



New Paradigm: Coal Fly Ash as the Main Cause of Stratospheric Ozone Depletion

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ABSTRACT

We provide further compelling evidence that aerosolized coal fly ash and its various components, especially iron, is the primary cause of stratospheric ozone depletion, not chlorofluorocarbon (CFC) gases, as “decreed” by the Montreal Protocol of 1989. Aerosolized coal fly ash is a toxic “witches’ brew” of numerous elements and substances that destroy ozone directly and indirectly by numerous chemical reactions, the full extent of which is not yet known. The prevailing CFC-ozone depletion theory is simply wrong, and does not account for multiple chemical and photochemical reactions that kill stratospheric ozone. We discuss the primary role of coal fly ash particles in ice nucleation and cloud formation in the upper troposphere and stratosphere, and dispel the notion that meteoric or extra-terrestrial material is responsible for polar stratospheric clouds. We provide extensive documentation that iron and several other elements found in coal fly ash are trapped in polar stratospheric clouds and destroy ozone by various means, especially when they are released in the spring. Recent scientific discoveries “fit together” to strongly support the New Paradigm of stratospheric ozone depletion by coal fly ash. The “World Not Avoided” by the Montreal Protocol is already here: The biosphere is in collapse with runaway global warming, and lethal ultraviolet radiation penetrating to Earth’s surface. This new paradigm shift must be operationalized. Time is critically short to salvage what we can of Earth’s vital life support systems, including the stratospheric ozone layer. We reiterate that all sources of aerosolized coal fly ash must be reduced and/or eliminated. All forms of geoengineering *must* stop immediately if we are to survive as a species. The deliberate assault on Earth’s natural processes, we allege, constitutes no less than acts of planetary treason.

INTRODUCTION

We have previously provided compelling evidence that coal fly ash particles, not chlorofluorocarbons (CFC’s), are the primary cause of stratospheric ozone depletion, through numerous ozone-killing reactions, graphically illustrated in Figure 1 from [1].

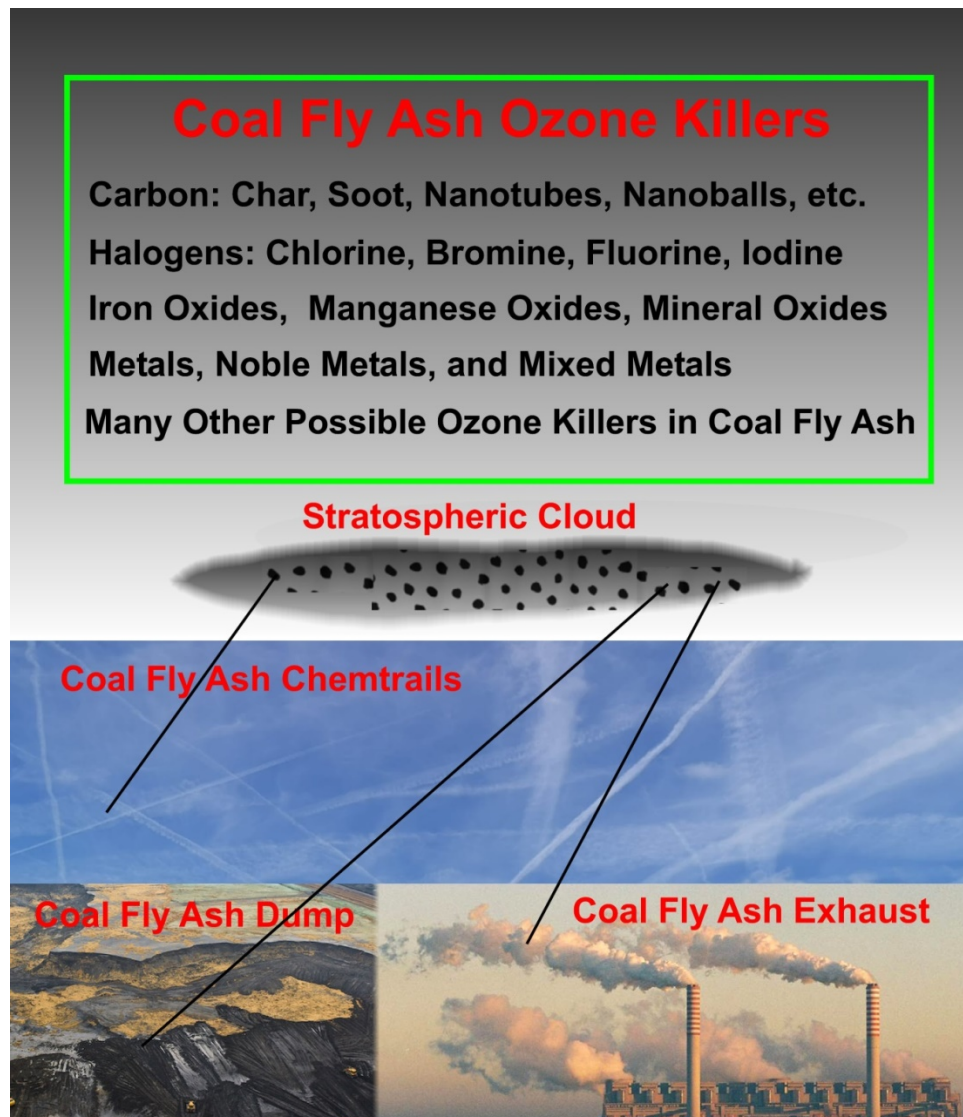


Figure 1. Graphic illustrating the major sources of aerosolized coal fly ash lofted into a particle laden polar stratospheric cloud, and some of the many components of coal fly ash that directly kill ozone, from [2]

Coal fly ash itself can destroy ozone in a variety of ways [1, 3-8]. Stratospheric ozone can be destroyed by reactive halogens, and chlorine, bromine, fluorine, and iodine, of which are found in coal fly ash [9]. Ironically, combustion of coal even produces some chlorofluorocarbons that are found in coal fly ash [10]. Experimental data shows that separate components of coal fly ash can absorb or destroy ozone. For example, there is reactive uptake of ozone on mineral oxides including those of aluminum, silicon, and iron, all major components of coal fly ash [11]. The surfaces of coal fly ash carbon are oxidized by ozone [5], and ozone reacts with carbon nanoparticles [6-8]. Submicron carbon and iron aerosol particles are found to destroy ozone efficiently, with the implication that these particles in the stratosphere may represent a significant cause of ozone depletion [12].

We have examined the central role of coal fly ash iron in stratospheric ozone depletion [2]. Iron particles in primary and secondary coal fly ash aerosols lead to the formation of ice crystals in cirrus clouds and in the polar stratospheric clouds whose coal fly ash constituents are mainly responsible for creating ozone holes [1, 2]

Coal fly ash iron is associated with active reactive oxygen species, including the hydroxyl radical, which destroys ozone in the stratosphere. Ozone can be both adsorbed onto iron-containing particles and depleted by photochemical reactions with iron and other constituents of coal fly ash. Iron is known to activate halogens including chlorine, bromine, fluorine, and iodine. Here we further explore and elucidate the origin and speciation of iron particles in primary and secondary aerosols, the enhanced formation of ice clouds by iron, the chemistry of iron in cloud water, and iron interactions with halogens in ice. In addition, we discuss the fallacy of “meteoric” metals nucleating polar clouds. Finally, we present a unified understanding that explains stratospheric ozone depletion by coal fly ash, especially its iron component.

COAL FLY ASH IRON

Compared to gases, particulate aerosol particles are minor components of the atmosphere, but they are ever-present, and play a major role in chemical reactions, radiation effects, and cloud formation, and, significantly, stratospheric ozone depletion. Iron is one of the most reactive elements in the atmosphere. Iron oxides absorb sulfur dioxide, converting it to sulfates at the gas-solid interface. Surface coating of insoluble iron particles with soluble material enhances their ability to form clouds [13]. Iron and aluminosilicates are both primary constituents of coal fly ash, the abundant waste product of coal burning. Iron in aluminosilicate phases is continuously released into aqueous solution as fly ash particles break up into smaller fragments [14]. Soluble iron (Fe_2) in aerosols contributes to reactive oxygen species and catalyzes oxidation of atmospheric gases.

Most of the ultrafine and nano-sized iron particles from coal-burning sources are mixed with sulfates and nitrates, and they are associated with an increased percentage of soluble iron [15]. The solubility of iron from combustion sources is much greater than that from mineral dust. New estimates of the total deposition of soluble iron to the oceans indicates a larger contribution of anthropogenic combustion iron than either mineral dust or biomass burning [16].

Anthropogenic aerosol particles, especially coal fly ash, metals, and soot particles, are transported long distances to affect ecosystems, human health, and climate changes [17]. Coal fly ash and other aerosol particles in the troposphere cause regional and/or global warming by absorbing radiation, transferring that heat to atmospheric gases, which reduces the adverse temperature gradient relative to surface air, which concomitantly reduces convective heat loss from the surface [18-20].

Secondary organic aerosols are formed in the atmosphere when volatile organic compounds emitted from anthropogenic or biogenic sources are oxidized by reactions with OH radicals, O_3 (ozone), NO_3 radicals, or chlorine atoms to form less volatile products that enter into aerosol particles [21]. Secondary organic aerosols comprise a large fraction of atmospheric aerosol

mass and have significant effects on atmospheric chemistry, visibility, human health, and climate.

Secondary organic aerosols produced by atmospheric oxidation of primary emitted precursors is a major contributor to fine particulate matter (PM_{2.5}) pollution aerosols throughout the world. The study of winter (pollution) haze events in China indicates that most of the secondary organic aerosols originate from fossil fuel combustion, and that primary organic aerosols from this source convert to secondary organic aerosols in aqueous phase or high humidity environments [22].

In-cloud processing is the main pathway leading to the formation of secondary organic aerosols. Oxalic acid is the most abundant water-soluble organic compound identified in ambient aerosols, and it is closely associated with aerosol sulfates [23]. Cloud processing in the presence of water plays a vital role in the formation of secondary species including sulfate, nitrate, chloride, ammonium, and oxalate through the partitioning of gas into aqueous phases or heterogeneous/multiphase reactions. In a study of secondary species in cloud residue (dried cloud droplets) at a mountain top in China, iron from combustion sources, as opposed to mineral dust, contributed most of the iron-containing residual particles. These same particles were associated with sulfates, nitrates, chlorides, and oxalates. Notably, they were shown to increase iron bioavailability and reactivity [24].

Ozone is destroyed by reaction with halogens [25, 26]. Coal burning in China led to an unexpectedly large atmospheric component of reactive bromine and chlorine in the atmosphere [27]. Coal fly ash contains halogen elements in the ranges shown in Table 1 from [1].

Table 1. Range of halogen element contents in coal fly ash [9].

| Chlorine µg/g | Bromine µg/g | Fluorine µg/g | Iodine µg/g |
|---------------|--------------|---------------|-------------|
| 13 – 25,000 | 0.3 – 670 | 0.4 – 624 | 0.1 – 200 |

Volatile halogenated organic compounds (VHOCs) play a significant role in chemical processes in the atmosphere and potentially contribute to stratospheric ozone depletion. Both natural and anthropogenic VHOCs contribute to the release of these compounds into the atmosphere. Natural sources of VHOCs include wood-rotting fungi, biomass burning, and volcanic emissions. In soils and sediments, halide ions can be alkylated during the oxidation of organic matter by an electron acceptor like Fe (III): sunlight or microbial mediation is not required. When the halide ion is chlorine, the reaction products are CH₃Cl, C₂H₅Cl, C₃H₇Cl and C₄H₉Cl (corresponding alkyl bromide and alkyl iodides are produced when these halogens are present). Such abiotic processes can make a significant contribution to important atmospheric compounds like CH₃Cl, CH₃Br, and CH₃I [28, 29]. These halogenation processes are possible because iron containing minerals can catalyze the C-H bond cleavage of organic compounds [30].

Iron-induced and iron-catalyzed oxidation of organic substrates in nature lead to alkanes and alkenes as well as oxygenated and halogenated hydrocarbons [31]. Conversely, halogenated organic compounds can be degraded by iron-containing particles in water [32]. Ironically,

chlorofluorocarbons (CFC's), previously blamed for the destruction of stratospheric ozone in part because it was thought they could not be broken down in the troposphere, can also be degraded by both biotic and abiotic processes. For example, degradation of CFC's can be accomplished using granular iron and bimetallic iron (e.g., NiFe) [33].

COAL FLY ASH MEDIATED ICE FORMATION

It has long been known and observed that emissions from coal-fired power plants “make clouds.” After a very short time, most of the potential cloud condensation nuclei in power plant plumes have been produced by gas-to-particle conversion rather than emitted directly from the stack [34]. This process leads to the surface coating of insoluble fly ash particles with water soluble materials, with a multifold increase of cloud condensation nuclei over background concentrations [35, 36].

Data on the true abundance of coal fly ash in the atmosphere has been lacking because it is difficult to distinguish it from mineral dust, consequently, it is often counted with this material. However, it is now known that combustion ash plays a primary role in ice formation in mixed-phase clouds, especially in clouds that are formed near the emission source of these aerosol particles [37]. Furthermore, it has become evident that porous ice-nucleating particles (like many in coal fly ash) at cirrus level temperature initiate ice formation via the liquid phase in a two-part process involving the condensation and freezing of supercooled water in pores or surface defects. This mechanism is called pore condensation and freezing (PCF), and it allows stabilization of ice germs in the particle without the formation of macroscopic ice. The PCF mechanism could play a significant role in mixed-phase clouds where coal fly ash particles are injected from higher altitudes and then descend to lower altitudes after initially being exposed to lower temperatures [38]. Cloud processing is important for the ice nucleating ability of organic aerosol and coal fly ash particles. Unprocessed coal fly ash particles show strong heterogeneous ice nucleation activity at temperatures below 235 °K in the deposition and/or pore condensation and freezing mode. In the case of organic aerosols, cloud processing may turn particles from aqueous to a very viscous, solid-like glassy state promoting ice nucleation [39].

The influence of iron in the atmosphere is very broad and a function of its concentration, chemical environment, and solubility. In a sophisticated analysis of iron in urban aerosol samples, the bulk iron content was determined to be about 7%, predominately occurring as oxides with goethite (FeOOH) as the major phase. Only 2% of the total iron content was soluble in aqueous phase [40]. Among the many elements in coal fly ash, iron oxides are known to have high ice nucleation activity. In immersion freezing experiments performed using an environmental chamber, iron oxides including wustite (FeO), hematite (Fe₂O₃), magnetite (Fe₃O₄), and goethite (FeOOH) showed varying but effective ice nucleation in part related to the degree of their lattice mismatch to hexagonal ice [41].

In simulated cloud-water using ambient aerosol samples suspended in an aqueous solution, important species (i.e., H₂O₂, total Fe, soluble Fe(II), and pH) were measured in different experimental conditions including when the solution was irradiated with ultraviolet light or when electron donors like oxalate were added. Hydrogen peroxide (H₂O₂) photoproduction was observed in the simulated cloud-water with added oxalate. The production of Fe(II)

showed that Fe from the ambient aerosols was available for photochemical redox reactions. In all cases the production of H_2O_2 and Fe(II) were greater under UV irradiation than in non-irradiated control samples [42].

Coal fly ash aerosols are an important source of OH in the presence of an added electron donor (e.g. ozone) or H_2O_2 [43]. In the aqueous phase of the atmosphere (aerosols, clouds, and fog) where iron, acids, and ozone are simultaneously present, the oxidation of Fe(II) by ozone (O_3) is a very important ozone sink [44]. In aqueous suspensions, ozone can replace the surface hydroxyl groups on the Lewis acid sites of iron oxides (including Fe_2O_3 , $FeOOH$, and Fe_3O_4), interacting with the surface metal ions, and decomposing into reactive oxygen species (ROS) and initiating the surface metal redox [45].

CIRRUS ICE CONNECTIONS

The majority of cirrus clouds freeze, or nucleate around either “mineral dust,” or “metallic aerosols”, presumably with important contributions from coal fly ash to both categories [46]. Aerosolized coal fly ash particles, lofted into the stratosphere, not only serve as ice-nucleating agents, but are further trapped by clouds, including Polar Stratospheric Clouds. In springtime, the icy stratospheric clouds melt/evaporate releasing their trapped coal fly ash particles, and making those ozone-consuming coal fly ash particles readily available for reaction with and destruction of ambient stratospheric ozone [1]. This activity principally produces the ozone holes observed in the Antarctic [47], Arctic [48], and tropics [49].

In addition, coarse aerosol particles in cirrus clouds can settle downward to supercool clouds at a lower level. This type of cirrus seeding is thought to organize chaotic middle-level convection fields into fully grown rainstorms [50]. In the atmosphere, liquid drops almost never exist as pure water but contain soluble and insoluble organic and inorganic material. In the upper troposphere and lower stratosphere, aqueous drops can contain sulfuric acid (H_2SO_4), nitric acid (HNO_3), and mixtures of sulfates, metals, and organics.

Ice is intolerant of impurities because the ice lattice develops by strong and directional hydrogen bonding between water molecules. Since the size and charge of solute molecules and ions differ from those of water, they are expelled from the ice lattice during ice formation/crystallization. Thus, a freeze-induced phase separation into pure ice and a freeze-concentrated solution occurs during the freezing of aqueous solutions. This freeze-concentrated solution coating around ice crystals determines the surface reactivity, radiative properties, and water vapor uptake during ice cloud development [51].

So-called deposition nucleation cannot explain the strongly enhanced ice nucleation efficiency of porous compared to non-porous particles at temperatures below $-40\text{ }^\circ\text{C}$ and the absence of ice nucleation below water saturation at $-35\text{ }^\circ\text{C}$. It follows that pore condensation and freezing is the dominant pathway for atmospheric ice nucleation below water saturation, and the ice nucleating activities of particles in cirrus clouds is partly determined by their structure and porosity [52].

AEROSOLIZED COAL FLY ASH: NOT CHLOROFLUOROCARBONS

In the 1970's, man-made chlorofluorocarbon (CFC) gases were identified as a potential source of stratospheric chlorine. It was thought that CFC's do not break down in the troposphere, but, when lofted up into the stratosphere, they can be photolyzed by ultraviolet radiation to create free radicals that destroy ozone. However, halogen release from source gases like CFC's typically form inorganic molecules like HCl [53]. CFC ozone depletion theory requires that a significant fraction of the total chlorine liberated from halocarbons (Cl_x) to be present in active forms (ClO, Cl₂O₂, and HOCl) rather than in more photochemically passive reservoirs (HCl, ClONO₂). In the absence of heterogeneous processing, inorganic chlorine in the lower stratosphere is present almost entirely as HCl and ClONO₂ [54].

Despite restrictions on chlorofluorocarbon production since the 1989 Montreal Protocols, the destruction of stratospheric ozone has not declined [47]. Recently, we provided evidence that an entirely different substance, aerosolized coal fly ash, is the main killer of stratospheric ozone [1, 2].

AEROSOLIZED COAL FLY ASH: NOT MAINLY METEORITIC MATTER

Particles responsible for the formation of polar clouds were previously attributed to meteoritic matter. Iron from presumed ablation of meteoroids was thought to be taken up on polar mesospheric (noctilucent) clouds [55]. Analogues of refractory, "meteoric" particles consisting of iron, magnesium, and silicon have been shown to be able to nucleate nitric acid hydrates in polar stratospheric clouds [56]. Similarly, nano-sized "meteoric" particles with iron-magnesium and silicates have been shown to be able to remove sulfuric acid from the gas-phase above 40 km, and affect composition and behavior of supercooled H₂SO₄-H₂O droplets in the stratospheric aerosol (Junge) layer [57].

For decades, it has been recognized that aerosolized coal fly ash closely resembles meteoritic dust [58]. As far back as the 1960's, it was determined that the smaller particles (< 5 μm) in the stratosphere were most likely of terrestrial, not meteoric origin [59]. Pollutants can reach the stratosphere in two ways: 1) By direct injection, as by aircraft and rockets [60, 61], and 2) By atmospheric injection from the troposphere [62-68], which is more likely for smaller (often nano-sized) refractory particles [67].

Typical elements of coal fly ash, including iron, magnesium, aluminum, chromium and nickel, are revealed by transmission electron microscopy to be contained within tropospheric sulfate particles [69]. Transport of air from the troposphere to the stratosphere occurs primarily in the tropics, which is associated with the ascending branch of the Brewer-Dobson circulation. Infusion of tropospheric aerosols into the stratosphere during convective overshoots can hydrate the lower stratosphere and suppress sublimation [70].

Aircraft tracer studies show transport from the lower tropical stratosphere brings ozone-poor air to mid-latitudes and the sub-vortex region. That mode of transport increases the water vapor content at high latitudes, potentially enhancing ozone destruction through heterogeneous processing in the polar vortex [71].

Micro-particles collected at high balloon altitudes in the stratosphere and analyzed by scanning electron microscopy (SEM) and proton-induced X-ray emission (PIXE) showed chlorine, sulfur, titanium, iron, bromine, nickel, zinc, strontium, and copper in decreasing order of concentration [72]. Notably, these elements are all found in coal fly ash.

Lidar measurements in 2000 of an unusual mid-stratospheric aerosol layer in the Arctic revealed soot, aluminum and silicon oxides, and iron; all primary components of coal fly ash [73]. We have recently shown that the size, morphology, and element composition of particles collected in polar stratospheric clouds are consistent with those found in coal fly ash [1].

Collectively, these findings imply that most of the smaller particles in the stratosphere are derived from terrestrial and anthropogenic sources, most prominently coal fly ash.

Another mistaken assumption is that “black magnetic spherules” principally originate from “extra-terrestrial” sources. Water-insoluble aerosol particles > 2 μm in diameter in cirrus clouds were studied and divided into nonmagnetic, non-spherical, and spherical magnetic particles. Particle concentration decreased with increasing particle size. The non-spherical magnetic particles were rich in calcium, indicating a terrestrial source. It was noted that the spherical magnetic particles of this size were washed out by precipitation [74].

Large numbers of black magnetic spherules raining down into the Eastern Gulf of Mexico were linked to industrial pollution from coal and coke-burning facilities in the area [75]. Analysis of power plant fly ash indicates that the strongly magnetic spherical particles occur mainly in the fine (< 60 μm) fraction of the ash [76]. Indeed, recent studies confirm that anthropogenic magnetic spherules containing magnetite and hematite in sediments reflect industrial activity [77]. Magnetic measurements in dated Finnish peat profiles reveal accelerating amounts of magnetite spherules since the beginning of the Industrial Revolution (ca. 1860), resulting from fallout of particulates from industrial and domestic coal-burning and combustion processes [78].

Great Extinctions like the Permian and the K/T have been linked to widespread volcanic activity associated with ignited coal-basalt mixtures and plumes of pyroclastic coal fly ash ascending to the upper atmosphere to destroy stratospheric ozone [79]. In this regard it is significant that marine K/T boundary clays are strongly magnetic, with remanent coercivities matching those of spheroids. The morphologies, mineralogy, and magnetic properties of K/T magnetic spheroids are analogous to magnetic fly ash spherules [80].

The stratospheric vertical distribution of submicron particles shows a maximum between 15 and 23 km, the so-called “stratospheric aerosol,” or Junge layer. Measurements of the composition of these stratospheric particles using balloon devices and U2 aircraft established they were predominately sulfur and water-soluble [81].

Analysis of stratospheric particles by Laser Mass Spectrometry (PALMS) collected up to 19 km showed most of the particles fell into one of three categories: 1) Sulfuric acid with metals, 2) Nearly pure sulfuric acid with water, and 3) Organo-sulfate particles originating in the troposphere. Positive ion mass spectra of the first category showed spikes of iron in several

forms, e.g., $\text{Fe}(\text{OH})_2$ and $\text{Fe}-\text{H}_2\text{SO}_4$, and as well as spikes in magnesium, aluminum, nickel, potassium, and sodium. Significantly, the third category (organo-sulfate) showed spikes of bromine, iodine, and mercury [82].

Analysis of particles collected over China showed that 20-30% of particles in the lower stratosphere that contained sulfur also contained iron [83]. Due to a huge amount of organic and sulfur emissions in this area, the Asian summer monsoon anticyclone serves as an efficient “smokestack”, venting aerosols to the upper troposphere and lower stratosphere [65]. Of the three major causes of tropospheric/stratospheric sulfate aerosols, increased tropical upwelling, volcanic emissions, and anthropogenic combustion, coal burning is probably the most important source of sulfur dioxide that ends up as the sulfate aerosol responsible for the increased backscatter from the stratospheric aerosol layer in the 21st Century [84].

Coal fly ash aerosols, especially those emplaced high in the troposphere by jet aircraft in ongoing, “covert” geoengineering operations, would not only explain the chemical composition of stratospheric particles, but provide numerous, experimentally verified reactions that destroy stratospheric ozone [2].

COAL FLY ASH: MAIN KILLER OF STRATOSPHERIC OZONE

Early theoretical ideas as to the nature of stratospheric ozone killers assumed a single perpetrator, such as chlorofluorocarbons. By contrast, aerosolized coal fly ash is a toxic nightmare of numerous substances that can kill ozone directly and indirectly by numerous chemical reactions, the full extent of which is not yet known [1].

Various experiments have been conducted to render coal fly ash safer and more amenable for commercial use, such as for use as a component of cement. Experiments on coal fly ash that employ ozone provide important information as to the ability of coal fly ash to destroy stratospheric ozone [1].

Surfaces of coal fly ash carbon particles are oxidized by ozone [5] demonstrating that coal fly ash carbon particles kill ozone. Coal fly ash contains bromine, chlorine, fluorine, and iodine [9] all of which kill ozone. Coal fly ash even contains chlorofluorocarbon compounds [10]. Other investigations also indicate that coal fly ash kills ozone [3, 4].

Mercury, a ubiquitous component of coal fly ash [85], reacts with and consumes ozone [86-88]. Inferences regarding ozone destruction by the components of coal fly ash can be made on the basis of ozone destruction by similar compounds: Ozone is consumed by reaction with carbon [89, 90]. Ozone is also consumed by reactions with mineral oxides [45, 91-94]. Furthermore, ozone is consumed by reactions with oxides of iron and manganese [95, 96]. Additionally, ozone is consumed by reactions with metals [97, 98] and noble metals [96, 99]. All of these substances occur in coal fly ash nanoparticles.

Aerosolized coal fly ash not only serves to nucleate ice, but is swept up and concentrated in both tropospheric and stratospheric clouds. In the springtime, stratospheric clouds, including and especially polar stratospheric clouds, melt/evaporate, releasing their occluded coal fly ash

particles. By a variety of direct and indirect chemical reactions, as described above, these newly liberated coal fly ash particles kill stratospheric ozone.

CONCLUSIONS

We have provided further compelling evidence that aerosolized coal fly ash, and its various components, especially iron, is the primary cause of stratospheric ozone depletion, not chlorofluorocarbon gases, as “decreed” by the *Montreal Protocol* of 1989. That misdiagnosis of the true cause of stratospheric ozone destruction is a potentially fatal mistake for mankind, unless an otherwise unresponsive scientific community awakens and addresses the true cause: coal fly ash, which is also responsible for runaway global warming, deadly ultraviolet B and C radiation penetrating to earth, climate collapse, and the systemic breakdown of the biosphere. The now defunct CFC-ozone depletion theory was not only overly simplistic, but it did not account for the myriad chemical and photochemical reactions brought about by biotic and abiotic aerosols in the atmosphere. The scientific community was misled by the false assumption that “meteoric” metals were responsible for mesospheric and stratospheric cloud formation. The primary role of coal fly ash in cirrus cloud formation has been explained away by “mineral dust.”

Considering the revelation over the last two decades that coal fly ash was central to stratospheric ozone depletion in previous Great Extinctions, like the Permian (“The Great Dying”), it is hard to understand why combustion coal fly ash would *not* be urgently investigated as the cause of ozone depletion. Even harder to understand is why academic scientists, including atmospheric and climate scientists, turn a blind eye to the deliberate and pervasive jet-spraying of particulate matter into the troposphere. Why are some of the same scientists obsessed with the need for “future” geoengineering projects, despite their deadly and inexcusable silence regarding long-term, ongoing, near-global, and undisclosed tropospheric aerosol geoengineering operations evidenced as utilizing coal fly ash? No legitimate discussion of our current “climate catastrophe” can take place without the recognition of this type of technological manipulation of Earth’s atmosphere.

Recent scientific discoveries cited here all “fit together” to support our New Paradigm of stratospheric ozone depletion by coal fly ash and its numerous reactive components including iron. Although there are still unanswered questions, the time for action is past due. One has only to look up to the atrocities in our skies and tune in to the terrible suffering of the natural world to understand our dire situation. Our time is short; we’re well into the anthropogenic Sixth Great Extinction, which is proceeding at “light speed.” Our children already face a ghastly future, potentially within the current decade. As we have argued repeatedly in our scientific articles over the past several years, all sources of coal fly ash aerosols must be reduced or eliminated. Domestic coal burning technology and concomitant technological management must be drastically improved throughout the world. First and foremost, however, the jet-spraying of coal fly ash and other particulates into the troposphere, which mixes with the air we breathe, must cease. When this particulate emplacement ends, most of these pollution particles will fall back to Earth in a matter of days or weeks, global warming will be reduced, and our planet will at least have a chance to heal its self. These steps are necessary to salvage what we can of Earth’s vital life support systems, including the stratospheric ozone layer, which has protected all higher life on Earth from damaging ultraviolet radiation. The deliberate

assault on Earth's natural processes, we allege, constitutes no less than acts of planetary treason [100].

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