physical and biological integrity is concerned with complete river ecosystems. Additionally, during the first decades of the act's implementation, little attention was paid to the runoff from streets, construction sites, farms, and other "wet weather" sources, instead efforts were concentrated on regulating discharges from conventional point source facilities like municipal sewage plants and industrial facilities. The main options for non-point source runoff, including farms, are voluntary initiatives like cost sharing with landowners. The EPA uses a regulatory strategy for wet weather point sources, such as urban storm sewage systems and construction sites. During the last ten years, the EPA's CWA initiatives have evolved from a program-by-program, source-by-source, and pollutant-by-pollutant strategy to a more comprehensive watershed-based approach. Protecting good waterways and restoring damaged ones are equally important under the water-shed concept. The primary objective is to include stakeholder groups in the formulation and application of plans for attaining and maintaining state water quality and other environmental objectives [2], [3].

In order to monitor and control stream flow by constructing or granting permits for dams, the CWA required that EPA coordinate actions of other federal agencies, such as the Corps of Engineers, the Bureau of Reclamation, and the Federal Power Commission. As watersheds cross state boundaries, the CWA promotes federal, state, and interstate cooperation. The CWA instructed the EPA to establish field labs and conduct research and surveys on the outcomes of the detrimental impacts of pollutants on human health or welfare. Research subjects for waste oil and pesticides were especially emphasized. Understanding freshwater ecosystems was the focus of research, which included collaboration between states and environmental groups at river study centers. Waste management, recycling, and sewage treatment were all to be integrated, as were industrial and

municipal wastes, including but not limited to solid waste, waste heat, and thermal discharges. The construction of the waste treatment facility included cost sharing, with the government portion starting at 75% and subsequently falling to 55%. Innovative awards may be able to get a larger federal proportion.

The CWA gave the EPA the mandate to support and assist in the implementation of a Long Island Sound Comprehensive Conservation and Management Plan. Due to excessive nutrient runoff and sluggish tidal movement, which takes time to clean out the runoff, the western part of the Sound is severely eutrophicated. The extra nutrients promote the development of phytoplankton and algae, which reduces the amount of oxygen in the environment. Fish and other aquatic life experience large die-offs throughout the summer due to hypoxia. It damages the natural marine habitat and is expensive for activities like commercial fishing, water sports, and even lying out in the sun on the public and exclusive beaches along the Sound. The goal of 61.5% nitrogen was agreed upon by New York and Connecticut.

In order to cleanse municipal waste and prevent phosphates from entering Shagawa Lake, which flows into the federal Boundary Waters Canoe Area Wilderness, Ely, Minnesota, was awarded a $2.3 million demonstration grant. Phosphates were a factor in the harmful algal blooms that occurred from July to September and were treated with copper sulfate using a boat that crisscrossed the whole lake. It required the tertiary treatment more than 20 years to decrease algal blooms. Tank models anticipated a reduction in phosphorus concentration from 51 to 12 micrograms per liter, however the amount only fell to 29 micrograms. The only obvious biological shift occurred in May and June, when the content of chlorophyll decreased by 50%. Blue-green algal bloom issues persisted throughout the 1980s and into the late summer. Studies in Ontario's Experimental Lakes Region revealed that phosphorus, not nitrogen, was the main nutrient responsible for algal blooms. By using a plastic screen, scientists split a research lake in two. The remarkable algal bloom that resulted from the addition of phosphorus to one area prompted legislators to gradually remove phosphate from detergents.

Parts of the Clean Water Act have been impacted by later legislation, such as Title I of the Great Lakes Essential Programs Act of 1990. By signing the Great Lakes Water Quality Agreement in 1978, the United States and Canada promised to minimize a number of hazardous contaminants in the Great Lakes. This statute put that agreement into effect. The EPA was asked again to set water quality standards for the Great Lakes, addressing the maximum levels of 29 hazardous contaminants that are acceptable for people, animals, and aquatic life. Also, EPA has to work with the states to adopt the standards according to a set timeline. In order to maintain and rehabilitate Lake Erie, a wastewater management plan had to be created.

To protect the delicate ecology of Lake Tahoe, the EPA was required to investigate the Tahoe Basin environment. To execute and coordinate research, as well as to enhance the water quality and living resources in the Chesapeake Bay ecosystem, a Chesapeake Bay Program was approved. The Chesapeake Bay Program, Great Lakes Program, and Gulf of Mexico Program are all coordinated by the National Coastal Water Program. The twenty-nine coastal states with federally approved coastal zone management plans were mandated by the Coastal Zone Management Act Reauthorization Amendments of 1990 to create and submit coastal non-point source pollution control programs for approval by the National Oceanic and Atmospheric Administration and EPA. States were obliged to establish management plans for certain types of runoff and erosion, to assess non-point sources, and to determine whether coastal regions might be adversely impacted by particular land uses [7].

The Ocean Dumping Act of 1972 made it illegal for any American ship leaving a U.S. port to dump ocean waste without a permit in any ocean seas under U.S. jurisdiction. The legislation also includes provisions for establishing marine sanctuaries, carrying out research on ocean discharge, and keeping track of the water quality along the coast. pollution reduction from both point and non-point sources, with a maximum daily load decrease from 4,552 pounds to 1,768 pounds. To preserve such waterways, each state must identify waters that are at danger and set total daily maximum loads. The four Westchester County sewer districts that border the Sound will see a $235 million tax hike to repair sewage treatment facilities. Taxes are collected by the sewer district. An increase of $350 per home will be required to pay for the improvements in order for Long Island Sound to satisfy federal criteria.

The TMDL is established following research into the unique characteristics of the water body and the pollution sources that contribute to the noncompliant status. Water quality standards are hazard-based criteria that specify site-specific permitted pollutant limits for particular water bodies. An implementation plan that specifies the steps required to lessen the pollutant loading of the noncompliant water body and bring it into compliance is created when the TMDL assessment is finished and the maximum pollutant loading capacity is established. Since less than 5 mg/L of dissolved oxygen will kill sensitive aquatic species, the TMDL objective is dissolved oxygen because bacterial metabolism of carbon compounds prevents that level from falling below that level downstream of the discharge. In the next 15 years, there will be more than 60,000 TMDLs planned or under development for U.S. waterways. The CWA mandates public participation in the creation of TMDLs. To preserve the integrity of waterways, water quality standards are based on bicriteria, chemical concentrations, and antidegradation. As they also take into account factors like temperature, dissolved oxygen, sedimentation, the state of various aquatic ecosystems, and other factors, bicriteria are complicated. Almost half of the rivers, lakes, and bays regulated by the EPA were unsafe for swimming and fishing as of 2007 [8], [9].

CONCLUSION

Nonprofit organizations that advocate for the environment disseminate knowledge about it to safeguard public health. This applies to the land, water, and air. Concerns over land, especially wilderness, are the focus of the Wilderness Society. There are still 200 million acres that are preserved after more than 100 million. These organizations' activities center on establishing environmental policy via legislation in Congress, executive agency regulations, and legal action when it seems that a federal agency is breaking the law. Environmental organizations may sue or participate as friends of the court in federal litigation, and they have access to the staffs and members of Congress as well as the staff and political appointees of the executive branch. They have sizable memberships that may directly affect public opinion via letters, media articles, sponsorship for non-profit research projects, and local advocacy for a wilderness area or environmental solution. They represent activism's grassroots. Last but not least, many of their members' vote.

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CHAPTER 23

A BRIEF DISCUSSION ON CLEAN WATER ACT REGULATIONS

Dr. Anita Walia, Assistant Professor,
Department of Management, JAIN (Deemed-to-be University), Bangalore, India,
Email Id- anita@cms.ac.in

ABSTRACT:

Clean, safe water is defined by the USGS as "water that won't hurt you if you come in touch with it." While drinking water is often mentioned when discussing clean water, clean water is also crucial for all residential uses. In this chapter author is discusses the water-borne diseases. Direct emissions into navigable waterways are regulated by the National Pollution Discharge Elimination System, which was created under the CWA. Forty states run the NPDES program in accordance with EPA approval and requirements. The kinds of contaminants contained in the facility's wastewater must be quantified by the permit application. After that, the permit will outline the terms and effluent restrictions for emissions from a particular plant.

KEYWORDS:

Amendment, Act, Environment, Violation, Water.

INTRODUCTION

The CWA of 1972 mandated technology-based effluent restrictions in addition to adding the permit. Without taking into account the circumstances of a specific receiving water body, the EPA defined the requirements for groups of dischargers based on the effectiveness of pollution control methods. By adopting a fundamental national discharge standard for all facilities within a category using the greatest technology available, Congress aimed to level the playing field. More recently, NPDES permits mandate that regulated communities utilize best management practices to cut pollution to the "greatest degree practical." Because each permit must be made public, environmental groups and individuals have the chance to influence crucial public policy choices. Several state permitting organizations are prepared to send out notices of permission requests before the permit is even written. Creating a rapport with agency personnel may help the public get information about permits more quickly. If there are sufficient requests or if the discharge permit is contentious, there may be a public hearing when considerably more information may surface. After the public hearing, there could be a chance to challenge the judgment or even file a lawsuit in state or federal court [1], [2].

There are 126 prioritized pollutants according to the EPA. Operations that concentrate aquatic feeding are direct dischargers and need an NPDES permit. The EPA was obligated by the 1987 CWA amendments to create a program to address storm water discharges. Storm water concerns must be followed while obtaining NDPES licenses for both industrial dischargers and municipal waste treatment facilities. The EPA uses civil enforcement operations, criminal prosecution, and citizen lawsuits to enforce these requirements. The CWA allows for fines of up to $31,500 each day of infringement.

Wastewater Treatment and the Clean Water Act

Sludge or biosolids are residuals from wastewater treatment that are governed by the CWA. It took 10 years to create this guideline because there were so many toxics and exposure routes to take into account. The hazards to the environment and human health were judged to be very minimal, despite all the safety and uncertainty elements that were included into the procedure. Rainfall or snowmelt flowing over and through the ground is the main cause of non-point source pollution. It takes up and transports away both natural and man-made pollutants before depositing them in lakes, rivers, wetlands, coastal waterways, and subterranean sources of drinking water. Fertilizers, herbicides, pesticides, oil, grease, hazardous chemicals, silt, salt, bacteria, and nutrients are examples of non-point pollutants. In order to lessen or avoid non-point source pollution, the EPA and the states support and encourage producers to utilize best management practices.

The 1987 CWA amendments created a National Estuary Program to preserve the integrity of whole estuaries, including their chemical, physical, and biological features. With its Spill Prevention Control and Countermeasures Program, the EPA issued rules to address oil spill prevention. These laws also apply to farms and gas stations that have huge underground storage tanks. The CWA applies to wetlands; covered activities include mining operations, gravel fill for infrastructural development, and water resource projects. Congress is required to receive a biannual report on the country's water quality from EPA and the states. The EPA approved lists that were clearly incomplete in the 1990s, which led to multiple public interest organizations around the nation suing the agency and winning their cases. Material from this study is used to create "impaired waterways lists." When a body of water is added to the list of impaired waters, it joins a long list of others waiting to go through the TDML procedure as mandated by the CWA. This method defines the problems, identifies the sources of pollution, decides what pollution reductions are required to address the issues, and assigns accountability for necessary actions. Plans for additional and new releases are subject to further scrutiny after impaired waterways are listed. One-fourth of all houses and small businesses in the country use septic tanks to treat their wastewater; every year, 10%–20% of them fail. The EPA and fourteen national organizations have come to a voluntary agreement to address broken systems and the damage they pose to groundwater quality [3]–[5].

Violations of CWA's Regulations

More than 23,000 manufacturing facilities and other places of employment have broken the CWA more than 506,000 times since 20053, with the violations ranging from failing to report emissions to dumping toxins at levels that regulators believe may be linked to cancer, birth defects, and other diseases. Most of these polluters have gotten away with it. Clearly unlawful dumping has been regularly disregarded by state authorities, and the EPA has often refrained from taking action. Between 2004 and 2007, the most recent year for which there is full data, the number of facilities infringing the CWA increased by more than 16%. The workloads and resources of the state Departments of Environmental Protection have grown, but the EPA has committed to put more pressure on the states to improve their enforcement record right away. Another issue is that some businesses are pumping contaminated water into the ground, which ultimately contaminated the groundwater that is drawn from via artesian wells to provide drinking water. It is necessary to expand the CWA to control other, mainly unrestricted forms of pollution, such as agricultural and livestock runoff [6], [7].

DISCUSSION

Wetlands are protected under the Clean Water Act. Legal disputes have arisen about the CWA's applicability to intermittent waterways that may or may not be navigable and may or may not constitute wetland areas. Prior to doing any work or construction affecting wetlands, the Army Corps of Engineers must provide the necessary regulatory permits, according to the CWA. This includes the development of real estate on land that could include wetlands. The CWA was affirmed in 1985's U.S. v. Riverside Bayview Homes, Inc. case for regulating wetlands that overlap with navigable waterways.

The Clinton Clean Water Action Plan set a target of preserving 100,000 acres of wetlands from 1997 to 2005. The court has addressed what is considered a wetland. In the case of Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, U.S. In 2001, the Supreme Court ruled that the United States lacked jurisdiction over "isolated" wetlands frequented by migrating birds. In Rapanos v. U.S., a majority of the Supreme Court defined "navigable waterways" and "waters of the U.S." The Court affirmed the "significant linkage" test and ruled that the federal government required a strong relationship between navigable federal waters and wetlands. Environmental organizations saw the revocation of protection for up to 60% of the country's waterways and 20 million acres of wetland as a significant setback. As regulators lacked information on whether the streams and wetlands in issue were included by the statute, more than 400 suspected legal violations cases nearly half of the EPA's total docket were withdrawn or postponed. Sen. Russ Feingold responded by introducing the Clean Water Restoration Act in 2007, declaring that Congress intended to safeguard all waterways. Twenty-three senators and 162 other People co-sponsored the measure in the U.S. in 2010. Representatives' House.

Act to Protect Drinking Water

In reaction to outbreaks of water-borne illnesses and rising chemical pollution of public water supplies, the Safe Drinking Water Act was passed in 1974. According to the SDWA, the EPA has the authority to determine maximum contaminant levels for hazardous substances, germs, and viruses that may live in water. The greatest amount of a pollutant permitted in drinking water is determined by MCLs, which are enforceable regulations. Each state creates a source assessment plan for the drinking water in each district, requiring the public to be informed about the source of the water and the pollutants present.

Water Pollution with Arsenic

Pesticides, highly soluble arsenic trioxide stocks that have contaminated ground waters, mineral extraction and processing wastes, additives in poultry and swine feed, and arsenic contamination sources include all of these. During 1942, the U.S. The first drinking water arsenic standard was established by the Public Health Service at 50 mg/L, and in 1986, Congress ordered the EPA to establish a new level by 1989. The EPA calculated that exposure to 50 mg/L would increase the risk of skin cancer by 1 in 400 and the risk of internal cancer by 1.3 per 100 people.4 In 1996, Congress instructed the EPA to establish the new standard by 2000, and under President Bill Clinton's administration, the EPA established a new arsenic standard of 10 parts per billion in January 2000.

The Ganges River delta in West Bengal, India, and Bangladesh has the worst arsenic-related health issues. There are 36 million people who might become sick from drinking water with high arsenic levels, according to estimates. In addition to lung, bladder, and skin cancers, arsenic poisoning

causes keratoses on the palms and soles of the feet and changes in the upper chest's coloring. Since at least many decades ago, 100,000 to 200,000 persons in Taiwan have a higher than average risk of exposure to arsenic. After accounting for age, sex, and cigarette smoking, epidemiological studies from Taiwan showed increased mortality from lung and bladder cancers, which all sites combined in a dose-response fashion. Bladder cancer mortality rates for those with more than 600 mg/L of arsenic in their water were more than 30–60 times this same rate in the unexposed population. There was a synergistic interaction ranging from 32% to 55% between the two factors. Blackfoot disease, which can be found in southwestern Taiwan, is a progressive arterial occlusion that causes gangrenous appearance of the feet in affected patients. The prevalence ranged from 6.5 to 18.9 per 1,000 people and was correlated in a dose-response manner with arsenic exposure with hyperpigmentation, hyperkeratosis, and skin cancer. Implementing tap water decreased the frequency of the condition and allowed for the demonstration of subclinical peripheral vascular disease. Arsenic's atherogenicity may also be linked to oxidative stress, endothelial damage, smooth muscle proliferation, and hypercoagulability. In Taiwan's blackfoot disease endemic region, those who had more arsenic exposure and less ability to methylate inorganic arsenic had a higher chance of developing peripheral vascular disease. Arsenic amplifies the dihydrofolate reductase gene, although mutation has not been shown.

Bangladesh's groundwater has been impacted by arsenic as well. Assuming that the water would be free of bacterial contamination, about 4 million tube wells were drilled into aquifers at depths of 40 to 300 feet, and sometimes much farther. The government of Bangladesh and UNICEF installed tube wells all around the nation with the main goal of avoiding cholera and other diarrheal illnesses. These wells have been designed to provide safe drinking water using basic technologies at a low cost since the late 1960s. Millions of lives were saved by the tube well initiative, but it also caused a massive arsenic tragedy11: out of the 60 Bangladeshi districts, 50% had arsenic concentrations over the country's acceptable limit of 50 mg/L, with the highest concentration being 2,970 mg/L. 7,500 people had arsenicosis diagnoses in 40 regions. Ahmad and colleagues evaluated the pregnancy outcomes of 96 arsenic-exposed patients and 96 matched controls since arsenic breaches the placental barrier.11 They discovered a considerably higher risk of spontaneous abortions, stillbirths, and preterm deliveries in the arsenic-exposed group.

Water-Borne Diseases

Over 1.1 billion people lack access to sand-filtered and chlorinated clean water, and 2 billion lack basic sani- tation, which together form a hidden catastrophe affecting more than a third of the world's population. This contributes to cholera, hepatitis A, typhoid fever, giardia, legionella, and shigella dysentery, among other water-borne illnesses. In Milwaukee, Wisconsin, there was a cryptosporidiosis epidemic in 1993 that affected 400,000 individuals and claimed fifty-four lives. This was caused by problems with physicochemical drinking water purification, which has sparked interest in other techniques for water disinfection. Milwaukee has two facilities for treating water that had been drawn from Lake Michigan. Water turbidity at the southern plant increased as a result of livestock manure entering the lake nearby the southern water treatment plant from two rivers and a sewage treatment facility. This significant diarrheal epidemic was caused by inadequate public health monitoring. Several drinking water treatment facilities are considering sequential disinfection schemes because they are particularly successful in preventing the growth of Cryptosporidium parvum oocysts. Unfortunately, these new techniques could not completely destroy viruses.

Ecosystems Around Water, the Environment and Public Health

The projects to remove the dam and divert the water of the Klamath River. Wild rivers are protected by the National Wild and Scenic Rivers Act, although dams, canals, highways, and other development have had a negative impact on rivers and marshes. There may be sections of rivers that cross many states that are categorized as wild, scenic, or recreational. A classic example of dueling river/water interests is the 250-mile-long Klamath River, which has designs in both California and Oregon. The Klamath River in the Klamath National Forest was requested to be named a beautiful river by California Governor Jerry Brown in 1981. The Bureau of Land Management designated the same river in Oregon as a scenic river. In 2004, the permits for four dams on the lower Klamath River expired, providing a chance to dismantle these dams and restore the lower river's natural flow. Dams and water diversion to the Sacramento Valley almost obliterated the Trinity River tributary. 800,000 chinook salmon, the third-largest salmon fishery in the continental United States, used to spawn in the Klamath and Trinity rivers. For 300 years, the Yurok Indians lived along its banks and subsisted on its fish. The Bureau of Reclamation irrigated more than 100,000 acres of fertile volcanic soil in the old Tule Lake Basin of the Klamath River, which became the primary source of livelihood for more than 1,400 farmers. Onions, potatoes, grains, and alfalfa were all cultivated. Creating pools of warmer water that are unbearable to fingerlings traveling downstream was a drawback of damming, and algae grew prolifically in this warmer, phosphorus-rich water.

A minimum flow of water was created to safeguard the coho salmon under the Endangered Species Act after they were designated endangered in 1997 due to their extreme depletion. Likewise, in 2001, Oregon potato growers in the upper Klamath River sought water from the Interior Department to be used for the endangered fish because they were experiencing a protracted drought. In order to enhance the water supply to 220,000 acres of agriculture, Vice President Dick Cheney and Secretary of the Interior Gale Norton manually opened the irrigation floodgates in the spring of 2002. By the autumn of 2002, the river's low water quality had caused a number of contagious illnesses, including the death of 30,500 adult chinook salmon from Ichthyophthirius multifiliis. The power company controlled the water levels, the salmon had to reach their spawning areas for the fisherman, the Indians required their traditional fishing grounds, the farmers needed water for irrigation, and they held leases on federal wildlife refuges.

Negotiations between farmers, the hydropower firm, Native American tribes, fishers, the states, and the federal government started when the licenses for all four dams were up for renewal from the Federal Power Commission. Low salmon stocks in the Klamath River resulted in a dramatic reduction in commercial fishing in 2007. The cyanobacteria, often known as blue-green algae, which grow profusely in the calm summer waters below Iron Gate Dam, were found to be producing toxins that rendered fish and freshwater mussels unsafe to consume, according to a 2008 study by the Karuk Tribe. Ultimately, the Klamath Basin Restoration Accord was finalized by 2008; it called for the removal of four dams, which together generated 750,000 kilowatt hours of electricity for 70,000 houses. This was done to allow for the recovery of the salmon migration. In accordance with federal wildlife refuges, farmers allowed fallow fields to cycle into lakes and marshes and moved to less water-intensive crops. They also replaced flooded fields with pivot irrigators. By 2020, the four dams were supposed to be taken down, freeing roughly 300 miles of the Klamath River.

Representatives of the farming towns and the Indian tribes living along the river, together with two significant environmental organizations, American Rivers and Trout Unlimited, immediately

endorsed the idea. The power company avoided building expensive salmon ladders and upgrading the aging hydropower dams, and the economic end of the agreement was appealing thanks to a premium for Oregon power users and a California bond.

The Everglades in Florida

The Everglades, or Grassy Waters as the Seminole Indians named it, is a delicate environment generated by a river of fresh water that runs slowly over the flat stretch of land near the southern point of Florida. The river is 6 inches deep and 50 miles wide. Everglades National Park, with its 1.5 million acres, was created in 1947. The park is home to more than 300 different bird species. The Central and South Florida Project was started by the U.S. in 1948 due to flooding and a lack of available land for construction. US Corps of Engineers; it severely undercut the water environment of the Everglades by rerouting water for buildings and cultivation. The general consensus was to clear that dreadful marsh! Using hundreds of control gates, 720 miles of levees, 1,000 miles of canals, and dozens of pump stations, the Everglades' hydrology was controlled. Very little water enters the Everglades; it leaves to the east and west. With the introduction of salty water, the ecology of the Everglades National Park began to progressively disintegrate as it was eventually deprived of its own water. The state, the nation, the people of the towns, environmentalists, and the sizable sugar cane agricultural sector quickly made the restoration of the waterflows and the Everglades National Park a political priority.

The 5.7 million acre watershed and ecosystem in southern Florida are being restored as part of the Comprehensive Everglades Restoration Project, the biggest ecosystem restoration project in the world. It encompasses a region of 18,000 square miles and sixteen counties. The $40 billion, 40-year CERP is based on infrastructure modification and partial removal to transform the ecosystem to a more natural and sustainable configuration. The Water Resources Development Act of 2000 authorized the plan, which included over sixty components. Prior to 2000, there was a consensus on all sides of the political aisle to reestablish the flow of water via the River of Grass from Lake Okeechobee in south-central Florida into the Everglades, including the National Park at the southernmost point of the state. The intergovernmental South Florida Ecosystem Restoration Task Force, which acts as a focal point for the continuous cooperation required to carry out the biggest watershed restoration initiative in the world, is led by the Department of Interior.

The plan included building additional reservoirs and other storage facilities to collect extra water during south Florida's rainy seasons, ensuring a sufficient supply of water for towns, agriculture, and the Everglades. The state of Florida and the federal government were supposed to split the cost, but by 2008 Florida had outspent its partner 6-1, spending $2 billion on 68 restoration projects. This excludes the $1.34 billion agreement between Florida and the United States to purchase 180,000 acres. Sugar Company, which continues to be in doubt. The strategy enhances flows into the park in terms of quality, quantity, timing, and distribution. The 240 miles of canals and levees will also be taken out in order to restore the water's natural sheetflow. Florida's state government bought 207,000 acres of land, or 51% of what is required for restoration. State and the U.S. The Kissimmee River, the headwater of the Everglades ecosystem, has been restored to more natural water flow by the Corps of Engineers, which also constructed filter marshes south of Lake Okeechobee. With the Kissimmee River project, 29,000 acres of wetlands will be restored and 52 miles of the original 103-mile river will be recreated. The lake gets 1.5 tons of phosphorus from dairy farms upstream each day, which builds up on the lake's bottom and hastens the natural eutrophication process. Increased phosphate and nitrogen help nourish non-native plants since native species need relatively little nutrients. For instance, cattails smother typical sawgrass. Via

Shark River and Taylor Sloughs, two significant waterways of the River of Grass, two significant initiatives will restore water flows to Everglades National Park.

The Multi-Species Recovery Plan, a comprehensive plan developed by the U.S. Fish and Wildlife Service, addresses the habitat requirements of the sixty-eight endangered species in the region. Miami-Dade County's redevelopment is focused eastward in order to reroute future growth towards the historically eastern corridor and revive older metropolitan neighborhoods. In light of the fact that 50% of the Everglades have been permanently lost to agricultural and urban development, the design attempts to reproduce the natural water flow as closely as feasible. It is planned to build two reservoirs. As the Everglades and Biscayne Bay National Parks need more water flow, the Central Lake Belt Reservoir will catch the extra water and send this clean water to the parks' natural regions. In order to sustain the ground water table in the metropolitan regions, the Northern Lake Belt Reservoir is planned to collect extra urban runoff and transport it back to the urban canal system. The purpose of this reservoir is to stop saltwater from getting into freshwater wells.

Despite the recent creation of 45,000 acres of filter wetlands to minimize toxins in agricultural runoff, the South Florida Water Management District reported in 2008 that farmers had failed a phosphorus reduction objective for the first time in eleven years. Everglades National Park was first recognized as a World Heritage Site in 1979. However, Hurricane Andrew and other environmental threats led to its designation as a World Heritage in Danger in 1993. In 2007, the World Heritage Committee removed the Everglades from that list after the United States had approved $8 billion for the Comprehensive Everglades Restoration Plan's implementation.

Hetch Hetchy Dam Disputation

Before Yosemite National Park was given national park status in 1890, John Muir first visited the Hetch Hetchy Valley in 1871. With the 1906 San Francisco earthquake and fire, a reliable water supply became crucial for the city. While the Tuolumne River could be dammed anywhere along its length, Yosemite National Park's Hetch Hetchy Valley entry was the least expensive location. To acquire the lands, rights, and claims of the valley, the city fathers engaged in conflict with John Muir and the Sierra Club. The City of San Francisco voted 86% in favor of permission after the Department of Interior denied it twice. The permit was subsequently authorized in 1908 but halted the following year. The dam was approved by Congress in 1913, and President Woodrow Wilson signed the law. The O'Shaughnessy Dam was finished in 1923. Dam Hetch Hetchy! John Muir wrote in Yosemite in 1912 There is an active Restore Hetch Hetchy organization affiliated with the Sierra Club that promotes the demolition of the dam and restoration of the Hetch Hetchy Valley. They argue that the dam should be removed in order to restore the Hetch Hetchy Valley. According to the arguments in favor of restoration, the reservoir only supplies 25% of San Francisco's water needs, and the other 75% could be kept in reservoirs farther down the river. Electricity might be generated elsewhere. Most importantly, restoration would enable many more people to experience nature's virtues and remove the crowds from Yosemite Valley [8]–[11].

CONCLUSION

Due to the strict enforcing of the Clean Water Act, the Cuyahoga River, which is close to Akron and Cleveland, Ohio, has improved from a polluted river fire in 1969 to become the home of the Cuyahoga Valley National Park over fifty years later. To prevent the eutrophication of American rivers, bays, and lakes, the Clean Water Act has traditionally established limits for total suspended solids, nitrogen, and phosphorus species. The surface waters of the United States have been heavily

manipulated. A federal regulation that establishes pollution thresholds in waterways that must be reached by water treatment districts has been passed to address the issue of safe drinking water. The Clean and Safe Drinking Water Acts are enforced by the EPA. The Klamath River in Oregon and California, where four dams will be dismantled to restore river flow and conserve the endangered coho salmon, is one example of a river that has been restored with great success. The state and federal governments are working together on the Everglades restoration projects to buy sugar fields and redirect water to its historical flows.

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CHAPTER 24

TOXIC CHEMICALS IN THE ENVIRONMENT

Dr. Shruthi K Bekal, Assistant Professor,
Department of Management, JAIN (Deemed-to-be University), Bangalore, India,
Email Id- shruthi_b2015@cms.ac.in

ABSTRACT:

A media notice concerning a chemical in the environment that may be harmful to human health almost always appears each day. It may do this by interfering with our hormones, starting a cancerous tumor, starting a cardiac condition, delaying brain development, or any combination of these. It might also include oxybenzone, which is found in sunscreens, tetrachloroethylene, which is left behind in dry-cleaned clothing, caramel coloring, which is found in cola beverages, arsenic, which is found in rice, and phthalates, which are found in plastics. In this chapter author is discusses environmental response, compensation, and liability act.

KEYWORDS:

Act, Chemical, Environment, Government, Health.

INTRODUCTION

More than 34 million metric tons of chemicals are manufactured or imported daily in the United States, and over the next 25 years, worldwide chemical output is expected to treble, exceeding the pace of population increase. Hundreds of compounds have been found in humans and ecosystems all around the globe, and these substances eventually find their way into the Earth's environment. An expanding field of study called biomonitoring measures the kinds and concentrations of substances in people. It has been used in studies conducted as part of the National Health and Nutrition Examination Survey, a program of research aimed at determining the health and nutritional status of adults and children in the United States. The Toxic Substances Control Act regulates 80,000 chemicals in the U.S. environment, and 3,000 chemicals are produced or imported in excess of 1 million pounds each. According to the NHANES study, 75% of Americans have triclosan, 100% have some type of measurable PCB, 98% have poly-fluoroalkyl chemicals, and more than 90% have measurable levels of bisphenol A [1], [2].

Regulation of Toxic Substances Act

In 1976, the Toxic Substances Control Act was passed as a groundbreaking piece of environmental law. It called for the creation of a list of chemicals produced or processed in the US by the Environmental Protection Agency. After that, manufacturing, importing, or processing of chemicals not included in the inventory was prohibited without EPA premanufacture notice. The default premise of TSCA is that chemicals stay on the market until or until EPA has adequate data to demonstrate danger.

Chemical descriptions of the material and its byproducts, expected volume and use types, manufacturing processes and locations, worker and environmental exposure, and test results for health, safety, and environmental fate and effects that are known to the submitter or reported in the

literature are all required in a PMN. The PMN is not necessary to show effectiveness or a lack of negative effects on human health or the environment. The Federal Register contains a notification that the EPA has received PMNs. The chemical is added to the inventory and the submitter is free to produce, import, or process it if the EPA does not take any action for ninety days after the submission. However, if the EPA determines that the chemical's uncontrolled manufacture, processing, distribution, use, or disposal may present an unreasonable risk of harm to human health or the environment, or that the data available are insufficient for the EPA to determine that the chemical will not present an unreasonable risk, it may stop this by order, rule, or legal action.

According to the Toxic Substances Control Act, the EPA has extensive jurisdiction to enact rules that are intended to collect data on exposure, health, and safety risks, demand testing, and limit exposure to chemical compounds and combinations. The names of all currently used chemical substances, together with their corresponding Chemical ABSTRACT Service Registry numbers, production or importation volume ranges, and particular production or importation locations, are included in the TSCA inventory. High production volume chemicals are those produced in yearly amounts more than one million pounds. The Office of Prevention, Pesticides, and Toxic Substances' ongoing Chemicals Data Collecting and Data Development initiatives are mostly focused on this group of 3,000–4,000 HPV compounds. Data on chemicals that are generated or collected are made publically available with the goal of assisting efforts to assess possible harm from exposure to these substances.

The EPA is empowered to issue regulations for any chemical included in the inventory requiring testing by makers, importers, or processors to assess if the chemical poses an unreasonable risk of harm to human health or the environment. If so, the EPA may also issue rules to stop a chemical from posing such an unjustified danger throughout its production, processing, distribution, use, or disposal. The EPA has very seldom exercised these powers, but chemical producers, importers, and processors are nonetheless required to tell the agency of any evidence that would support the claim that a certain chemical poses a significant risk of harm to human health or the environment.

Endocrine-disrupting chemicals (EDCs) are a distinct class of dangerous compounds.4 EDCs, which include polychlorinated biphenyls, phthalates, and bisphenol A, interfere with biological signaling processes that control immunological function, development, and reproduction in both people and animals. EDCs have been connected to population declines brought on by feminization or masculinization, eggshell thinning in birds and reptiles, and decreased reproductive capacity in fish, mammals, and amphibians.6 EDCs can cause life-long, multigenerational changes, which suggests that risk assessment should take into account both the timing of exposure and dose.

Comprehensive Environmental Response, Compensation, and Liability Act

On December 11, 1980, Congress passed the Comprehensive Environmental Response, Compensation and Liability Act, often known as Superfund. For the purpose of cleaning up uncontrolled or abandoned hazardous waste sites, spills, and other urgent discharges of pollutants and toxins into the environment, CERCLA establishes a government "Superfund" program. The Chemical and Petroleum Industries were taxed to pay for the Superfund, and CERCLA gave the federal government wide jurisdiction to react immediately to discharges or threatened releases of hazardous chemicals that might jeopardize human health or the environment. The Superfund gives the EPA permission to choose one of two remedial paths. The first is to file a lawsuit against those who are at fault to have them pay for the remedial work. Responsible parties include the producers of the dangerous materials discovered at the infringing site, the carriers who brought the materials

there, the site's present owners or operators, and the site's owners and operators at the time the dangerous materials were disposed of there. The second option is for the EPA to repair the property on its own and file a lawsuit against the parties at fault to recoup its expenditures. Either path the EPA takes, the end consequence and corrective action are roughly the same, and the final financial burden of cleaning falls to the culpable parties. In a location, there might be hundreds of accountable parties. Typically, the EPA is only able to address a small number of these cases [3]–[5].

DISCUSSION

To recoup their share of the expenses associated with remediation, the parties the EPA names have the authority to prosecute the remaining responsible parties. The law permits two different types of response actions: immediate removals, which can be used to address releases or threatened releases that need to be addressed right away, and long-term remedial response actions, which significantly and permanently reduce the dangers associated with releases or threats of releases of hazardous substances that are serious but not immediately life-threatening. Only locations identified on the EPA's National Priorities List, which is a list of known or imminent discharges of hazardous chemicals, pollutants, or contaminants throughout the United States and its territories, are eligible for these measures.

Over 1,300 sites have been added to the NPL for Superfund action out of the more than 30,000 sites on the EPA's Comprehensive Environmental Response, Compensation and Liability Information System list for Superfund consideration. When a site is put on the first list, it is assessed to see if any urgent action is required to stop major negative impacts, and a hazard evaluation is finished to see whether the site should be put on the NPL. When a site is added to the NPL, a remedial study is carried out to identify the kind, level, and pathways of contaminated exposure to humans and the environment. The cost of such measures is then determined by conducting a feasibility study. After making a decision via a public notice and comment process, the EPA implements corrective action. State environmental protection or waste management agencies coordinate the identification, monitoring, and response actions for Superfund sites.

All sites on the NPL and locations for which doctors petition are subject to a health evaluation by the Public Health Service's Agency for Toxic Substances and Disease Registry. The evaluations are conducted to identify any possible risks to human health at the locations, to assist in determining what corrective action should be done, and to evaluate if any further health information, such as epidemiologic studies and exposed-person registries, should be established. Also, ATSDR is tasked with creating toxicologic profiles of the 100 or more hazardous compounds that are most often discovered at Superfund sites. These dangerous substances are classified according to how often they are found at NPL sites, their toxicity, and the possibility of human exposure. The development of toxicological profiles starts with a priority list of 275 chemicals. The information on toxicology and adverse health consequences for the hazardous material discussed here is summarized in the ATSDR toxicological profile. Each peer-reviewed profile finds and evaluates the essential literature that outlines the toxicologic characteristics of a dangerous chemical.

Regulation on Resource Conservation and Recovery

The Resource Conservation and Recovery Act, passed in 1976, added to prior law, which had set criteria for federal solid waste reduction and disposal programs and allowed the EPA to provide technical assistance to states on solid waste disposal. Over 20,000 hazardous waste producers and

280 million tons of hazardous waste are regulated by RCRA, which also oversees about 208 million tons of municipal solid trash in the US. RCRA establishes a cradle-to-grave regulatory framework to control the storage, transportation, and disposal of hazardous waste under the control of the EPA or states with programs that have been authorized. Hazardous waste must be disposed of in facilities approved for that type of trash by its generators. The generator must transfer the trash to the designated disposal location if it is not on the generator's property, together with an RCRA manifest to prove appropriate disposal. Regulations for the most popular kinds of storage and disposal facilities, including incinerators, landfills, and surface impoundments, set precise criteria. The dumping of specified wastes in particular facilities is prohibited by these regulations. To prevent garbage from being released into the environment once the disposal facilities are closed, closure and postclosure standards are also created. For the purpose of preventing the discharge of hazardous waste into the environment, permitted establishments are required to identify any on-site pre-RCRA disposal locations and take corrective action, if needed. Generators of hazardous waste must verify that they have made steps to reduce the production of hazardous waste. Nonetheless, the high cost of disposal generates an incentive for waste reduction independent of the need. The production of hazardous waste is widely believed to have decreased by around 25% since the system went into place as a consequence.

Wastes that fall under this system's purview include those that are corrosive, ignitable, reactive, and capable of releasing excessive amounts of heavy metals, pesticides, or organic contaminants. They also include wastes that are on a list of over 100 distinct industrial wastes or several hundred distinct discarded commercial chemical products. These broad categories include certain trash that are not really harmful. Such wastes may be "delisted" in accordance with the EPA regulations in order to be taken out of the RCRA system. Yet, delisting is a costly, time-consuming procedure with a hazy success rate. Although RCRA established a comprehensive program to regulate the disposal of hazardous waste, it solely addresses the disposal of nonhazardous trash by mandating that states bring their municipal landfills up to EPA standards. Unless the state's solid waste regulating regime is found to be lacking, the EPA cannot enforce the standard against infringing landfills. Practically speaking, producers of hazardous waste who dispose of it in amounts small enough to evade regulation on hazardous waste may utilize municipal landfills subject to these criteria. Moreover, domestic product remnants that would be considered hazardous wastes if they were dumped by companies in greater amounts are found in landfills. It is hardly unexpected that leachates from municipal and industrial dumps have comparable chemical compositions. The fast depletion of available landfill capacity and the difficulty to find additional landfills in the face of local resistance, particularly to the disposal of trash generated outside of state borders, have created a dilemma across much of the Northeast.

During the 1980s, recycling has been a significant factor in the decrease of solid waste. Since aluminum beverage cans are the most recyclable product in the country and as a result, they make up less than 1% of all garbage generated in the country. Recycling paper is essential since a single Sunday New York Times run uses 75,000 trees. The annual paper consumption of Americans is 85,000,000 tons, or 680 pounds per person. Seventeen trees, 380 gallons of oil, 3 cubic yards of landfill space, 4,000 kilowatts of electricity, and 7,000 litres of water may all be saved with every ton of recycled paper. This results in a 64% reduction in energy use, a 58% reduction in water use, and a 60% reduction in air pollution. Recycling half of the world's paper would save 20 million acres of forestland from being cleared for farming. According to the EPA, recycling paper results in 74% less air pollution and 35% less water pollution than producing new paper. With 1,609 pounds of garbage produced per person annually, the United States produces 40% of the world's

rubbish while having only 5% of the global population. Each ton of waste costs around $30 to recycle, $50 to transport to a landfill, and $65 to $75 to burn.

The Federal Hazardous and Solid Waste Amendments of 1984 to RCRA required that hazardous waste be gradually removed from land-based disposal. Other requirements of this harsh regulation include giving the EPA additional enforcement power, stricter guidelines for the handling of hazardous waste, and a thorough program for underground storage tanks. The EPA, states, or private parties may request that ATSDR perform public health evaluations at these locations under these modifications, which address the management of commercial hazardous waste storage or destruction facilities. The RCRA was amended in 1986 to allow EPA to handle potential environmental issues brought on by underground tanks used to store petroleum and other hazardous materials. Whereas CERCLA is concerned with abandoned or historical sites, RCRA exclusively addresses current and future facilities.

Rodenticide, fungicide, and insecticide Federal Act

The Federal Insecticide, Fungicide, and Rodenticide Act was enacted in 1947 as a piece of law to guarantee the effectiveness of goods for farmers, growers, and other agricultural consumers. Congress significantly changed the prior initiative in 1972 to include health and the environment in addition to effectiveness. The registration of pesticides is FIFRA's primary regulatory mechanism. All pesticides used in the United States must be registered with the EPA. Pesticides will be correctly labeled and, if used in line with specifications, won't have an unjustified negative impact on the environment, thanks to registration. The pesticide must be effective for the intended use, have a label with use instructions, carry out the intended use without unreasonable detrimental effects on human health and the environment, and not produce such effects when used in routine operations in order to be registered for that use. The EPA balances the benefits of pesticides against their drawbacks. Pesticides almost always have some negative side effects, although they may offset these effects if they help to increase food production, prevent food from going bad, or get rid of pests on the property. By mandating that pesticide labels provide instructions for safe, authorized applications, adverse effects may be prevented or reduced.

FIFRA's main components include the following: EPA registration is required for pesticide products prior to manufacturing, transportation, and sale under a product licensing legislation. Based on a risk/benefit threshold, registration. High ability to demand data, including the power to issue data call-ins on degradation, toxicity tests, chemical activity, and other topics. Possibility of pesticide usage regulation by labeling, packaging, composition, and disposal. Emergency exemption authority: allows for the authorisation of unregistered uses of items that are registered on a temporary basis. Possibility to put a product's registration on hold or cancel it: appeals procedure, adjudicatory duties, etc.

For either broad or limited usage, pesticides may be registered. Only applicators who have received training and have a valid license from the state may use pesticides with a restricted use. Current FIFRA changes mandate that previously registered pesticides be reregistered in order to be evaluated using current data and standards. If information discovered after registration would make it appropriate to forego registration, registration may be revoked. A violation of FIFRA is the distribution of an unlicensed pesticide or disregarding label instructions.

Both active and inert components are found in pesticides. These phrases need to be understood in the context of pesticides. A purportedly inert substance has another function in addition to not being a pesticide, such as serving as a transporter. The environment and human health might be

just as harmed by inert pesticide chemicals as by active ones. The EPA is presently concentrating its registration efforts on the generic registration of each active component. According to this method, the EPA examines the information that is currently available on each chemical that is used as an active ingredient, finds information gaps that must be addressed, and produces a general standard that specifies the applications for which the component will be permitted. Nevertheless, these criteria are temporary and should be used until the data gaps are addressed. Remainder chemistry, environmental fate, studies on degradation, metabolism, mobility, dissipation, and accumulation, acute, long-term, and subchronic effects on people and other nontarget species, teratogenicity and mutagenicity studies, and an assessment of pesticide spray drift are among the data the EPA requires for registration. Moreover, anytime a registrant learns of facts that point to negative consequences, they are required to continue to disclose post-registration data to the EPA. Individual event reports and partial toxicologic research are included in this [6], [7].

The EPA maintains a vast database of data on the health consequences of licensed pesticides. The security maintained for company private information given to the EPA under FIFRA is very tight, even though most of data is accessible to the general public. In fact, revealing business-related FIFRA information may result in a lengthier jail sentence than breaking the law's core provisions. The EPA employees who handle requests for FIFRA information are hindered by this. Nonetheless, the majority of health information is accessible to the general public, and in certain cases, physicians and others may be given access to personal data in order to diagnose or treat patients. The Health Impacts Division of the Office of Pesticide Programs in Washington, D.C. is the department to contact for such information.

Whenever a pesticide is being considered for use on a crop intended for human consumption, the EPA evaluates whether a "tolerance"—a acceptable amount of pesticide residue—can be established under the Federal Food, Drug, and Cosmetic Act. Before a pesticide may be registered for use on food, a tolerance must be established. If any registration is authorized, the agency details the permitted uses and conditions of use, including secure ways to store and dispose of pesticides, which the registrant must include on the product label.

Health and Environmental Issues Related to Air Pollution

Emissions of air pollution come from both natural and man-made sources. The anthropogenic portion of air pollution is caused by human-driven activities that are intended to provide society with the essential commodities and services. Emissions of air pollutants occur throughout the lifespans of goods and services, i.e., during the extraction of raw materials, energy acquisition, production and manufacture, consumption, reuse, recycling, and final disposal. The resulting emissions go through a variety of physical and chemical changes, which have a negative impact on the environment and human health. These effects include noise, poor air quality, toxicological stress on ecosystems and humans, photo-oxidant formation, stratospheric ozone depletion, and climate change.

Over 2 million premature deaths are estimated to occur annually due to air pollution, a serious environmental health concern. As exposure to air pollution is mostly beyond of a person's control, public authorities at the national, regional, and even worldwide levels must take action. People in underdeveloped nations bear more than half of the cost of air pollution to human health. Average yearly PM10 levels in many cities are more than 70 g/m3. According to the WHO Air Quality Guidelines, these values should be lower than 20 g/m3 to avoid illness. By lowering air pollution levels, we can significantly lower the worldwide burden of lung cancer, heart disease, and

respiratory infections. For instance, by lowering PM10 pollution from 70 to 20 g/m3, we may reduce mortality brought on by poor air quality by around 15%.

The aforementioned information makes it abundantly evident that air pollution is a serious issue for everyone's health in both industrialized and developing nations. The WHO has created AQGs based on several research to reflect the most current and commonly accepted evaluation of the health consequences of air pollution and to provide objectives for air quality at which the health risks are greatly reduced. The most recent WHO AQGs from 2005 provide updated worldwide advice on decreasing the negative effects of air pollution on health. The new guidelines, which are based on a professional assessment of the most recent scientific data, are applicable globally. They suggest updated standards that are applicable to all WHO areas for the concentration of a few specific air pollutants, such as PM, O3, nitrogen dioxide, and sulfur dioxide. These are some highlights from the 2005 AQGs:

Several negative health impacts are linked to air pollution, even at very low concentrations. In many cities in industrialized and developing nations, exposure to PM and O3 poses substantial health hazards. Almost half of the world's population may be at risk for health problems due to poor indoor air quality. PM levels in houses that cook and heat with coal and biomass fuels may be 10 to 50 times higher than recommended limits. Lowering the amounts of some of the most prevalent air pollutants released during the burning of fossil fuels may significantly reduce exposure to air pollution. It's interesting to note that these actions will also lower greenhouse gas emissions and help to slow down global warming. More individuals are impacted by PM than any other air contaminant found in ambient air. At exposure levels now encountered by the majority of urban and rural residents in both industrialized and developing nations, PM has harmful impacts on human health. Sulfates, nitrates, ammonia, sodium chloride, carbon, mineral dust, and water are the main components of PM. PM is made up of a complex combination of suspended organic and inorganic solid and liquid particles. Particles are classified as either PM2.5 or PM10 depending on their aerodynamic dimensions. The latter are regarded as being more harmful because, when breathed, they may reach the outer bronchioles and obstruct lung gas exchange.

Lung cancer risk is increased by persistent particle exposure, which also increases the chance of developing respiratory and cardiovascular conditions. Young children in underdeveloped nations are more susceptible to acute lower respiratory infections and the related mortality due to exposure to pollutants from the indoor burning of solid fuels on open flames or conventional stoves. A significant risk factor for lung cancer and chronic obstructive pulmonary disease in adults is indoor air pollution from solid fuel consumption. Mortality is 15-20% higher in places with high pollution levels than it is in those with lower pollution levels. Due to exposure to PM2.5 caused by human activity, the average life expectancy is 8.6 months shorter even inside the European Union. The PM guideline levels are established for PM2.5 and PM10 independently in accordance with the 2005 WHO AQGs. The 24-hour mean should not exceed 25 and 50 g/m3, respectively, whereas the yearly means of PM2.5 and PM10 should be 10 and 20 g/m3, respectively.

It is significant that the 2005 AQGs contain a guideline value for PM for the first time. The lowest concentrations are what are desired. The proposed value should reflect an acceptable and reachable target to reduce health consequences in the context of local restrictions, capacities, and public health objectives since there is no PM threshold below which no harm to health is detected. Based on new proven connections between daily mortality and O3 levels occurring at O3 concentrations below 120 g/m3, the previously advised limit for O3, which was established at 120 g/m3 8-hour mean, was decreased to 100 g/m3. One of the main components of photochemical smog is ground-

level O3. It is created when pollutants like nitrogen oxides from industry and car emissions and volatile organic compounds from automobiles, solvents, and industry combine with sunlight. When the weather is bright, the levels of O3 pollution are at their peak [8], [9].

CONCLUSION

There are tens of thousands of chemicals in use today that have bioaccumulated in human serum and fat and escaped into the environment. These substances might put people at risk for developing cancer, liver illness, cardiovascular problems, neurobehavioral side effects, and impaired fertility. Regulatory solutions are required to prevent these negative impacts. The EPA serves as the primary agency under the Toxic Substances Control Act to regulate compounds that are shown to have hazardous effects. The precautionary principle is not used under this legislation, and chemicals are not eliminated unless a risk has been established. Contrarily, European regulatory legislation requires that substances be validated as safe before being on sale. The precautionary concept is applied to new TSCA reauthorization proposals. Ecosystems have been exposed to toxic compounds such tremolite asbestos, PCBs, and endocrine disruptors. The EPA and past or present polluters are identifying and cleaning up Superfund sites. Another chemical stream that is subject to EPA registration and regulation is pesticides, and hazardous waste, which often contains harmful compounds, enables EPA to control chemicals from cradle to grave.

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CHAPTER 25

A DISCUSSION ON TROPOSPHERIC LEVEL

Mr. R. Thanga Kumar, Assistant Professor,
Department of Management, JAIN (Deemed-to-be University), Bangalore, India,
Email Id- thanga@cms.ac.in

ABSTRACT:

The area of the atmosphere between the surface of the planet and the bottom of the stratosphere, where temperatures often drop quickly as one rises in height. The troposphere is located the closest to the surface of the planet. Change is a tropos. Because to the continually shifting weather that stirs up the gases in this region of our atmosphere, this layer received its name. In this chapter author is discusses the climate-change-related health impacts. Tropospheric O3 levels are susceptible to regional NOx and VOC concentrations. According to model studies, increased UV-B radiation decreases tropospheric O3 in unpolluted regions while increasing it in contaminated ones. The effects of too much oxygen in the air may be felt strongly on people, things, and plants. It may result in breathing issues, asthma attacks, decreased lung function, and lung illnesses. It is now one among the air contaminants that Europe is most concerned about. According to many European studies, for every 10 g/m3 increase in O3 exposure, daily mortality increases by 0.3% and that for cardiac illnesses by 0.4%.

KEYWORDS:

Disease, Environment, Health, Radiation, Symptoms.

INTRODUCTION

Combustion activities are the main anthropogenic sources of NO2 emissions. According to epidemiological research, prolonged exposure to NO2 is linked to an increase in bronchitis symptoms in asthmatic children. NO2 concentrations as they are now assessed in cities throughout Europe and North America are similarly associated with slower lungs function development. The current WHO recommendation of 40 g/m3 has not altered from the amount advised in earlier AQGs in order to safeguard the population from the negative health consequences of gaseous NO2. It is also advised to use an extra AQG value of 200 g/m3 for the 1-hour mean. NO2 has a number of linked actions as an air contaminant, including:

It is a hazardous gas that significantly inflames the airways at short-term doses over 200 g/m3. The primary source of nitrate aerosols, which make up a significant portion of small particles and, when exposed to UV light, produce O3, is NO2. Burning fossil fuels and smelting sulfur-containing mineral ores both result in the production of SO2. Burning sulfur-containing fossil fuels for home heating, electricity production, and transportation is the largest anthropogenic source of SO2. According to studies, some asthmatics show alterations in their pulmonary function and respiratory symptoms after only 10 minutes of SO2 exposure. For average intervals of 10 minutes, a SO2 concentration of 500 g/m3 shouldn't be surpassed; nevertheless, over a 24-hour mean period, it shouldn't be higher than 20 g/m3. Since that health impacts are now known to be linked with far lower levels of SO2 than previously thought, and consequently a higher degree of protection is required, the 24-hour recommendation for SO2 has been revised from 125 to 20 g/m3. The

respiratory system, lungs, and eyes may all be impacted by SO2, in addition to these other effects. Coughing, mucus secretion, asthmatic flare-ups, and chronic bronchitis are all symptoms of respiratory tract inflammation, which also increases the risk of respiratory tract infections. On days with greater SO2 levels, hospital admissions for heart illness and death rise. Acid rain, which harms delicate ecosystems, is mostly composed of sulfuric acid, which is created when SO2 reacts with water [1], [2].

It should be highlighted that the WHO AQGs are designed to provide governments consistent background knowledge and advice when making choices about health risk management, especially when defining standards. At a local or regional level, the recommendations may also be utilized in planning procedures and many types of air quality management choices. The AQG document's wording makes clear that the recommendations are not standards in and of themselves. The guideline values must be taken into account in the context of current exposure levels, technological viability, source control measures, abatement techniques, and social, economic, and cultural situations before being transformed into legally enforceable norms. There may be good reasons to implement measures that might raise or lower air pollution concentrations depending on the situation. Despite the fact that these recommended values are thought to safeguard human health, pollution is in no way encouraged by them. It should be emphasized that because there is no definite threshold or level beyond which there are no negative effects, efforts must be taken to maintain air pollution levels as low as reasonably possible.

The health burden associated with environmental exposures, such as ambient air pollution and the health effects of climate change, is not evenly distributed between or within regions and nations. Environmental policy, where appeals for environmental fairness are increasingly commonly heard, is presently paying greater attention to these discrepancies and appreciating them more fully. Even the WHO Global Update of the AQGs, which attempts to address global-scale disparities in exposure to air pollution and the burden of diseases caused by air pollution, falls short of explicitly addressing the disparities in exposure and adverse health effects within countries and urban areas due to the differential distribution of sources of air pollution, such as motor vehicles and local industry, and differences in susceptibility to the adverse health effects. Yet, these disparities may be taken into account when making local choices about land use and air quality management.

With this viewpoint, the current book contains not only general information and the basics of the air pollution issue, but also studies and instances from many global locations so that the unique characteristics of each place are recorded. The book is intended to help readers better understand social and environmental determinants of public health and apply evidence from country-based research to reduce health disparities and environmental inequalities. This includes understanding the scientific basis of air pollution and its effects on health and the environment. The book is also anticipated to inspire more study and policy action on the local to global health and environmental effects of air pollution [3], [4].

The s cover nearly all of the major aspects of air pollution, such as monitoring and source characterization of air pollution, modeling, health effects, environmental impacts, risk assessment, air quality management, and pertinent policy issues, to help readers understand the complex problem of air pollution and its detrimental effects on human health and the environment in their entirety. The book has been separated into five main sections to make it easier to understand the topic: Environmental Consequences of Air Pollution, Health Risk Assessment and Management, Air Quality Management: Methods and Policy Issues, and Air Pollution and Health Effects. The foundations of air pollution monitoring and source characterisation are first presented. This mostly

covers the goals of air pollution monitoring, sample collection, choosing contaminants for air quality monitoring, choosing monitoring locations, data validation and interpretation, monitoring methods, monitoring of gaseous compounds and PM, direct and indirect mass measurement techniques, and source apportionment and characterization using enrichment factor analysis, chemical mass balance methods, and multivariate receptor models.

Collecting data via direct measurements and analyzing it by fitting it into any model is the most crucial activity for managing ambient air quality. These models may then be used to forecast air quality in various scenarios and to estimate the health and environmental hazards associated with emissions from polluting sources. Presents an introduction of the fundamental theory and application of air pollution modeling. Because air quality modeling is a well-studied and developed field, and various publications are available that solely deal with this topic. So, this analyzes several kinds of commercial software and atmospheric dispersion models before providing a short remark on the newly well-liked modeling techniques of statistical/probabilistic modeling, artificial neural network modeling, and fuzzy modeling. It is clear that there has been significant growth and progress in air pollution modeling throughout time. With the growth of several software programs, the usage of computational fluid dynamic models seems to be the most prevalent among them. It has also become commonplace to apply specialized methods like time series analysis, fuzzy logic, and ANN. The use of ANN to generate data at various sample rates is quite promising. Yet, time series may be employed locally for meaningful predictions of air pollution concentrations even in the absence of any thorough modeling. 3 also includes a variety of case studies from emerging nations, like Chile and India. Several chapters in this book cover certain facets of air pollution modeling. Examples include the use of suitable modeling approaches to evaluate acute or short-term risk from the unintentional discharge of industrial hazardous chemicals in 4 and the discussion of IAQ modeling.

DISCUSSION

Emissions of air pollutants may contaminate both indoor and outdoor air. The majority of people's time is spent inside. Hence, it presents a risk to the inhabitants' health if the air they breathe inside is contaminated. Indoor air pollution is to blame for 2.7% of the total world illness burden, according World Health Reports 2002. In order to assess the air quality of interior spaces in terms of its physical, chemical, and biological qualities as well as the wellbeing of the inhabitants, IAQ studies become important. IAQ studies first identify indoor pollutants, their sources, and causes. Then, they require extensive survey, monitoring programs, and health investigation studies to determine the various parameters associated with IAQ, such as building parameters, occupant parameters, meteorological parameters affecting the IAQ, etc. S 4 and S 5 are devoted to discussing these topics in depth. Although Chapter 4 provides an overview of indoor air pollution, briefly covering indoor air pollutants, their origins and causes, several relevant IAQ parameters, monitoring and modeling of IAQ, health-related aspects and studies, and some management approaches,

The case study that is being given is particularly important since indoor air pollution caused by the use of unprocessed solid biomass fuels for home cooking and room heating, such as wood, dung cake, and agricultural wastes, is a serious health hazard in developing nations like India. In India's rural regions, over 74% of residents still rely mostly on biomass for home energy. The concentration of respirable suspended PM10 in the kitchen during biomass burning is far greater than traffic pollution in cities, indicating how severely polluting biomass fuels are. Many hazardous chemicals that are bad for human health are present in biomass smoke. Most at risk are

the children and women who use these fuels to cook. Yet, little is known about the effects of using biomass fuel on health in India and many other poor countries. In light of the above, this research was conducted to investigate the respiratory and systemic toxicity linked to long-term biomass smoke exposure in the nation. In the current case study, a total of 650 age-matched women from the same area who cooked with cleaner fuel liquefied petroleum gas and 1260 non-smoking women from rural West Bengal who used to solely use traditional biomass fuel were included. Yet, as shown in illustration 10, it's crucial to remember that ultrafine particles that pose health concerns to a population are caused by both the cooking technique and the cooking fuel [5]–[7].

Women who used biomass fuel had a significant increase in the incidence of respiratory symptoms, decreased lung function, airway inflammation, and hidden pulmonary bleeding as compared to those who used LPG. The blood plasma's superoxide dismutase enzyme activity significantly decreased, indicating a deterioration in the body's antioxidant defense. This was followed by an increased frequency of micronucleus generation in lymphocytes and buccal and airway epithelial cells, which indicates a greater frequency of chromosomal and DNA damage. Moreover, biomass users had higher rates of metaplasia and dysplasia in their airway epithelial cells, which suggests a higher risk of cancer in the airways. Also, women who used biomass had irregular menstrual periods, a greater incidence of unplanned pregnancies, stillbirths, and low birth weight infants. Also, they had increased sadness and other neurobehavioral issues, as well as changes in reproductive hormones as a result. After controlling for possible confounders including education, family income, and ambient cigarette smoke, the changes were directly related to the degree of indoor air pollution. According to this research, using biomass fuels for household cooking is linked to significant indoor air pollution, which has a negative impact on the physical and emotional well-being of women who use these fuels. The results call for quick action to rectify the situation since millions of impoverished people still use these fuels throughout the nation.

Urban air pollution emissions have been shown to significantly harm people's health and worsen ambient air quality across the globe. It is still a serious health problem in India because to the high ambient air concentrations of many air pollutants in Indian cities. Although though respiratory, cardiovascular, and genotoxic alterations are significant consequences of air pollution on health, little is known about the prevalence and risk of these changes among urban Indians, who are subjected to some of the highest levels of pollution on the planet. In light of this, the authors of 6 undertook epidemiological research in Delhi and Kolkata, two of the nation's most polluted megacities, to ascertain the effects of persistent exposure to urban air pollution on the body's respiratory and other organ systems. The research, which was done between 2000 and 2006, included 6862 non-smoking inhabitants of Kolkata and Delhi and 3715 controls from West Bengal's less-polluted rural regions, where the PM10 level was much lower. 12,688 school-age youngsters from these two cities as well as 5649 from rural West Bengal were also examined.

Urban participants were shown to have a significantly greater incidence of upper and lower respiratory symptoms, bronchial asthma, and lung function impairments than rural controls. In comparison to 20% of comparably matched controls, over 40% of Delhi residents had impaired lung function, and the most common form of impairment was a restrictive one. Urban patients reported higher rates of hypertension, activated leukocytes and platelets, and leukocyte-platelet aggregates, all of which are possible risk factors for cardiovascular disease. These participants reported higher rates of neurobehavioral symptoms, such as depression, and more nuclear anomalies in their airway epithelial cells. After adjusting for relevant confounders including environmental cigarette smoke and socioeconomic factors, multivariate logistic regression

analysis revealed a significant correlation between personal exposure to benzene and poor health effects in urban participants. According to the research, continuous exposure to high levels of urban air pollution in India is negatively impacting residents' physical and mental health, particularly the old and young. In order to protect the public's health, efforts should be undertaken by all parties involved to lower pollution levels.

Megacities have grown throughout time into both sources of heavy urban air pollution and engines of economic expansion, especially in emerging nations. According to the 2000 census, the Mexico City Metropolitan Area has 18 million residents, making it one of the world's most densely inhabited megacities. O3 and PM concentrations have been seen in certain city areas of Mexico City for numerous days each year at levels substantially above the national threshold. According to data collected during the extensive MCMA-2003 campaign, MCMA motor vehicles emit significant amounts of primary PM, particle-bound polycyclic aromatic hydrocarbons, and a variety of air toxics, such as formaldehyde, acetaldehyde, benzene, toluene, and xylenes. In this regard, number seven explains the exposure to air pollutants and the health impacts that were tracked and noticed during the MILAGRO-MCMA2006 program. Children between the ages of 9 and 12 who had been recruited from primary schools in three separate down- ward locations that were intercepting the air pollution plume from Mexico City throughout the campaign made up the volunteers who underwent the investigation. Despite recent considerable reductions in air pollution levels in the MCMA due to extensive air quality management, the MILAGRO campaign findings draw attention to the high frequency of various subclinical manifestations associated with air pollution. Children, who are the most vulnerable members of a population for a variety of reasons, may be severely impacted by many chronic illnesses if stricter regulations and preventative measures are not put in place in this metropolitan region, according to the authors.

The ubiquitous persistent organic pollutants known as PAHs, which have the potential to cause cancer, mutagenesis, and immunotoxicity, have become one of the most concerning types of air pollutants in recent years. the origins, dissemination, chemical synthesis, toxicokinetics, health effects, and preventative actions of PAHs.

They are produced and released into the atmosphere by both anthropogenic and natural sources. Volcanoes and forest fires are examples of natural sources, while man-made sources mostly result from the high-temperature burning of fossil fuels in motor vehicles, stoves, power plants, refineries, and other industrial processes. These pollutants have a high lipophilicity, limited biodegradability, and high persistence in the environment. The susceptibility of the public health upon exposure and inhalation of the aerosols is increased by the connection of dangerous 4-6-ring PAHs with tiny particles as well as their pervasive presence in the atmosphere. In order to detect PAHs in airborne particles and evaluate their environmental fate and human exposure, aerosol characterisation studies have been conducted around the globe. A variety of PAHs are mutagenic because they may produce protein adducts by covalently attaching to DNA in the target tissues and signaling via aryl hydrocarbon receptors. Mutations caused by subsequent DNA replication lead to carcinogenesis. A PAH that might cause mutations has the potential to harm the germ line, which could result in infertility issues and mutations in subsequent generations. A single PAH has a far greater potential to cause cancer and mutation than a combination of the same PAH with a similar dosage.

As was previously said, PM is the air pollutant that has the greatest human health impact of all those present in ambient air. Toxic effects and bad health effects may be attributed to certain PM features, however the data at this time is inconclusive. Although epidemiological research showing

that PM is the air pollutant most consistently and strongly associated with a variety of unfavorable health outcomes, we still have a long way to go before fully understanding the mechanisms at play. 9, then, focuses on the cellular processes underlying the negative health impacts of PM air pollution. Exposures to particles from different emission sources and of varying nature, as well as cell cultures of target cell types known to be pertinent to organs impacted by PM, form a variety of factors included in the studies described below. During in vitro exposure of cells to PM, three biological response patterns have been identified: cytotoxicity, cytokine generation, and genotoxicity. Nevertheless, further research is needed to determine the specific impact that these cellular responses play in the health effects seen in people. Understanding the impacts of different PM constituents has so far centered on identifying certain PM constituents that indicate toxicity with a particular cellular effect.

There is evidence that interactions between PM components result in more complicated patterns of cellular responses, which in turn influence cellular responses. An intellectual and methodological challenge is presented in the creation and interpretation of the findings achieved with PM-related mixes. Recent research using concentrated ambient particles have made it possible to analyze ambient PM with the option of looking into interactions between PM and components as well as interactions between PM and gases. The authors provide experimental data linking proinflammatory conditions, oxidative stress, and brain activation brought on by exposure to PM to respiratory and cardiovascular system damage. The relationship between PM air pollution and adverse consequences on human health has been demonstrated, notwithstanding the current uncertainty. Future studies should concentrate on developing methodologies suitable for addressing multipollutants multiple effects, as well as the ability of various PM components, and their interactions, to convey toxicity and porosity; using samples from ambient air at relevant doses, relative to open population exposures; greater understanding the potential effects of cumulative exposures and exposures occurring within susceptibility time-windows in the development and growth of children; and

a basic framework for evaluating possible health effects and human exposure to particular air pollution, specifically with regard to indoor airborne particles. This document presents and discusses case stories to demonstrate how to use the risk assessment framework. These case studies concentrate on cooking techniques since they are a significant source of particle air pollution in enclosed spaces. The research outlined here aims to assess any possible health hazards experienced by cooks using a mix of controlled tests and in-the-field observations. This covers both the physical qualities and the chemical properties, as well as their respective potential dangers, to show how important both are in assessing risks from particles. Pan-frying, stir-frying, boiling, and steaming are shown to release the fewest particles and the largest proportion of nanoparticles, respectively. This relationship between particle number concentrations and various cooking techniques suggests that using oil results in higher particulate emissions than using water. The fraction of ultrafine and accumulation mode particles increased during water-based cooking, which is assumed to be a result of the newly released particles' hygroscopic development when exposed to high humidity.

The deep-frying cooking technique was when the PM2.5 and PAH levels were found to be at their greatest. Strong evidence has been shown to relate urban/rural air pollution to acute and chronic diseases, as well as to early mortality, and these negative health effects, in turn, have large societal economic implications. As compared to other air pollutants, PM10 has been identified as a significant contributor to health issues, notably asthma. Outlines the numerous sources of PM10 as well as the current concentrations of PM10 in India's main cities. For 14 major Indian cities, the

effects on health in terms of increased mortality and morbidity were calculated. Data analysis shows that most cities have PM10 levels that are 2-3 times higher than the permissible limit of 60 g/m3. Bangalore is reported to be the least impacted in terms of health implications, whereas Delhi is shown to be the most affected based on the concentration levels of PM10 in 2001. The uncertainty surrounding the calculation of health effects highlights how PM10 levels change significantly over time, leading to wide estimations. To provide improved estimates, accurate pollution measurement and the selection of their representative values are crucial inputs. Hence, gathering systematic and trustworthy data on air quality would be a key step in reducing the negative effects of air pollution on health. This would then allow for the development of suitable strategies and action plans for managing air quality.

There are two different types of environmental risks posed by toxic or hazardous air pollutants: "short-term or acute risk" and "long-term or chronic risk." Short-term risk is connected to a single acute exposure to potentially hazardous substances that are unintentionally released into the atmosphere, whereas long-term risk is brought on by ongoing exposure to potentially harmful substances. To calculate the acute or short-term danger from the unintentional discharge of industrial hazardous chemicals, the relevant modeling approaches are used. Dose-response models and dense gas dispersion models have been applied. A case study for chlorine storage in the Indian environment serves as an illustration of the model's use. Administrators construct nomograms for use in industrial chemical accidents to aid with evacuation when rapid modeling applications are not necessary. The nomograms are created for eight dangerous compounds that are utilized frequently in Indian businesses.

Moreover, it assesses the possible health hazards associated with certain carcinogens and noncarcinogens found in various Indian states. For this, appropriate dose-response models with input data and assumptions tailored to the Indian environment have been found and employed. The additional cancer risks for both individuals and society as a whole have been calculated. Estimates have also been made of the hazard quotients and hazard indexes that indicate the noncarcinogenic chronic health consequences of chromium and cadmium owing to their long-term exposure via food and water. When the risk findings are compared to disease surveillance data, a sufficient level of validation is found. Additionally, two case studies of the country's chlorine industries are used to illustrate an integrated approach to risk assessment. Lastly, the state of quantitative risk assessment approaches today is discussed, along with its shortcomings. In order to eventually control pollution and manage air quality, epidemiological studies of air pollution, international and national guidelines of emissions and air quality, approaches and techniques to monitoring and modeling air pollution, as well as the creation and implementation of suitable policy frameworks, are also crucial.

This is done in order to determine where the problem with air pollution originated in the first place. Discusses several points of view, including the Neoclassical Environmental Economic Perspective, which continues to have a significant impact on theories of natural capitalism and environmental finances, in order to address this problem from the perspectives of environmental economics and public policy. Neoclassical economic analysis continues to be crucial in today's economic decisions, including those involving consumption, production, and policy-making. The primary public policy approach, for instance, that is used to make environmental choices and shape environmental legislation at any national, international, or supranational level is cost-benefit analysis. As a result, public policy on environmental concerns have been centered on neoclassical environmental economics for decades. There are few alternatives to Neoclassical Environmental

Economics, and the issue of whether it is the appropriate economic strategy for making policy decisions is very contentious which begins from the Neoclassical Economic viewpoint and reviews the key alternative methods to get a highly balanced picture of the global environment, offers insight into air pollution and its effects on health and the ecosystem.

A highly developed area of environmental management is the creation of air quality policies and techniques for determining how actions affect air quality. The essential scientific components involved in this process are covered in detail. Measurements of the environment, emission inventories, and atmospheric models form the basis of air quality management. They provide a quantitative knowledge of how the chemistry of the atmosphere, the weather, and natural emissions affect human emissions, the accumulation of pollutants, and the concentrations of those pollutants in the air. These data may be used to calculate population exposure, quantify risk, and evaluate health effects, eventually leading to integrated models that can calculate the improvements to human health brought on by certain emission reduction initiatives. Reducing the negative impacts on human health is one of the main reasons to improve air quality, hence the latest research on the subject is covered here. This article's major emphasis is on technical issues relating to the effective creation and use of air quality models, emission inventories, and measurement programs, including a discussion of estimating uncertainty. To examine how models, emission inventories, and measurements enhance air quality management and then to address technical challenges and uncertainties in the implementation of these tools is one of the main objectives of this. The successful implementation of these techniques and the effective communication of their findings to air quality managers at all levels of government and in the commercial sector are aided by awareness of these concerns.

As was previously said, air pollution not only has a negative impact on human health, but also on the ecosystem and environment. Due to its phytotoxicity and widespread high concentrations in agriculturally significant places, ground-level O3 is undoubtedly the air pollutant most likely to harm agricultural crops globally. South Asia, Southeast Asia, and southern Africa have far less developed research than Europe and North America, despite the fact that substantial experimental studies to evaluate the potential harm presented by O3 to agriculture have been undertaken in these regions. With the current acceleration of economic expansion and related pollution emissions, study in these areas is likely most urgently required. In this context, 15 recounts one of the first analyses of the effects of air pollution on agricultural yield in South and Southeast Asia and southern Africa. The work described here has established the current state of knowledge on the effects of air pollution on significant arable crops across geographies and discovers evidence of significant effects often happening under high ambient O3 concentrations for numerous significant species. With photochemical modeling suggesting O3 concentrations in excess of European and WHO AQGs, preliminary risk assessments have identified high risk across the Indo-Gangetic plain region of South Asia, large portions of Thailand, some areas in Burma, and regions in Zimbabwe and Botswana in southern Africa. The highest statistically significant yield losses were in the range of 30% and above and tended to occur in the high-risk regions identified by the risk-assessment modeling, according to a coordinated and standard experimental campaign conducted across South Asia to assess yield losses to mung bean.

It would seem that O3 pollution may very well be an additional and major stress on agro-ecosystems given the scale and scope of yield losses documented for important crops throughout the South Asian area in this and other research. Given the challenge of the region to offer sustained gains in productivity to offset decreasing per capita area harvested, a thorough knowledge of the

relative impact of all pressures confronting present and future agricultural output in the South Asian areas is crucial.

O3 annual mean surface averages for South Asia and southern Africa might range from -5.9 to +11.8 ppb for South Asia and from -2.5 to +7 ppb for southern Africa in 2030, according to global modeling of ground-level O3 concentrations, depending on the emission scenario used. Since the climatic circumstances favor the chemical synthesis of O3 in the atmosphere, the potential increases in mean year averages would translate into disproportionally larger average concentrations during the growth season. As a result, it is very probable that O3 concentrations, which are now at levels capable of resulting in yield and productivity losses in many regions of South Asia and southern Africa, will deteriorate over the course of the next 20 to 50 years. So, it would be wise to take this pollutant into account when doing future study to determine how various pressures affect agricultural output in southern Africa and Asia.

Future analyses of the effects of O3 on crops should ideally take the effects of climate change into account and strive to engage experts in adaption strategies. In an ideal world, top government decision-makers would get together to discuss potential combined effects, steps to lessen end users' exposure, national risk assessments, and policy choices to lessen the danger from this environmental issue. In many developing areas where there is skepticism about climate change policies but where the significance of reducing air pollution is understood, the prospect for cobenefits for air pollution and climate change in emission reduction policy is of special relevance. Yet, the majority of the work on cobenefits has been done with goals and viewpoints from the industrialized world. To now take into account the interests and views of emerging nations, this has to be expanded. With a focus on sustainability, it discusses how air pollution affects ecosystems and human health. The authors provide an overview of the science behind sustainable development and the interplay between the environment, society, and economics. A short conceptual explanation of the interaction between ecological, social, and economic systems, emphasizing the advantages of ecosystems for people and the dangers to maintaining them, sets the stage for the rest of the voyage. A stable environment is necessary for the long-term growth of the global economy. Recognizing that economics, society, and environment must all be taken into account at the same time in any development strategy is the first step toward achieving sustainable development. As a result, air pollution has been examined in the context of human efforts to achieve sustainable development.

The development that is environmentally conscious must consider a number of key factors, including the measurement and evaluation of air pollution's causes and effects, its causes and effects' irreplaceability, the carrying capacity of ecosystems, the ecological footprint of human activity, and the significance of various research fields. The concept of ecological sustainability is a component of environmental education, as is the capacity to create and use sustainability indices, such as the Environmental Sustainability Index (ESI), Ecological Footprint Index (EFI), Environmental Vulnerability Index (EVI), Millennium Development Goal 7 Index (MDG7), and Living Planet Index (LPI). For all significant environmental challenges, there are several particular environmental indices available, including those used by the Organization for Economic Cooperation and Development. Measurements of greenhouse gas emissions, apparent consumption of O3-depleting substances, SOx and NOx emission intensities, municipal waste generation intensities, wastewater treatment rates, intensities of use of energy and water, forest and fish resources, and threatened species are also included in this list. Yet, they do not provide a comprehensive view of the status of the ecosystem. Thus, there is a critical need for composite

indicators that link environmental degradation throughout the world to economic growth. Aggregated indices must be utilized carefully, notwithstanding how effective they are at summarizing complicated realities in simple terms since the more complex the reality they focus, the greater the risk that they will not apply to the required circumstances. In what Edward O. Wilson termed the "Century of the Environment" and the "bottleneck" of the near future, education for sustainable development is our greatest hope. We share his belief that the only approach to ensure a long-term perspective for mankind is to combine science and technology with wisdom and moral bravery. Most all, this education should work toward fostering a reflex that evaluates short-term financial advantages in light of long-term impacts on our ecological, social, and economic systems.

air pollution-related regional and worldwide environmental problems. In general, air pollution is seen as more of a short-term local issue than a long-term worldwide change problem. Yet, there is mounting evidence that, from urban and regional to continental and global dimensions, human activities in a more globalized, industrialized, and linked globe are having an impact on both air quality and climate change. The main factors causing significant environmental changes are rapid population expansion and rising energy consumption. The chemical composition of the downstream troposphere is changing fundamentally as a result of emissions from urban and industrial centers in industrialized nations as well as increasingly from big cities in emerging nations. As was already established, NOx and VOC emissions contribute to photochemical smog and its accompanying oxidants, lowering air quality and endangering ecosystem and human health. These same emissions act as a larger-scale catalyst for the creation of O3 in the free troposphere, which greatly contributes to global warming. The principal directly driving greenhouse gases, including carbon dioxide, methane, NOx, and halocarbons, are also mostly produced in urban and industrial regions. NOx and SO2 emissions are also converted to powerful acids by atmospheric photochemistry on regional to continental scales, generating acid deposition to sensitive ecosystems and damage to materials, including historic structures and monuments. Direct urban/industrial emissions of carbona- ceous aerosol particles are exacerbated by the release of high amounts of secondary aerosol precursors, including NOx, VOCs, SO2, and NH3. The ensuing combination of primary and secondary aerosols is now known to have an essential impact in the Earth’s climate [8]–[11].

CONCLUSION

The troposphere is the lowest layer of Earth's atmosphere. Most of the bulk (approximately 75-80%) of the atmosphere is in the troposphere. Most forms of clouds are located in the troposphere, and practically all weather happens inside this layer. The troposphere includes around 85% of the atmosphere's total mass. Tropospheric processes, such as the water or hydrologic cycle (the generation of clouds and rain) and the greenhouse effect, have a tremendous impact on meteorology and the temperature of our planet. This shows some of the regional and worldwide implications of air pollution and the difficulties and possibilities in tackling these complex concerns. One of the first elements in any reasonable strategy to tackling regional and global environmental difficulties is to foster internationalism—a general knowledge that all of our human problems are interrelated. Regional and international collaboration will be vital to the solving of environmental concerns. Strong involvement of stake- holders at all levels, changes in human behaviour and attitude, coupled with suitable mechanisms for facilitating both financial and technological flows, and the reinforcement of human and institutional capacities will be crucial to the future success of attempts to regulate atmospheric pollutions.

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CHAPTER 26

AIR POLLUTION MONITORING AND MODELING

Ms. Sunitha B K, Assistant Professor & HOD, Department of Management,
JAIN (Deemed-to-be University), Bangalore, India,
Email Id-sunitha@cms.ac.in

ABSTRACT:

The term "air pollution" refers to the degradation of the natural environment or the release into the atmosphere of physico-chemical or biological substances that might injure or irritate people or other living things. Modeling helps determine the link between sources of pollution and their impacts on ambient air quality. Air quality managers utilize models to determine source contributions to air quality issues and aid in the creation of successful measures to minimize dangerous air pollutants. In this chapter author is discusses the selection of contaminants for air quality monitoring.

KEYWORDS:

Air, Environment, Monitoring, Modeling, Pollution.

INTRODUCTION

Our health and quality of life are significantly impacted by the composition of outdoor and indoor air. The environment, particularly more global environmental problems like stratospheric ozone depletion and climate change, may be significantly impacted by air pollution and greenhouse gas emissions. Primary or secondary air pollutants may be generally categorized in this way. Typically, primary air pollutants are compounds that are released into the atmosphere as a direct result of a human-made or natural activity, such as sulfur dioxide from industries or carbon monoxide gas from automobile exhaust. Yet, main pollutants do not cause all of the negative impacts of air pollution on their own. Primary pollutants and atmospheric elements may react chemically with one another. As a result of gaseous contaminants interacting with airborne particles and each other, a wide variety of novel chemical compounds are created. Secondary air pollutants are those that are generated in the air rather than being directly released, and they are to blame for a number of negative impacts of air pollution, including fog, haze, eye irritation, and harm to flora and other materials [1]–[3].

Using air pollution monitoring to get a detailed picture of the present pollution condition is the first step in putting measures against air pollution in place. A solid scientific foundation for managing air quality and controlling the causes of air pollution is provided by measuring air quality and comprehending its effects. In order to design policies and strategies, measure adherence to guideline values, and monitor progress toward environmental objectives or targets, air quality or pollution monitoring is crucial. Thus, much effort should go into the systematic measuring of air pollution levels on various sizes, from local to global. Monitoring air pollution and the data it produces are not goals in and of themselves. Instead, it provides us with the most effective means of comprehending air pollution issues, evaluating and monitoring environmental controls, and addressing pollution issues at local, national, and worldwide levels. The ultimate goal of air pollution monitoring is to gather trustworthy data that can be utilized by researchers, decision-

makers, and planners to help them manage and enhance the environment's overall quality. Monitoring data, together with emission inventories and precise objectives, may be used to create policies that are specifically suited to deal with the most pressing problems. In addition to ensuring that the effects of management choices may be accurately analyzed, well-presented monitoring data aid in educating local people about air quality challenges. Every successful air quality management plan must include high-quality monitoring data that track changes in pollution levels and identify possible health or environmental repercussions. The findings of additional assessment approaches, such as modeling, emission inventories, interpolation, and mapping, should be employed in addition to any monitoring program's limits and the use of analytical data from one methodology.

DISCUSSION

Selection of Contaminants for Air Quality Monitoring

As it is impractical to monitor every airborne pollutant, monitoring programs typically only measure a select few chemicals that serve as indicators of air quality. Certain pollutants are chosen based on that

1. They have major negative consequences on the environment or people's health.
2. They often leak from local sources that are known or believed to be in the region.
3. They provide a reliable estimate of the air's general quality.

Which contaminants to watch depends a lot on the types of sources in a given location. For instance, monitoring should be done for nitrogen dioxide, CO, and maybe benzene and fine particles if automobiles are the main source of pollution. Particles, perhaps CO, and polycyclic aromatic hydrocarbons should be analyzed if the region is impacted by home fire emissions from wood burning. SO2 should also be monitored in areas where coal is often used as domestic fuel or by industry.

It's crucial to take into account if there is a reference value or benchmark against which the findings may be compared when choosing which pollutants to monitor. If monitoring data are compared to recommended levels, it may be determined if the pollutant is likely to have a negative impact on health. Usually, for this purpose, regional, national, and sometimes worldwide guideline values are resorted to. Guidelines may be very qualitative or quantitative [4]–[6].

Choice of Monitoring Locations

Every scheme for monitoring air pollution must include site selection as a crucial component. The region that the data would represent is directly tied to the placement of a monitoring station. The monitoring program's goals will determine where to do the sample. It is often unwise to place a monitoring station near to a potent localized source, as a vent from a factory or garage, for the purpose of monitoring air pollution within an urban airshed. High pollutant levels that often do not create issues or accurately represent the local air quality may be found at these locations. Nonetheless, it is suitable to locate the monitoring equipment near to the source for some projects, such as establishing a correlation between CO concentrations at a roadside and car emissions or between an industrial discharge and its effects on air quality. Moreover, care must be taken to choose a location that is not significantly impacted by nearby airflows, whether by shielding or funneling. The monitoring site should be representative of the environment being impacted or potentially affected. In other words, the monitor should be placed where people may potentially be harmed, either now or in the future, if negative consequences on human health are a worry. The

monitor should be placed close to a delicate ecosystem that could be damaged if influences on ecosystems are the problem.

The appropriate average period for the guideline of the target pollutant should be considered while choosing a location. For instance, when individuals are exposed to CO levels that are too high for an extended period of time like an hour or eight hours health issues arise. For CO, it is thus reasonable to install the equipment where humans may be exposed over the course of one or eight hours. Since domestic emissions account for a considerable portion of CO emissions, such locations are situated inside larger airsheds or close to busy transportation routes and interstates. On the other hand, a yearly exposure time is often used to evaluate the health impacts of benzene. Consequently, it is necessary to place a benzene monitor in an urban residential neighborhood, away from the main effect of a busy road, in order to determine the total yearly exposure of the majority of urban inhabitants. This is due to the fact that, on a yearly basis, few individuals spend a lot of time close to a busy road. Nonetheless, it can be desirable to place the monitor close to the road in order to conduct a more thorough human exposure evaluation. Also, it's critical to gather data from all the major locations where a person may be exposed in order to conduct epidemiological research. This might apply to indoor air or air inside a vehicle.

When choosing a site, it's important to consider how atmospheric processes might impact how a contamination forms and degrades. For instance, ozone is created over time when air contaminants interact with one another when exposed to sunlight. Thus, it is necessary to monitor ozone downwind from the main sources of its precursors, where it is most likely to be present. Similar to NO, NO2 is a pollutant that is produced over time from NO emitted from combustion sources rather than being discharged into the atmosphere in significant proportions. As a result, a monitor near a busy road, where NO hasn't had a chance to turn into NO2, would not be the greatest place to measure NO2 concentrations.

Examination and Maintenance of Equipment

For accurate and dependable monitoring data, proper equipment maintenance and inspection are essential. The majority of air pollution monitoring equipment has to be calibrated periodically. Instrumental drift and bias are prominent characteristics. Based on the findings of the calibration, the data should be rectified. It is necessary to keep a record of the calibration processes and histories and to make it accessible upon request. Calibrations may vary from simple visual inspections of equipment performance to in-depth analyses of individual parts and multipoint tests on intricate combinations of pollutants. Checking the accuracy of the monitoring system's measurements of a contaminant in a sample with a known concentration is a common step in calibration. Data loggers should be used wherever feasible to automatically collect air quality data with the highest temporal resolution available. By employing several methods/equipment at the same time or in separate laboratories to evaluate duplicate samples, it is possible to assess the precision and variability of each one. This is especially helpful for differentiating various particle sampling techniques. When a method's dependability or accuracy is questioned or when other, less costly ways are being considered, such comparisons should be done [7], [8].

Validation and Interpretation of Data

The goal of monitoring is to create information that is helpful for technical, policy, and end-users in the general public, not only to gather data. Raw data have relatively little practical use on their own. To create a trustworthy and reputable dataset, this data must first be checked by validation and ratification.

Each air pollution monitoring site's circumstances and ramifications should be considered while interpreting the results. Provide a broad description of the site's features as well as any nearby sources of air pollution. A short description of meteorological circumstances that are likely to impact the site's air quality, such as inversions and the predominating wind, should be noted together with a record of meteorological variables such wind speed, wind direction, temperature, and so on.

Choice of Monitoring Techniques

There are several different ways to measure air pollutants, each with a different set of costs and levels of accuracy. The aim and goals of the monitoring program, the available budget, and if it is necessary to follow any standard procedures and/or national guidelines should all be taken into account when choosing specific monitoring techniques. The following categories apply to air monitoring techniques.

Techniques Using High-Precision Instruments

These techniques offer a high degree of measuring accuracy and give continuous records of pollution levels over long periods of time with little operator interaction. These devices' detection thresholds often fall an order of magnitude or more below normal urban background values. These monitoring techniques are also the costliest, and in order to attain high accuracy, proper calibration and operation are needed. In order to understand how pollutant levels change over short time periods, high-precision experimental approaches, such as differential optical absorption spectroscopy, are often utilized in research projects or other specialized investigations.

Lower-Level Methods of Instrumentation

The low-precision approaches are more affordable than the instrumental methods, such as automated monitors used for regular air quality monitoring. While their functioning checks and adjustments must be made more often, the measurement accuracy is only slightly lower than regular background levels.

Manual Fractionation Techniques

The majority of semiautomated systems are also available, although manual filter-based particle collecting techniques often involve human filter replacements between each sample and provide time-averaged findings of PM, typically over 24 hours. Most manual particulate techniques have a precision of 10–20% of average background values.

Manual Wet-Chemical Methods

For a range of gaseous pollutants, including SO2 and NO2, manual wet-chemical procedures are often utilized; they demand ongoing operator involvement and also provide time-averaged findings. Most wet-chemical procedures have accuracy that is just slightly below usual background values, and the approaches are

Methods of Passive Monitoring

On the basis of long-term sampling, passive samplers are often used for surveys or to categorize regions as having low, medium, or high pollution levels. In most cases, they don't provide any information on short-term pollution levels or enable accurate assessment of the actual pollutant concentrations under field settings without calibration utilizing concurrent real-time measurements with active analyzers. This solution for monitoring is the least expensive since it doesn't need

energy or regular upkeep. In rural or distant places, passive samplers are often used to test trace gases including O3, SO2, and NO2.

About sulfur and nitrogen gaseous substances in the atmosphere are their equivalent oxides, hydrides, and organic compounds. Sulfur dioxide (SO2) and sulfur trioxide are the two main sulfur oxide pollutants. When sulfur-containing fossil fuels are burned, S is oxidized to produce SO2 and, to a lesser degree, SO3, which is the principal source of SO2. Nitric oxide and NO2 are the nitrogen oxides that are most dangerous. These contaminants may be quantified using chemical and physical techniques. Acidimetric, colorimetric, chromatographic, and coulometric chemical techniques may be used to analyze gaseous sulfur and nitrogen pollution. Details on these methods can be found in the relevant literature. Moreover, optical optical techniques including chemiluminescence, fluorescence, and absorption spectroscopy are used to analyze gaseous S and N molecules.

PM Measurement

A complex combination of organic and inorganic, water-soluble and water-insoluble, volatile and semi-volatile materials makes up ambient aerosol. It also has a variety of morphological, chemical, physical, and thermodynamic characteristics. Combustion-generated particles from combustion, such diesel, soot, and fly ash, photochemically produced particles, like those in urban haze, salt particles from sea spray, and crustal particles from resuspended dust are all included in atmospheric PM. Certain particles may be hygroscopic and have moisture that is linked to the particle. The relative humidity of the surrounding air and the makeup of the particles both affect how much moisture is present. Water often makes up more than half of the mass of fine air particles when the relative humidity is over 80%. Measurements of airborne PM are often used for a number of purposes, such as apportioning sources, evaluating the efficacy of control measures, and examining the connection between air quality and health. Measuring PM10 and PM2.5 is difficult due to the very changeable nature of airborne PM. The exact quantification of tiny quantities of mass is necessary for the measurement of the mass of PM floating in the air, whether it be coal dust in mines or ambient air PM. In general, there are two approaches to this measurement: direct microweighing techniques that directly determine the mass and indirect methods that estimate the mass using other particle characteristics.

Methods for Direct Mass Measurement

The gravimetric method is one of the direct mass measuring methods. The easiest and most straightforward sampling method is to gather particles on filters. The PM mass is obtained by subtracting the pre- and postsample weights on a laboratory gravimetric balance. Calculating the PM mass concentration requires knowledge about the amount of air that went through the filter. This time-tested technique of measuring the mass that has been deposited on a filter is often regarded as the gold standard.

Water may be used to remove the soluble parts of aerosol particles, and the cation and anion concentrations can be measured using an ion chromatograph. For elemental composition analysis, insoluble particles are commonly subjected to instrumental neutron activation analysis, proton-induced x-ray emission, or inductively coupled plasma mass spectrometry. Gas chromatography is often used to analyze semivolatile components using an electron capture detector or one connected to a mass spectrometer. The different origins and atmospheric processing of the individual particles are reflected in the vast variations in the bulk composition of the particles gathered by particulate sensors. The link between the mass and composition of particles collected

on a filter and the actual composition of PM in the environment has been observed to be subject to several errors. According to Chuen-Jinn and Hsin-Ying, sampling artifacts, such the loss of semivolatile material, may be seen for a variety of filter-based measuring methods. Glass fiber filters have been shown to often absorb SO2 and HNO3 gases, resulting in extraneous sulfate and nitrate in collected particle samples, which causes an overestimation of both and may influence the reported mass of PM. Both the filter material and the deposited PM may exhibit this. Evaporation and/or chemical reactions during sampling might produce unwanted artifacts. One example is the loss of nitrate as a result of the interactions between ammonium nitrate that has been collected on the filter medium and acidic aerosol, such as particulate H2SO4. Nitric acid gas evaporates as a consequence, and ammonium nitrate is lost. Also, when air passes through an aerosol sampling device, the pressure drop causes the concentration of certain species in the gas phase to fall. Due to the concentration difference created between the air stream and the particle mass, semivolatile material collected in the mass on the filter is once again lost by evaporation. Depending on the mass concentration and composition of the aerosols as well as the local climatic circumstances, the degree of these processes varies with location. Moreover, it has been noted that sampling, transit, and storage artifacts exist. One such instance is the loss of volatile compounds, which may do so after sampling but before being weighed or subjected to chemical analysis. Additionally, the actual mass on the filter is significantly influenced by the temperature and humidity history of the filter that has been exposed to dust [9], [10].

Methods for Indirect Mass Measurement

The beta gauge and tapered element oscillating microbalance are two examples of indirect techniques that may provide measurements of ambient particle concentrations almost continuously. The use of optical and filter pressure drop techniques are other examples of indirect procedures. As there is no constant physical relationship between other particle characteristics and particle mass, indirect techniques are fundamentally flawed.

Microbalances with Tapered Elements That Oscillate

This filter-based, real mass measuring method, which is capable of high-time resolution, marks a significant advancement in PM monitoring. Inertial mass detectors, also known as TEOMs, have been developed during the last few decades to provide this functionality for a variety of demanding applications. TEOM mass detectors are used in near-real-time PM monitors for ambient air, diesel exhaust, stack emissions, fly ash carbon concentration, and in devices exploring the chemical kinetics of catalysts. They were originally developed for space-related applications. The TEOM monitor draws a sample via a sampling inlet, then the sample filter, and constantly weighs the sample filter to give a filter-based, direct mass measurement of PM in ambient air. The mass calibration ambiguity that arises in systems that do not directly measure mass is eliminated by TEOM technology. Although having the benefit of providing filter-based mass readings very instantly, manual, gravimetric procedures also avoid any potential filter handling mistakes. Every TEOM-based monitoring equipment's engineering design offers autonomous, real-time flow control, sample conditioning, and PM mass measurement.

When used in combination with a size-selective intake, the TEOM may be utilized to monitor the mass concentration of total suspended particles or size-fractionated PM. Also, a number of well-known research programs that examine semivolatile particles, tiny and coarse particles, and particle behavior employ the TEOM as the primary mass measurement method. To improve the TEOM, optional add-on components may be used to remove particle-bound water, keep a

particular semivolatile particle composition, or measure the overall mass of nonvolatile and volatile particles. Real-time monitors, including the TEOM, are reported to lose semivolatile material when operated at high temperatures, raising questions about their ability to accurately measure atmospheric particles. In fact, the mass recorded by the TEOM is on average 18.3% lower than the reference method across Europe.

Beta Scale

A popular continuous monitoring technique for measuring PM10 concentrations is the beta gauge. It is based on the measurement of the attenuation of ionizing radiation via particle mass deposited on a filter, or beta-ray absorption in a sample caught on filtering material. With a 0.5-2 h time precision, it enables unattended operation over long periods of time. The beta absorption coefficient of the particle, which might change depending on chemical composition, determines the instrument's reaction. The variance is not very large, however, thus this is not a major drawback in the majority of monitoring applications. Its concentration may be determined by comparing the beta-ray absorption of exposed and unexposed filtering material, which is proportional to the mass of the trapped suspended particle matter.

Light-Scattering Devices

Light-scattering equipment has been around for a while, but it has mostly been used to track worker dust exposure. Several of these sensors have been modified for ambient monitoring during the last few years, with varying degrees of effectiveness. The "workplace" machines provide an immediate readout of particle concentrations and are portable and reasonably priced. Unfortunately, they often have very low measurement sensitivity and accuracy. They are thus only appropriate for little survey work. On the other hand, certain instruments are now on the market that function at a considerably better level, to the point where they may be used in regional networks and for monitoring against environmental standards. The GRIMM aerosol spectrometer is one such device, and its producers anticipate that the USEPA will soon award it equivalence status.

The fundamental drawback of light-scattering instruments is that they don't respond to airborne particulate mass as much as they respond to particle size distribution and quantity. This may be somewhat mitigated by doing recurring calibrations using manual filter sampling. Nevertheless, because to variations in the makeup and characteristics of the airborne particles, such calibration "factors" are likely to vary with various monitoring sites and seasons of the year. Particle size distributions may be inferred from certain light-scattering sensors. This could be useful in certain studies.

Characterization and Apportionment of Sources

An effective air quality management plan must take into account the significant pollution sources that influence ambient concentrations of pollutants. Air quality models describe the physical and chemical processes that impact air pollutants as they scatter and react in the atmosphere using mathematical and numerical methodologies. These models are created to characterize primary pollutants which are emitted directly into the atmosphere and, in some cases, secondary pollutants that are formed as a result of complicated chemical reactions within the atmosphere. They are based on inputs of meteorological data and source information such as emission rates and stack height. These models are crucial to the air quality management system since they are often used by organizations charged with reducing air pollution to both identify the sources of issues with the quality of the air and help with the development of efficient methods to do so. For instance, during

the permitting process, air quality models may be used to confirm that a new source won't violate ambient air quality criteria or, if necessary, to identify the appropriate extra control measures. In order to determine how well a new regulatory regime is working to reduce hazardous exposures to people and the environment, air quality models may also be used to anticipate future pollutant concentrations from a variety of sources.

Receptor modeling involves observational methods that determine the existence of and quantify source contributions to receptor concentrations by comparing the chemical and physical properties of gases and particles observed at source and receptor. They begin by measuring a particular aspect of the air pollutant, such as particle size, size distribution, component identification, chemical state and concentration, as well as temporal and spatial variation at the receptor. They next compute the contribution of a certain source type. The behavior of the surrounding environment at the site of impact is the subject of receptor modeling. The core tenet of receptor models is that sources of airborne PM in the atmosphere may be located and estimated using a mass balance analysis under the assumption of mass conservation.

Receptor models may be divided into two categories: chemical approaches and microscopic methods. Microscopic techniques identify the origins based on distinctive morphological characteristics like wood fiber, tire rubber, pollen, and so on. They calculate the volume, density, and quantity of particles in order to make quantitative predictions. Chemical approaches are based on the presumption of mass conservation and need knowledge of the chemical composition of both ambient and source particles. The degree to which this assumption is true relies on the species' chemical and physical characteristics as well as its capacity to influence the atmosphere via processes including condensation, volatilization, chemical reactions, and sedimentation. Chemical methods can be further divided into subgroups that primarily provide quantitative information about potential sources, such as enrichment factor analysis, time and spatial series analysis, while the chemical mass balance and advanced multivariate methods also provide quantitative information about sources and are primarily used for source impact assessment studies.

Analysis of Enrichment Factors

In continental and marine regions, respectively, atmospheric aerosols are anticipated to have the crust and the sea as their primary natural sources. When atmospheric aerosol components are discovered to have larger concentrations than would be predicted based on their proportions in the background aerosol, this comparison is crucial. This comparison may be used to determine whether the origin of these components is natural or manmade. Calculating EFs for each element in the aerosol in relation to the background and normalizing them to the element thought to be the clearest sign of the source material allows for this comparison [11], [12].

CONCLUSION

Since it harms not just the environment but also crops, forests, animals, and people's bodies, air pollution is seen as an issue. Acid rain and ozone layer depletion are issues brought on by the sources of air pollution. Some stations are outfitted with meteorological sensors and/or noise level meters to measure noise levels. Air Quality Monitoring Networks allow for the measurement, operation, and predictive analysis of the evolution of air pollution in different areas (urban areas, industrial areas, special nature conservation areas, etc.). Industrial air pollution, particularly low birth weight and preterm delivery, is a significant risk factor for ABO. The correlations between ABO and air pollution from power plants and the petrochemical industry provide the most convincing data.

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