



Fifty Years after “How to Wreck the Environment”: Anthropogenic Extinction of Life on Earth

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Authors' contributions

This work was a joint effort between the authors that is part of an ongoing collaboration aimed at providing scientific, medical, public and environmental health implications and evidence related to the near-daily, near- global covert geoengineering activity. Author JMH designed the study. All authors contributed to the writing and read and approved the final manuscript.

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ABSTRACT

Aims: Fifty years ago geoscientist Gordon J. F. MacDonald penned a book-chapter entitled, “How to Wreck the Environment”, in which he described how a nation might alter the environment so as to covertly inflict harm on an enemy nation. Our objective is to review MacDonald’s suggestions of environmental warfare strategies in light of subsequent technological advances, and in the context of actual deployment of the war methods he described.

Methods: We review the interdisciplinary, historical, scientific and medical literature.

Results: MacDonald discussed overt and covert weather warfare based upon seeding clouds to cause rainfall. Subsequently, a method was developed for inhibiting rainfall by jet-emplacing pollution particulates where clouds form. For at least two decades citizens have observed such

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particulate trails occurring with increasing frequency. Forensic scientific investigations implicate toxic coal fly ash as their main constituent. Around 2010, the aerial particulate spraying ramped-up to a near-daily, near-global level. Presumably, a secret international agreement mandated the aerial spraying as a 'sunshade' for Earth. However, aerial spraying, rather than cooling, heats the atmosphere, retards Earth's heat loss, and causes global warming. MacDonald also discussed destroying atmospheric ozone and triggering earthquakes and volcanic eruptions, activities now possible with high-frequency ionospheric heaters.

Conclusions: The U. S. military's ongoing decision to weaponize the environment for national security purposes was accurately forecasted by MacDonald. But he failed to realize that national militaries could and would be co-opted by a secret international agreement the consequence of which, however unintentional, was to wage war on planet Earth, on all its biota, and on its natural, biogeochemical processes. Unless and until politicians, news media, scientists, and others in our society face the truth of what is happening before their very eyes and collectively demand a halt to these covert technological activities, we will march onward – to the first anthropogenic-caused mass extinction.

Keywords: Trigger earthquakes; climate modification; ozone depletion; ionospheric heater; Gordon J. F. MacDonald; coal fly ash; geoengineering.

1. INTRODUCTION

The politically powerful geoscientist Gordon J. F. MacDonald (1929-2002) wrote an influential essay titled, "How to Wreck the Environment," that was published in 1968 in a book called *Unless Peace Comes* [1]. At a time when the military's focus centered on nuclear warfare, MacDonald prophetically suggested: "Among future means of obtaining national objectives by force, one possibility hinges on man's ability to control and manipulate the environment of his planet." MacDonald, a top presidential science advisor and participant in national science-policy discussions, was well qualified to address the subject of future environmental warfare possibilities.

Much of what MacDonald predicted or speculated about has come to pass, not with the technology he described, but with potentially far more effective and devastating technology developed during the succeeding fifty years.

As MacDonald noted in 1968: "The key to geophysical warfare is the identification of the environmental instabilities to which the addition of a small amount of energy would release vastly greater amounts of energy." MacDonald discussed purposefully triggering instabilities in such large-scale natural systems as the weather, the climate, the oceans, and the human brain, including such phenomena as hurricanes, earthquakes, and tsunamis for use in warfare. He was aware, considering the limitations of geophysical understanding, that one should also anticipate unforeseen adverse consequences

that could arise from deliberately disturbing complex natural systems that have unknown 'tipping points'.

During the fifty years since MacDonald's landmark publication [1], the technology necessary for the weaponization of the environment has undergone major advances, well-known to those who have funded the research. In tandem, the scientific understanding of Earth's behavior has likewise undergone major advances over the last half-century.

However, major new concepts in geophysics – such as those being developed by the 'military industrial complex' – have been typically ignored in the geoscience community for decades. It is not surprising, therefore, that deployment of radical environmental warfare technologies that alter fundamental natural processes of our planet is proceeding, without scientific warning or a full understanding of the underlying geodynamics and dangers such technologies pose to human and other life. For example, to be habitable, Earth must maintain a delicate energy balance by radiating into space essentially all of the energy it receives from the sun and from its own intrinsic geophysical and anthropogenic energy sources. Since the late 1990s, there has been a well-organized effort, orchestrated by the United Nations' Intergovernmental Panel on Climate Change (IPCC) and others, to promote the idea that anthropogenic greenhouse gases, preeminently carbon dioxide, are adversely affecting Earth's heat loss, causing global warming [2]. To compensate, the IPCC repeatedly promotes the idea of engaging in

future geoengineering, i.e., placing substances into the atmosphere to block a portion of sunlight [3]. However, the IPCC has failed to acknowledge the possibility of military geoengineering being conducted with ever increasing scope and range for decades and that its primary consequence is not to cool Earth, but to cause global warming and climate chaos.

Here, we review some of the ideas expressed by MacDonald in "How to Wreck the Environment" [1] in the light of subsequent technological developments. We also review evidence that environmentally destabilizing military technologies are being deployed on a global scale. Where applicable, we discuss potential risks to our planet, and its biota, that likely are underappreciated by those responsible.

2. METHODS

We reviewed interdisciplinary, historical, scientific and medical literature.

3. RESULTS AND DISCUSSION

The long-held dream of military planners to control the weather began to become reality with the discovery in 1946 that clouds, when seeded with silver iodide or dry ice (solid carbon dioxide), under appropriate circumstances, could result in rain or snow [4]. MacDonald [1] discussed that form of cloud seeding and its military potential both for causing rainfall to impede enemy ground operations and for covertly causing long-term drought, by forcing clouds to release their moisture before they reached the targeted nation. These have been matters of serious concern to the U. S. military then and now [5].

Weather became a weapon of war during the Vietnam War when cloud seeding operations were conducted to extend the monsoon season over the Ho Chi Minh Trail to impede movement of supplies and troops (Operation Popeye) [5]. The U. S. military also seeded clouds approaching Cuba in an attempt to cause drought to spoil the sugarcane harvest [6].

Seeding clouds to cause rain, as described by MacDonald [1], was only the first step in weather manipulation. Subsequent research produced the technology to impede the fall of rain. For clouds to yield rain, tiny droplets need to nucleate and then coalesce to form drops sufficiently massive to fall to Earth. The technology for impeding rainfall is known from pollution investigations. A

sufficiently large number of pollution particles, dispersed into the region where clouds form, poses impediments to the tiny droplets, blocking and keeping them from coalescing to become massive enough to fall as rain. Eventually, the moisture burden becomes unbearable and clouds release their moisture in deluges.

In the late 1990s, alert citizens became concerned about the aerial particulate trails that extended from horizon to horizon in the skies above them. With the passage of time, these aerial trails became more frequent, while at the same time, the public was being misled that these were harmless contrails, ice crystals formed from exhaust vapor [7]. By about 2010 the aerial spraying ramped up to a near-daily activity over much of the globe [8]. (Fig. 1)

Weather modification is a phenomenon limited in duration and geographical extent, whereas climate modification is necessarily global. The current, near-daily, near-global aerial spraying seems to represent an attempt at climate modification, which MacDonald also discussed [1], and likely involves weather modification activity as well. As MacDonald noted: "...climate is primarily determined by the balance between the incoming short-wave radiation from the sun (principally light) and the loss of outgoing long-wave radiation (principally heat)." He goes on to list the three factors that dominate this balance: 1) sun's energy; 2) Earth's atmospheric transparency to different forms of radiated energy; and, 3) Earth's surface characteristics. Alteration of any of the three can modify climate.

Altering the sun's energy output is not technologically feasible even today, but there are various ways of effecting radiant energy transport through Earth's atmosphere. Among the possibilities mentioned by MacDonald [1], albeit without specificity, is the idea of placing material into the upper atmosphere that would "absorb either incoming light (thereby cooling the surface) or outgoing heat (thereby warming the surface)." In speculating about such a possibility, MacDonald noted: "At present we know too little about the paradoxical effects of warming and cooling, however, to tell what the outcomes might be." That statement is as true today as when published 50 years ago.

The explanation of the behavior of material placed into the upper atmosphere, as stated by MacDonald, is simplistic and incorrect. So too, is the oft-repeated proposition by members of the



Fig. 1. Climate manipulation particulate trails. (Photographers with permission) Clockwise from upper left: Paris, France (Patrick Roddie); Karnak, Egypt (author JMH); London, England (author IB); Northern California, USA (Patrick Roddie); Geneva, Switzerland (Beatrice Wright); Yosemite, California USA (Patrick Roddie); Jaipur, India (author JMH)

geoscience community who now discuss the possibility of placing material in the upper atmosphere to reflect a portion of sunlight back into space, 'sunshades for the Earth'. As we discuss below, particles placed in the atmosphere exhibit behavior in response to incident radiation that is considerably more complex than described by MacDonald, as are their physical and chemical reactions in the atmosphere and at the Earth's surface.

As noted above, the U. S. military has been engaged for decades in aerial spraying of particulates into the regions where clouds form to modify weather and for other reasons, such as to

enhance communication systems associated with electromagnetic radiation programs.

Aerial spraying appears to have become an international operation sometime around 2010, and is *presumably based* on a secret international agreement, as observed climate modification activity must involve, *ipso facto*, the collaboration of multiple states. As Figs. 1 and 2 illustrate, diverse independent countries are involved. MacDonald advised that *the key lesson* of the Vietnam war's highly secret weather modification program, Project Popeye, was not its failure to alter the war's outcome, but that "one can conduct covert operations using a new

technology in a democracy without the knowledge of the people" [1].

In the case of a possible secret international agreement to modify the climate, the presumption would be it was made to benefit humanity. However, as we show, its implementation is exacerbating the problem of global warming and causing climate chaos, and adversely affecting the health of organisms, including humans. At face value it would seem that the actual geophysical and biological consequences of such covert military operations would be inconsistent with an international program for the benefit of humankind, unless that secret international agreement/understanding was based on misrepresentations. If so, a strange dichotomy marks the subject of weather and climate modification, characterized by a blatant contradiction between ends and means, intent and consequences.

Science should be based upon truth, but improper administration and funding of science has corrupted science's integrity [9]. Since 1989, the United Nations' Intergovernmental Panel on Climate Change (IPCC) has remained silent about the military aerial particulate spraying, and failed to take into account its geophysical consequences in its climate models [10]. At present, large-scale aerial particulate emplacement can only take place under the aegis of military entities, but there is a global effort to encourage governance that permits non-military entities such as universities and for-profit companies to also engage in climate intervention [11].

What reason was given to national governments to get them to agree to become willing parties to near-daily, near-global, aerial particulate spraying into the atmosphere? Few government leaders, politicians, and bureaucrats are trained in science. Have they been told that the aerial emplacements of particulates will act like a sunshade to cool Earth to compensate for alleged anthropogenic greenhouse-gas global warming?

If so, they have been conned into the greatest "science-based" scam ever perpetrated [12]: Cause global warming and climate chaos by daily aerial spraying and then blame the warming result on anthropogenic greenhouse gases to undermine the authority of nation states, and erect new world governance structures to regulate anthropogenic, transnational greenhouse gas emissions.

3.1 The Real Consequences of Aerial Particulate Spraying

One of the original military purposes of aerial particulate dispersal into the regions where clouds form was to impede precipitation and to cause drought in an unfriendly country. Indeed, former Iranian President Mahmoud Ahmadinejad accused Western countries of doing just that [13]. Fig. 2 shows particulate trails blanketing the Republic of Cyprus, whose citizens sought, so far unsuccessfully, an explanation from their government for the deliberate obscuring of their skies [14]. There is no information available to the public about the extent of weather warfare. Interestingly, covert environmental warfare was predicted by MacDonald [1]: "...removing moisture from the atmosphere so that a nation dependent on water...could be subjected to years of drought. The operation could be concealed by the statistical irregularity of the atmosphere. A nation possessing superior technology in environmental manipulation could damage an adversary without revealing its intent." Not only the adversary, but the aggressor nation's own citizens would be unaware. As noted, MacDonald observed that, "one can conduct covert operations using a new technology in a democracy without the knowledge of the people."

Presumably the use of readily available, inexpensive particulate matter was considered a practical necessity and was implemented without regard for its possible adverse health effects. We know this was done in Vietnam [5]. The undisclosed international agreement for near-daily, near-global aerial spraying and its concomitant funding has allowed military entities to indiscriminately expose millions of uninformed citizens to the dispersed particulate matter day after day, year after year, *inside their own sovereign countries*. Moreover, the aerial spraying has been accompanied by a concerted disinformation campaign to mislead the public, as well as the scientific community, about its adverse health consequences [7,15-17]. In the following subsections, we review various consequences of aerial spraying.

3.1.1 Aerosolized particulate composition

The composition(s) of the military aerial particulate sprayed into the atmosphere has long been a closely held secret. At the beginning of the 21st century, concerned citizens took samples of post-spraying rainwater and had them analyzed at commercial laboratories.

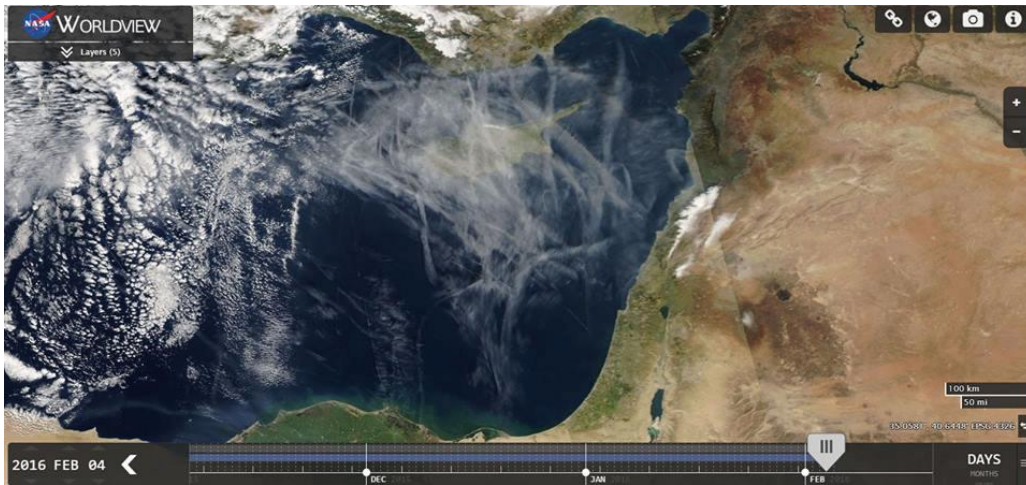


Fig. 2. NASA Worldview satellite image from February 4, 2016 showing jet-laid particulate trails blanketing the air above the Republic of Cyprus but nearly absent in surrounding regions. The Cyprus Environment Services Department, part of the Cyprus government, promised to investigate the aerial spraying following the February 2016 presentations made to the Parliamentary Environmental Committee, but to date there is no sign of an investigation

Usually only aluminum analysis was requested; occasionally both aluminum and barium; rarely aluminum, barium, and strontium. The presence of those elements in rainwater indicated to one of us (JMH) that the particulate matter sprayed into the atmosphere was capable of being rapidly leached by atmospheric water, elements partially extracted from the particulates into the water (like tea is made from tea leaves), just as the toxic waste product of industrial coal-burning, coal fly ash (CFA) is readily leached by water.

By comparing laboratory CFA leachate [18,19] with samples of post-spraying rainwater [8,20,21], we demonstrated that the aerosolized particulates are consistent with coal fly ash. We further showed that element-ratios measured in post-spraying air-suspended dust collected outdoors and in matter brought down by snow and rain are consistent with similar ratios measured in CFA [18,19].

Coal fly ash forms in the hot gases above the coal-combustor. Typically CFA forms as spheres, 0.01 – 50 μm in diameter [22]. Readily available throughout the world at low cost, the fine grain-size of this major industrial waste product means that little further processing is necessary before it is deployed in aerosolized form in the atmosphere.

A large proportion the toxic heavy metal and radioactive elements originally present in coal

end up concentrated in CFA [23]. Because of its toxicity, regulations in Western nations require CFA to be collected, usually trapped by electrostatic precipitators, rather than allowed to exit smokestacks. The circumstances of CFA formation are unlike circumstances found in the natural environment (except when coal deposits catch fire), condensing and accumulating in the hot gases above the combustor, where burning takes place. Because the chemical reactions during formation of CFA are different from reactions usually found in nature, many of the elements present in CFA are capable of being partially extracted by exposure to moisture [18].

For the military this is advantageous, since CFA aerial spray makes atmospheric water more electrically conductive, because of the many dissolved, ionized elements, and thus more responsive to electromagnetic radiation. But for the humans, plants, and animals exposed to these toxins, the consequences are devastating.

3.1.2 Public and environmental health concerns

Epidemiological investigations of particulate aerosol pollution in the same particle size range as CFA provide some guidance as to the adverse health effects of the particulate matter sprayed into the troposphere and lower stratosphere. Pollution particles in the size range ($\text{PM}_{2.5}$) [24] are associated with morbidity and

premature mortality [25-27], Alzheimer's disease [28,29], risk for cardiovascular disease [30], risk for stroke [31], lung cancer [32], lung inflammation and diabetes [33], decreased male fertility [34], reduced renal function in older males [35], onset of asthma [36], increased hospital admissions [37], and low birth weight [38].

The adverse health consequences of aerosolized CFA are even more dire. Ambient air pollution contributes to the growing global burden of respiratory disease and lung cancer [39,40]. Inhaled, aerosolized CFA, with its complement of carcinogens, such as arsenic, chromium VI, and radionuclides, settles deep in terminal airways and alveoli where it remains and can pose risks for lung cancer [41].

Spherical exogenous magnetite (Fe_3O_4) nanoparticles, recently discovered in brain tissue of persons with dementia [42], suggests an origin in the kind of air pollution produced by CFA, which is characterized by spherical particles. Iron oxides and aluminosilicates, primary components of CFA, are all found in the abnormal proteins that characterize Alzheimer's dementia, which leads to oxidative stress and chronic inflammation of brain tissue [43].

Coal fly ash, when exposed to moisture or body fluids, releases numerous toxins, including aluminum in a chemically mobile form, which is an environmentally and biologically unnatural state [18]. Chemically mobile aluminum is deadly to plants and trees as well as to amphibians [44]. Aluminum is associated with neurological disorders [8], and has been found in high levels in bees [45].

3.1.3 Thermal consequences of aerial particulate spraying

In addition to inhibiting rainfall by interfering with moisture droplet coalescence, particles sprayed into the troposphere and lower stratosphere reflect a portion of sunlight back into space. But a portion of the incident sunlight is absorbed by the particles as heat. That heat can be transferred to the atmosphere by molecular collisions or can be re-radiated in any direction, and not returned to space. The aerosolized particulates also act to restrain infrared radiation loss from Earth's surface and thus *become a source of atmospheric heating – global warming* [46].

Iron oxides, a significant component of CFA, absorb strongly in the ultraviolet range but reflect

in the infrared range [47]. Most of the airborne iron oxide particles observed in the continental outflows of anthropogenic origin in China consist of magnetite nanoparticles or iron-bearing particles in CFA [48]. Strongly light-absorbing aerosols, such as CFA, *directly heat the atmosphere* and indirectly reduce snow albedo by their warming effect [49]. As the aerosolized particulates fall to Earth, especially in far northern and far southern regions, they change the albedo of the ice/snow, which allows more solar energy to be absorbed by Earth [50]. This behavior, especially when considered in the context of near-daily, near-global aerosol spraying clearly may contribute to global warming. Consequently, the thermal state of Earth is biased toward warming, *the exact opposite* of official claims for geoengineering.

There are other consequences of atmospheric CFA particulate matter in the troposphere and lower stratosphere that further lead toward warming. For example, CFA particles can cause super-cooled droplets of moisture high in the atmosphere to form ice crystals, which form cirrus clouds whose effect is to retard Earth's infrared heat loss [51,52]. Current levels of CFA emissions are estimated to contribute 0.1-0.6W/m² of extra warming through their role in cirrus cloud formation [53]. This estimate, however, does not take into account the massive quantities of CFA used in aerial particulate spraying.

With all of the concern expressed in the press and elsewhere about global warming, it seems inconceivable to us that political leaders would knowingly sign a secret international agreement that promotes global warming. The presumptive alternative is that political leaders were deceived into believing that they were agreeing to an activity that would cool the Earth, when in fact the net effect of the activities warm the Earth and will destroy life if permitted to persist.

3.1.4 Ozone destruction

In 1968 MacDonald [1] warned: "More sudden, perhaps much briefer but nevertheless disastrous, effects are predictable if chemical and physical means were developed for attacking one of the natural constituents of the atmosphere – ozone." In the intervening years, such means have been developed and deployed. The chemical means are principally manifest in the form of aerosolized CFA; the physical means, by radiofrequency ionospheric heaters.

Many assume that the protective ozone layer in the stratosphere is slowly recovering primarily due to the international ban on chlorofluorocarbons (CFC's) by the Montreal Protocol [54], and that the Antarctic ozone hole is slowly healing [55]. However, it is coming to light that these assumptions may be wrong. There is new evidence for the continuous loss of ozone in the lower stratosphere [56]. It is thought that a reduction in ozone in the tropical stratosphere, where most of the ozone is formed, leads to transport of this ozone-rich air to the mid-latitudes via the Brewer-Dobson circulation [56].

Ozone column losses at high latitude are in the range of 6% [57]. Previously, depletion of lower stratospheric ozone has been attributed to rapidly increasing anthropogenic (and some natural) short-lived substances that contain chlorine or bromine [56]. However, the aerosolized CFA used for climate modification, now conducted on a near-daily, near-global basis, places *massive quantities* of chlorine, bromine, fluorine, and iodine into the atmosphere (Table 1), including *highly reactive nanoparticles*. These are potential destroyers of ozone [58].

There is a disquieting parallel for this ecosystem degradation: Despite strengthened mercury emission regulations, mercury measured in rainwater is increasing [60]. As the upper troposphere has now been found to contain oxidized, particle-bound mercury [61], it is not unlikely that covert aerosolized CFA, which contains up to 2 µg/g mercury, is a major source of mercury pollution when sprayed into the atmosphere [21].

In addition to the chemical destruction of stratospheric ozone, there are indications that high-frequency ionospheric heaters, now dispersed globally [62,63], may adversely affect stratospheric ozone. Russian scientists have

discovered a new physical phenomenon of the decrease of the intensity of microwave emission from the mesosphere in the ozone line upon the modification of the ionosphere with high-power high-frequency (HF) radio waves [64,65]. The Sura facility for generation of high power radio waves is located near the village of Vasil'sursk in Russia. It has 190MW effective radiated power transmitter and operated in the 30 min on/30 min off mode. Thermal radiation of the atmosphere in the ozone spectral line, at a frequency of 110836.04 MHz, decreased in intensity during the heating-on portion of the cycle by an average of 10±2% over all sessions of measurements in March, 2009, as shown in Table 2.

3.1.5 Turning the environment against humanity

The Russian discovery may be a bellwether of severe problems to come. For 60 years the U. S. and other major powers' militaries have conducted ionospheric modification 'experiments' without regard for the integrity of the ozone layer or life in general, exploiting the ionosphere to serve multiple military ends, including communications with submarines, resource mapping and exploitation, and weaponization of weather and climate [5,66]. In 1968, MacDonald [1] foresaw the possibility that in the future the military might develop the means to trigger on-demand covert environmental modifications to cause storms, floods, droughts, earthquakes, and tidal waves. Although one would not expect an admission from the steeped-in-secrecy military, an email to then Secretary of State Hillary Clinton [67], sent February 21, 2011 at 7:35 PM states "6.3 magnitude earthquake in Christchurch, New Zealand **And on cue...**"[emphasis added]. The phrase, "And on cue", seems to indicate that the time of a 6.3 magnitude earthquake in New Zealand was known in advance, presumably an indication that the earthquake was deliberately triggered.

Table 1. Range of halogen element compositions of CFA [59]

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

Table 2. Comparison of O₃ number density x10⁹ reduction during the thirty minute heating facility emitted high-power X-polarization radio waves at 4.3 MHz. Data from [64]

DATE>>>	3/ 14/ 2009	3/ 15/ 2009	3/ 16/ 2009	3/ 17/ 2009
Night		12.1±0.7	13.6±0.7	13.6±0.5
Day	9.37±0.48	9.60±0.50	9.55±0.40	9.82±0.35
HF Pumping	8.03±0.38	8.31±0.29	7.32±0.47	8.97±0.49
Day	9.09±0.42	9.23±0.21	9.01±0.24	9.67±0.30
Night	12.8±0.6	14.4±0.7	11.9±0.6	12.2±0.5

In 1997 Secretary of Defense William Cohen directly stated [68]: “Others are engaging...in an eco-type terrorism whereby they can alter the climate, set off earthquakes, [and] volcanoes remotely through the use of electromagnetic waves....It’s real, and that’s the reason why we have to intensify our efforts.”

Fifty years ago MacDonald [1] noted: “The enhanced low-frequency electrical oscillations in the earth-ionosphere cavity relate to possible weapons systems through the little-understood aspect of brain-physiology....No matter how deeply disturbing the thought of using the environment to manipulate behavior for national advantage is to some, the technology permitting such use will very probably develop within the next few decades.” With ionospheric heater transmitters scattered throughout the world, that time might be close at hand – half a century after MacDonald’s forecast.

3.1.6 Extinction of life on earth

Historically, the militaries of the world’s major powers have exhibited little or no concern for the health of their own citizens when what they perceive as ‘national security’ goals are at stake [69, 70]. During the 1950s and 1960s, more than one hundred nuclear devices were detonated above ground in Nevada (USA) [71]. Without being told of the potential health risks, thousands of military personnel were deliberately exposed to nuclear blasts, including “war game” maneuvers that took place directly beneath the

atomic clouds [71,72]. Nor were local residents clearly informed of the risks or provided with ways to minimize those risks [71]. Radioactive fallout occurred not only in the area near the nuclear blasts, but as winds propelled the radioactive cloud across the United States, fallout occurred along the paths, shown in Fig. 3, that depended on local weather conditions.

Atmospheric nuclear aboveground testing came to an end only as the result of public outcry over news reports that bomb-produced radioactive strontium-90, found in cows’ milk, posed dangers of being incorporated into the teeth and bones of infants and children especially [73]. Now, more than a half-century later, the scientific community is mute about vast military experiments on such Earth systems as the climate, and the world’s media are similarly mute. Yet the dangers of aerial particulate spraying and ionospheric heating activities, taken as a whole, *may prove as serious as those once posed by atmospheric nuclear testing* [41,43,74]. If not stopped, these military experiments in our atmosphere pose a risk of extinction of life on Earth.

Mass extinction, defined as when the Earth loses more than three-quarters of its species in a geologically short period of time, has happened only five times in the last 540 million years [75]. Common features of the “Big Five” suggest that key synergies may involve unusual climate dynamics, atmospheric composition, and global ecological stressors that affect multiple lineages [76]. Drizo et al. [77] have asserted that

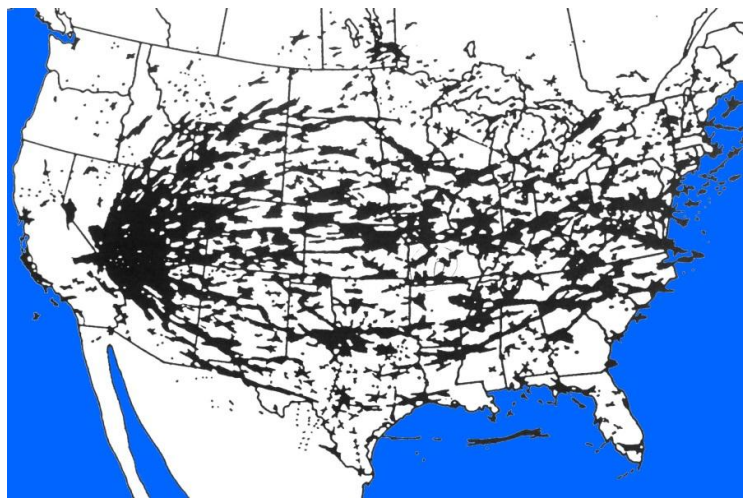


Fig. 3. U. S. Department of Energy image showing areas of the continental United States crossed by more than one nuclear cloud from aboveground detonations as indicated in black during the 1950s-1960s (courtesy of U. S. Department of Energy)

in just the past 500 years, humans have triggered a wave of extinction, threat, and population declines already comparable in rate and magnitude with previous extinctions. Earth is now experiencing a huge wave of population declines and extirpations with cascading consequences on both ecosystem functioning and resources vital to modern civilization. A recent study, for example, documents an alarming decline, a 75% reduction, in insect populations (biomass) over the past three decades in protected areas of Germany [78]. The term "biological annihilation" has been used to highlight the current state of Earth's ongoing Sixth Great Extinction [79].

3.1.7 Geophysical ignorance, arrogance, and secrecy

Earth's great extinctions correlate with epic volcanic phenomena called Large Igneous Province (LIP) [80]. Earth's most extreme mass extinction, at the end of the Permian (or "Great Dying"), 250 million years ago, coincided with the Siberian Traps LIP, a massive outpouring of lava and intrusion of underground magma. The underground magma mixed with thick coal seams and this hot coal-basalt mixture extruded

at numerous surface locations, producing plumes of pyroclastic fly ash, soot, sulfate, and basaltic dust which ascended to the upper atmosphere [81]. This material was dispersed globally, and the resulting char deposits in Permian-aged rock have been found to be remarkably similar to modern coal fly ash [82]. The Permian was characterized by high levels of carbon dioxide, methane gas and rapid global warming to levels lethal to most living organisms [83]. A period of deadly ultraviolet radiation stress during the Permian period may have resulted from depletion of stratospheric ozone by massive output of hydrothermal organo-halogens from the vast Siberian Traps volcanism [84].

The rifting that occurred east of the Urals 250 million years ago resulted in one of the world's largest petroleum and gas deposits, as shown in Fig. 4 [85]. There is considerable frozen methane trapped in the permafrost in that extensive northern area [86]. Anthropogenic global warming, caused by the near-daily, near-global aerial particulate spraying, poses a serious risk of massively thawing and releasing that entrapped methane to the atmosphere. The potential for another mass-extinction event, should this happen, cannot be dismissed.



Fig. 4. The relationship between major petroleum and natural gas production wells and the boundary of the Siberian Traps, indicated by the black line. Methane hydrate deposits currently locked in the permafrost within this extensive area upon melting pose a major catastrophe. From [85]

Military activities aimed at manipulating Earth's environment by polluting the atmosphere with CFA and utilizing ionospheric heaters to cause earthquakes, volcanic eruptions, and other undisclosed purposes are, we submit, causing great harm to life on Earth. One of the many tipping points the world's leading militaries are toying with involves Earth's global monsoon system, which directly impacts two-thirds of humanity, most of them in the global South. In scholarly discussions of the possible impacts of deliberate atmospheric aerosol climate management, it is widely recognized that the global monsoon system is imperfectly understood at present; that engaging in the deliberate alteration of the global climate regime could distort or upset the persistent overturning of the atmosphere over the tropics, with potentially grave implications for floods, droughts, and agriculture in Africa, China, India, and Southeast Asia [87,88].

It is doubtful that assent to a secret climate-engineering scheme by elites in developing nations highly dependent on the natural functioning of the global monsoon system is *fully informed* assent. The military classifies information it considers important to the carrying out of its security and war objectives, one of which is combating climate change [90]. The civilian world has no access to these secrets, except at the highest and most specialized levels of government [89]. The military regimes involved in executing the massive climate-change program discussed in this paper are like the Sorcerer's Apprentice: presumptuous, acting in secret, and unwittingly arrogant.

4. CONCLUSIONS

The decision to alter the natural workings of our planet, to pollute the air we breathe, to disrupt natural climate, to weaponize natural geophysical processes, to disrupt the ionosphere that protects us from the sun's deadly electromagnetic radiation, and to mislead the public about the health risks involved was accurately forecasted in 1968 by Gordon J. F. MacDonald in his essay aptly entitled "How to Wreck the Environment." But MacDonald's vision was not 20/20. He imagined that a nation would be able to develop military technology for the benefit of its own natural national interests, but failed to see the evolution of a planetary "enemy" and the resultant pressures on nation states' militaries to act in planetary concert against this so-called enemy – climate change.

MacDonald also failed to fully appreciate the negative impacts of the future environmental warfare technologies, including their impact on human and environmental health [20,21, 58,41,43,74]. Ninety percent (90%) of the world's population now lives in areas with unhealthy air. Coal-combustion products are the most important single contributor to this global air pollution, with exposure to the PM_{2.5} particles that characterize coal fly ash the leading environmental risk factor for all such deaths (4.5 million in 2015) [91]. Air pollution disproportionately affects the young and the old and those with chronic illness.

War trumps all humanity's other organized activities. It involves not only life-and-death secrecy protocols but distorts the openness of scientific discovery [92,93]. The secret war on climate change is no exception to this rule. MacDonald did not realize half a century ago that the world's militaries could be co-opted by a secret international agreement to wage a first-ever war on the planetary Earth system, on all Earth's biota and fundamental biogeochemical processes.

Unless and until politicians, news media, scientists, and others in our society face the truth of what is happening before their very eyes and collectively demand a halt to these covert technological activities, we will march onward – to the first anthropogenic-caused mass extinction of life on Earth.

ETHICAL STATEMENT

The authors hold that technical, scientific, medical, and public health representations made in the scientific literature in general, including this particular journal, should be and are truthful and accurate to the greatest extent possible, and should serve to the highest degree possible to protect the health and well-being of humanity and Earth's natural environment.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. MacDonald GJ. How to wreck the environment. In *Unless Peace Comes: A Scientific Forecast of New Weapons*, ed. Nigel Calder. 1968;181-205.

2. Frumhoff PC, Stephens JC. Towards legitimacy of the solar geoengineering research enterprise. *Phil Trans R Soc A*. 2018;376(2119):20160459.
3. Available:<https://www.scientificamerican.com/article/latest-ipcc-climate-report-puts-geoengineering-in-the-spotlight/> (Accessed July 2, 2018)
4. Schaefer VJ. The production of ice crystals in a cloud of supercooled water droplets. *Science*. 1946;104:457-9.
5. Fleming JR. *Fixing the Sky: The checkered history of weather and climate control*. New York: Columbia University Press; 2010.
6. Palm Beach Post-Times. Ex-Researcher Says U. S. Seeded Clouds Over Cuba. June 27; 1976.
7. Available:<http://www.nuclearplanet.com/USAF.pdf> (Accessed June 8, 2018)
8. Herndon JM. Aluminum poisoning of humanity and Earth's biota by clandestine geoengineering activity: Implications for India. *Curr Sci*. 2015;108(12):2173-7.
9. Herndon JM. Corruption of Science in America. *The Dot Connector*. 2011.
10. Available:<http://www.ipcc.ch/report/ar5/> (Accessed June 8, 2018)
11. Virgoe J. International governance of a possible geoengineering intervention to combat climate change. *Climatic Change*. 2009;95(1-2):103-19.
12. Herndon JM. An open letter to members of AGU, EGU, and IPCC alleging promotion of fake science at the expense of human and environmental health and comments on AGU draft geoengineering position statement. *New Concepts in Global Tectonics Journal*. 2017;5(3):413-6.
13. Staff R. Ahmadinejad says enemies destroy Iran's rain clouds -reports. *Commodity News [Internet]*. 2011.
14. Available:<http://cyprus-mail.com/2016/02/17/minister-pledges-probe-into-chemtrails/> (Accessed June 8, 2018)
15. Weart S. A national security issue? How people tried to frame global warming. In: Pumphrey C, editor. *Global Climate Change: National Security Implications*. Carlisle, PA (USA): Strategic Studies Institute, US Army War College; 2008.
16. Available:http://www.nuclearplanet.com/Public_Deception_by_Scientists.html (Accessed June 8, 2018)
17. Available:<http://www.nuclearplanet.com/explainretractions.pdf> (Accessed June 8, 2018)
18. Moreno N, Querol X, Andrés JM, Stanton K, Towler M, Nugteren H, et al. Physico-chemical characteristics of European pulverized coal combustion fly ashes. *Fuel*. 2005;84:1351-63.
19. Suloway JJ, Roy WR, Skelly TR, Dickerson DR, Schuller RM, Griffin RA. *Chemical and toxicological properties of coal fly ash*. Illinois: Illinois Department of Energy and Natural Resources; 1983.
20. Herndon JM, Whiteside M. Further evidence of coal fly ash utilization in tropospheric geoengineering: Implications on human and environmental health. *J Geog Environ Earth Sci Intn*. 2017;9(1):1-8.
21. Herndon JM, Whiteside M. Contamination of the biosphere with mercury: Another potential consequence of on-going climate manipulation using aerosolized coal fly ash *J Geog Environ Earth Sci Intn*. 2017;13(1):1-11.
22. Chen Y, Shah N, Huggins F, Huffman G, Dozier A. Characterization of ultrafine coal fly ash particles by energy filtered TEM. *Journal of Microscopy*. 2005;217(3):225-34.
23. Pandit GG, Sahu SK, Puranik VD. Natural radionuclides from coal fired thermal power plants – estimation of atmospheric release and inhalation risk. *Radioprotection*. 2011;46(6):S173–S9.
24. Kampa M, Castanas E. Human health effects of air pollution *Environmental Pollution*. 2008;151:362-7.
25. Dai L, Zanobetti A, Koutrakis P, Schwartz JD. Associations of fine particulate matter species with mortality in the United States: A multicity time-series analysis. *Environ Health Perspect*. 2014;122(8):837-42.
26. Dockery DW, Pope CAI, Xu XP, Spengler JD, Ware JH, et al. An association between air pollution and mortality in six U. S. cities. *N Eng J Med*. 1993;329:1753-9.
27. Pope CAI, Ezzati M, Dockery DW. Fine-particulate air pollution and life expectancy in the United States. *N Eng J Med*. 2009;360:376-86.
28. Calderon-Garciduenas L, Franko-Lira M, Mora-Tiscareno A, Medina-Cortina H, Torres-Jardon R, et al. Early Alzheimer'd and Parkinson's diese pathology in urban children: Friend verses foe response - it's

- time to face the evidence. *BioMed Research International*. 2013;32:650-8.
29. Moulton PV, Yang W. Air pollution, oxidative stress, and Alzheimer's disease. *Journal of Environmental and Public Health*. 2012;109(8):1004-11.
 30. Haberzetti P, Lee J, Duggineni D, McCracken J, Bolanowski D, O'Toole TE, et al. Exposure to ambient air fine particulate matter prevents VEGF-induced mobilization of endothelial progenitor cells from bone matter. *Environ Health Perspect*. 2012;120(6):848-56.
 31. Hong YC, Lee JT, Kim H, Kwon HJ. Air pollution: A new risk factor in ischemic stroke mortality. *Stroke*. 2002;33:2165-9.
 32. Beeson WL, Abbey DE, Knutsen SF. Long-term concentrations of ambient air pollutants and incident lung cancer in California adults: Results from the AHSMOG Study. *Environ Health Perspect*. 1998;106(12):813-22.
 33. Potera C. Toxicity beyond the lung: Connecting PM2.5, inflammation, and diabetes. *Environ Health Perspect*. 2014;122(1):A29.
 34. Pires A, de Melo EN, Mauad T, Saldiva PHN, Bueno HMdS. Pre- and postnatal exposure to ambient levels of urban particulate matter (PM2.5) affects mice spermatogenesis. *Inhalation Toxicology: International Forum for Respiratory Research*. 2011;23(4). DOI: 103109/089583782011563508
 35. Mehta AJ, Zanobetti A, Bind M-A, C., Kloog I, Koutrakis P, Sparrow D, et al. Long-term exposure to ambient fine particulate matter and renal function in older men: The VA normative aging study. *Environ Health Perspect*. 2016;124(9):1353-60.
 36. Tetreault L-F, Doucet M, Gamache P, Fournier M, Brand A, Kosatsky T, et al. Childhood exposure to ambient air pollutants and the onset of asthma: An administrative cohort study in Quebec. *Environ Health Perspect*. 2016;124(8):1276.
 37. Bell ML, Ebisu K, Leaderer BP, Gent JF, Lee HJ, Koutrakis P, et al. Associations of PM2.5 constituents and sources with hospital admissions: Analysis of four counties in Connecticut and Massachusetts (USA). *Environ Health Perspect*. 2014;122(2):138-44.
 38. Ebisu K, Bell ML. Airborne PM2.5 chemical components and low birth weight in the northeastern and mid-atlantic regions of the United States. *Environ Health Perspect*. 2012;120(12):1746-52.
 39. WHO. Ambient air pollution: A global assessment of exposure and burden of disease. *Ambient air pollution: A global assessment of exposure and burden of disease 2016*.
 40. Ma J, Ward E, Siegel R, Jamal A. Temporal trends in mortality in the United States, 1969-2013. *JAMA*. 2015;314(16):1731-9.
 41. Whiteside M, Herndon JM. Coal fly ash aerosol: Risk factor for lung cancer. *Journal of Advances in Medicine and Medical Research*. 2018;25(4):1-10.
 42. Maher BA, Ahmed IAM, Karloukovski V, MacLauren DA, Foulds PG, et al. Magnetite pollution nanoparticles in the human brain. *Proc Natl Acad Sci*. 2016;113(39):10797-801.
 43. Whiteside M, Herndon JM. Aerosolized coal fly ash: Risk factor for neurodegenerative disease. *Journal of Advances in Medicine and Medical Research*. 2018;25(10):1-11.
 44. Sparling DW, Lowe TP. Environmental hazards of aluminum to plants, invertebrates, fish, and wildlife. *Rev Environ Contam Toxicol*. 1996;145:1-127.
 45. Exley C, Rotheray E, Goulson D. Bumblebee pupae contain high levels of aluminum. *PLoS ONE*. 2015;10(6):e0127665.
 46. Idso S, Brazel A. Climatological effects of atmospheric particulate pollution. *Nature*. 1978;274(5673):781.
 47. Torrent J, Barrón V. Diffuse reflectance spectroscopy of iron oxides. *Encyclopedia of Surface and Colloid Science*. 2002;1:1438-46.
 48. Moteki N, Adachi K, Ohata S, Yoshida A, Harigaya T, Koike M, et al. Anthropogenic iron oxide aerosols enhance atmospheric heating. *Nature Communications*. 2017;8:15329.
 49. Yoshida A, Moteki N, Ohata S, Mori T, Tada R, Dagsson-Waldhauserová P, et al. Detection of light-absorbing iron oxide particles using a modified single-particle soot photometer. *Aerosol Science and Technology*. 2016;50(3):1-4.
 50. Zhiyuan C, Shichang K, Dahe Q. Seasonal features of aerosol particles recorded in snow from Mt. Qomolangma (Everest) and their environmental implications. *Journal of*

- Environmental Sciences. 2009;21(7):914-9.
51. Cziczo DJ, Froyd KD, Hoose C, Jensen EJ, Diao M, Zondlo MA, et al. Clarifying the dominant sources and mechanisms of cirrus cloud formation. *Science*. 2013;340(6138):1320-4.
 52. Garimella S. A vertically-integrated approach to climate science: From measurements and machine learning to models and policy: Massachusetts Institute of Technology; 2016.
 53. Garimella S, Rothenberg DA, Wolf MJ, Christopoulos KD, et al. Climate implications of coal fly ash particles due to ice cloud formation. 2017.
 54. Weatherhead EC, Andersen SB. The search for signs of recovery of the ozone layer. *Nature*. 2006;441(7089):39.
 55. Strahan SE, Douglass AR. Decline in Antarctic Ozone Depletion and Lower Stratospheric Chlorine Determined From Aura Microwave Limb Sounder Observations. *Geophysical Research Letters*. 2018;45(1):382-90.
 56. Ball WT, Alsing J, Mortlock DJ, Staehelin J, Haigh JD, Peter T, et al. Evidence for a continuous decline in lower stratospheric ozone offsetting ozone layer recovery. *Atmospheric Chemistry and Physics*. 2018; 18(2):1379-94.
 57. Hossaini R, Chipperfield M, Montzka S, Rap A, Dhomse S, Feng W, editors. Ozone Destruction in the Upper Troposphere/Lower Stratosphere from Short-Lived Halogens and Climate Impacts. EGU General Assembly Conference Abstracts; 2014.
 58. Herndon JM, Hoisington RD, Whiteside M. Deadly ultraviolet UV-C and UV-B penetration to Earth's surface: Human and environmental health implications. *J Geog Environ Earth Sci Intn*. 2018;14(2):1-11.
 59. NRC. Trace-element Geochemistry of Coal Resource Development Related to Environmental Quality and Health: National Academy Press; 1980.
 60. Rice KM, Walker Jr EM, Wu M, Gillette C, Blough ER. Environmental mercury and its toxic effects. *Journal of preventive medicine and public health*. 2014;47(2):74.
 61. Murphy D, Thomson D, Mahoney M. In situ measurements of organics, meteoritic material, mercury, and other elements in aerosols at 5 to 19 kilometers. *Science*. 1998;282(5394):1664-9.
 62. Bust GS, Mitchell CN. History, current state, and future directions of ionospheric imaging. *Reviews of Geophysics*. 2008;46(1).
 63. Freeland E. Under an Ionized Sky. Feral House, Port Townsend WA. 2018.
 64. Kulikov YY, Frolov V, editors. Influence of HF powerful radio waves on the ozone number density in the earth's atmosphere. Physics and Engineering of Microwaves, Millimeter and Submillimeter Waves (MSMW), 2010 International Kharkov Symposium on, IEEE; 2010.
 65. Kulikov YY, Frolov V. Influence of an artificially disturbed ionosphere on the mesospheric ozone. *Russian Journal of Physical Chemistry B*. 2013;7(6):692-5.
 66. Bertell R. Planet Earth, the Latest Weapon of War: A Critical Study into the Military and the Environment. London: The Women's Press; 2000.
 67. Available:<https://wikileaks.org/clinton-emails/emailid/11791> (Accessed June 8, 2018)
 68. Cohen W. Address by Defense Secretary Cohen: Terrorism, Weapons of Mass Destruction, and U. S. Strategy; 1997.
 69. Cole LA. Clouds of secrecy: The army's germ warfare tests over populated areas. Oxford, Maryland: Rowman & Littlefield Publishers, Inc.; 1988.
 70. Miller RL. Under the cloud: The decades of nuclear testing. Woodlands, Texas: Two-Sixty Press; 1991.
 71. Fradkin PL. Fallout: An American Nuclear Tragedy. Boulder, Colorado: Johnson Books; 2004.
 72. Institute of Medicine NRC. Exposure of the american people to iodine-131 from nevada nuclear-bomb tests: Review of the national cancer institute report and public health implications. Washington, DC: National Academy Press; 1999.
 73. Reiss LZ. Strontium-90 absorption by deciduous teeth. *Science*. 1961; 134(3491):1669-73.
 74. Whiteside M, Herndon JM. Aerosolized coal fly ash: Risk factor for COPD and respiratory disease. *Journal of Advances in Medicine and Medical Research*. 2018; 26(7):1-13.
 75. Raup DM. Biological extinction in earth history. *Science*. 1986;231(4745):1528-33.
 76. Barnosky AD, Matzke N, Tomiya S, Wogan GO, Swartz B, Quental TB, et al. Has the Earth's sixth mass extinction already arrived? *Nature*. 2011;471(7336):51.

77. Dirzo R, Young HS, Galetti M, Ceballos G, Isaac NJ, Collen B. Defaunation in the Anthropocene. *Science*. 2014;345(6195):401-6.
78. Hallmann CA, Sorg M, Jongejans E, Siepel H, Hofland N, Schwan H, et al. More than 75 percent decline over 27 years in total flying insect biomass in protected areas. *PLoS ONE*. 2017;12(10):e0185809.
79. Ceballos G, Ehrlich PR, Dirzo R. Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines. *Proceedings of the National Academy of Sciences*. 2017;114(30):E6089-E96.
80. Wignall PB. Large igneous provinces and mass extinctions. *Earth-Science Reviews*. 2001;53(1):1-33.
81. Ogden DE, Sleep NH. Explosive eruption of coal and basalt and the end-Permian mass extinction. *Proceedings of the National Academy of Sciences*. 2012;109(1):59-62.
82. Grasby SE, Sanei H, Beauchamp B. Catastrophic dispersion of coal fly ash into oceans during the latest Permian extinction. *Nature Geoscience*. 2011;4(2):104.
83. Brand U, Blamey N, Garbelli C, Griesshaber E, Posenato R, Angiolini L, et al. Methane hydrate: Killer cause of Earth's greatest mass extinction. *Palaeoworld*. 2016;25(4):496-507.
84. Visscher H, Looy CV, Collinson ME, Brinkhuis H, Van Konijnenburg-Van Cittert JH, Kürschner WM, et al. Environmental mutagenesis during the end-Permian ecological crisis. *Proceedings of the National Academy of Sciences of the United States of America*. 2004;101(35):12952-6.
85. Herndon JM. New concept on the origin of petroleum and natural gas deposits. *J Petrol Explor Prod Technol*. 2017;7(2):345-52.
86. Collett TS, Ginsburg GD. Gas hydrates in the Messoyakha gas field of the West Siberian Basin—a re-examination of the geologic evidence. *International Journal of Offshore and Polar Engineering*. 1998;8(01).
87. Polson D, Bollasina M, Hegerl G, Wilcox L. Decreased monsoon precipitation in the Northern Hemisphere due to anthropogenic aerosols. *Geophys. Res. Lett*. 2014;41(16):6023-9.
88. Robock A, Oman L, Stenchikov GL. Regional climate responses to geoengineering with tropical and Arctic SO₂ injections. *J. Geophys. Res. Atm*. 2008;113(D16).
89. Ellsberg D. *Secrets: A memoir of Vietnam and the Pentagon Papers*; Penguin; 2003.
90. Available:<https://www.defense.gov/News/Speeches/Speech-View/Article/605617/> (Accessed July 2, 2018)
91. Health Effects Institute 2018. *State of Global Air 2018*. Data source: *Global Burden of Disease Study 2016*. IHME; 2017. Available:www.stateofglobalair.org (Accessed July 2, 2018)
92. Rhodes R. *The making of the atomic bomb*: Simon and Schuster. 1986;2012.
93. Rhodes R. *Dark Sun: The Making of the Hydrogen Bomb*: Simon and Schuster; 1996.

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