This massive research study is entitled: **Policy Implications of Greenhouse Warming: Mitigation, Adaptation, and the Science Base - Panel on Policy Implications of Greenhouse Warming**, sponsored by the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine. The results were presented in 1992 and published in book form in 2000 by the National Academy Press. This 994 page study is the textbook on greenhouse gasses, global warming, policy decisions and mitigation's (corrective measures). Included within is the hard science many chemtrails researchers have been searching for: the scientists, agencies, institutions and corporations involved, cost factors, chemical formula, mathematical modeling, delivery methods, policies, recruiting of foreign governments, acquisition of materials, and the manufacturing of aerosol compounds, etc.

In Policy Implications of Greenhouse Warming: Mitigation, Adaptation, and the Science Bases conclusion, the N.A.S. found that the most effective global warming mitigation turned out to be the spraying of reflective aerosol compounds into the atmosphere utilizing commercial, military and private aircraft. This preferred mitigation method is designed to create a global atmospheric shield which would increase the planet's albedo (reflectivity) using aerosol compounds of aluminum and barium oxides, and to introduce ozone generating chemicals into the atmosphere.

This method was the most cost effective, and yielded the largest benefits. It could also be conducted covertly to avoid the burdens of environmental protection and regulatory entanglements.

It is evident to anyone who cares to look up, that this mitigation is now being conducted worldwide and on a daily basis. It is certain that our leaders have already embarked on an immense geoengineering project; one in which they expect millions of human fatalities, and consider these to be acceptable losses.

Geoengineering is being carried on Earth on a staggering scale, without the impediment of environmental laws or regulatory constraints. This grand experiment is being conducted in full view, while being concealed in plain sight. ----------

The following excerpts detail the preferred geoengineering Mitigations for reducing greenhouse gasses, global warming and radiation from space. Quoted from: Policy Implications of Greenhouse Warming: Mitigation, Adaptation, and the Science Base - Panel on Policy Implications of Greenhouse Warming

Evaluating Geoengineering Options "Several geoengineering options appear to have considerable potential for offsetting global warming and are much less expensive than other options being considered. Because these options have the potential to affect the radiative forcing of the planet, because some of them cause or alter a variety of chemical reactions in the atmosphere, and because the climate system is poorly understood, such options must be considered extremely carefully. These options might be needed if greenhouse warming occurs, climate sensitivity is at the high end of the range considered in this report, and other efforts to restrain greenhouse gas emissions fail."

"The first set of geoengineering options screens incoming solar radiation with dust or soot in orbit about the earth or in the atmosphere. The second set changes cloud abundance by increasing cloud condensation nuclei through carefully controlled emissions of particulate matter."

"The stratospheric particle options should be pursued only under extreme conditions or if additional research and development removes the concern about these problems. The cloud stimulation option should be examined further and could be pursued if concerns about acid rain could be managed through the choice of materials for cloud condensation nuclei or by careful management of the system. The third class increases ocean absorption of CO_2 through stimulating growth of biological organisms."

Screening Out Some Sunlight "Another option for mitigating a global warming would be to try to control the global radiation balance by limiting the amount of incoming radiation from the sun. This could be done by increasing the reflectivity of the earth, i.e., the albedo. Proposals for increasing the whiteness of roofs and surface features would have some effect, but only a fraction of incident solar radiation reaches the earth's surface and a purposeful change in albedo would have more impact if done high in the atmosphere.

According to Ramanathan (1988), an increase in planetary albedo of just 0.5 percent is sufficient to halve the effect of a CO_2 doubling. Placing a screen in the atmosphere or low earth orbit could take several forms: it could involve changing the quantity or character of cloud cover, it could take the form of a continuous sheet, or it could be divided into many "mirrors" or a cloud of dust. Preliminary characterizations of some of the possibilities that might be considered are provided below."

Stratospheric Dust "Although the space dust option does not appear to be sensible, computations of the residence times of 0.2-µm dust above 20 to 40 km are of the order of 1 to 3 years (Hunten, 1975). It seems to be generally accepted that volcanic aerosols remain in the stratosphere for several years (Kellogg and Schneider, 1974; Ramaswamy and Kiehl, 1985). A screen could be created in the stratosphere by adding more dust to the natural stratospheric dust to increase its net reflection of sunlight."

Mass Estimates "Ramaswamy and Kiehl (1985) estimate that an aerosol dust loading of 0.2 g/m2 for dust with a radius of about 0.26 µm increases the planetary albedo by 12 percent, resulting in a 15 percent decrease of solar flux reaching the surface. Since an approximately 1 percent change in solar flux is required, and their Figures 13 and 15 suggest that, at these loadings, the dust effects may reasonably be extrapolated downward linearly, estimates will be made by using a dust loading of 0.02 g/m2 with a particle radius of 0.26 µm."

"The dust in Ramaswamy and Kiehl's model is distributed between 10 and 30 km in the stratosphere, uniformly over the globe. The actual effect on radiative forcing of a global distribution of additional dust would be somewhat greater at low than at high latitudes because more of the sunlight is effective there for geometric reasons. This would decrease slightly the equator-to-pole temperature gradients and might have some effect on weather intensity. Presumably, this effect can also be studied with global climate models."

Delivery Scenarios "Aircraft Exhaust Penner et al. (1984) suggested that emissions of 1 percent of the fuel mass of the commercial aviation fleet as particulates, between 40,000- and 100,000-foot (12- to 30-km) altitude for a 10-year period, would change the planetary albedo sufficiently to neutralize the effects of an equivalent doubling of CO_2. They proposed that retuning the engine combustion systems to burn rich during the high-altitude portion of commercial flights could be done with negligible efficiency loss. Using Reck's estimates of extinction coefficients for particulates (Reck, 1979a, 1984), they estimated a requirement of about 1.168 ¥ 1010 kg of particulates, compared with the panel's estimate of 1010 kg, based upon Ramaswamy and Kiehl (1985). They then estimated that if 1 percent of the fuel of aircraft flying above 30,000 feet is emitted as soot, over a 10-year period the required mass of particulate material would be emitted. However, current commercial aircraft fleets seldom operate above 40,000 feet (12 km), and the lifetimes of particles at the operating altitudes will be much shorter than 10 years."

"An alternate possibility is simply to lease commercial aircraft to carry dust to their maximum flight altitude, where they would distribute it. To make a cost estimate, a simple assumption is made that the same amount of dust assumed above for the stratosphere would work for the tropopause (the boundary between the troposphere and the stratosphere). The results can be scaled for other amounts. The comments made above about the possible effect of dust on stratospheric ozone apply as well to ozone in the low stratosphere, but not in the troposphere. The altitude of the tropopause varies with latitude and season of the year."

"In 1987, domestic airlines flew 4,339 million ton-miles of freight and express, for a total express and freight operating revenue of $4,904 million (U.S. Bureau of the Census, 1988). This gives a cost of slightly more than $1 per ton-mile for freight. If a dust distribution mission requires the equivalent of a 500-mile flight (about 1.5 hours), the delivery cost for dust is $500/t, and ignoring the difference between English and metric tons, a cost of $0.50/kg of dust. If 1010 kg must be delivered each 83 days, (provided dust falls out at the same rate as soot), 5 times more than the 1987 total ton-miles will be required."

"The question of whether dedicated aircraft could fly longer distances at the same effective rate should be investigated."

Changing Cloud Abundance - The Approach "Independent studies estimated that an approximately 4 percent increase in the coverage of marine stratocumulus clouds would be sufficient to offset CO_2 doubling (Reck, 1978; Randall et al., 1984). Albrecht (1989) suggests that the average low-cloud reflectivity could be increased if the abundance of cloud condensation nuclei (CCN) increased due to emissions of SO_2. It is proposed that CCN emissions should be released over the oceans, that the release should produce an increase in the stratocumulus cloud albedo only, and that the clouds should remain at the same latitudes over the ocean where the surface albedo is relatively constant and small."

"Albrecht (1989) estimates that a roughly 30 percent increase in CCN would be necessary to increase the fractional cloudiness or albedo of marine stratocumulus clouds by 4 percent. Albrecht's idealized stratocumulus cloud, which he argues is typical, has a thickness of 375 m, a drizzle rate of 1 mm per day, and a mean droplet radius of 100 mm, and he assumes that each droplet is formed by the coalescence of 1000 smaller droplets. The rate at which the CCN are depleted by his model is 1000/cm3 per day. Consequently, about 300/cm3 per day (30 percent of 1000) of additional CCN would have to be discharged per day at the base of the cloud to maintain a 4 percent increase in cloudiness. This assumes that the perturbed atmosphere would also remain sufficiently close to saturation in the vicinity of the CCN that additional cloud cover would be formed every time the number of CCN increased."

Mass Estimates of Cloud Condensation Nuclei "With Albrecht's assumption in mind that cloudiness in a typical ocean region is limited by the small number of CCN, we now extrapolate to the entire globe. On the average, 31.2 percent of the globe is covered by marine stratiform clouds (Charlson et al., 1987). If no high-level clouds are present, the number n of CCN that need to be added per day is 1.8 ¥ 1025 CCN/day. The mass of a CCN is equal to 4/3pr3 ¥ density, and it is assumed that the mean radius r is equal to 0.07 ¥ 10-4 cm (Charlson et al., 1987). Because the density of sulfuric acid (H_2SO_4) is 1.841 g/cm3, the CCN mass is 2.7 ¥ 10-15 g. The total weight of H_2SO_4 to be added per day is 31 ¥ 103 t per day SO_2 if all SO_2 is converted to H_2SO_4 CCN. To put this number in perspective, a medium-sized coal-fired U.S. power plant emits about this much SO_2 in a year. Consequently, the equivalent emissions of 365 U.S. coal-burning power plants, distributed homogeneously, would be needed to produce sufficient CCN."

"Cloud stimulation by provision of cloud condensation nuclei appears to be a feasible and low-cost option capable of being used to mitigate any quantity of CO_2 equivalent per year. Details of the cloud physics, verification of the amount of CCN to be added for a particular degree of mitigation, and the possible acid rain or other effects of adding CCN over the oceans need to be investigated before such system is put to use. Once a decision has been made, the system could be mobilized and begin to operate in a year or so, and mitigation effects would be immediate. If the system were stopped, the mitigation effect would presumably cease very rapidly, within days or weeks, as extra CCN were removed by rain and drizzle."

"Several schemes depend on the effect of additional dust compounds in the stratosphere or very low stratosphere screening out sunlight. Such dust might be delivered to the stratosphere by various means, including being fired with large rifles or rockets or being lifted by hydrogen or hot-air balloons. These possibilities appear feasible, economical, and capable of mitigating the effect of as much CO_2 equivalent per year as we care to pay for. (Lifting dust, or soot, to the tropopause or the low stratosphere with aircraft may be limited, at low cost, to the mitigation of 8 to 80 Gt CO_2 equivalent per year.) Such systems could probably be put into full effect within a year or two of a decision to do so, and mitigation effects would begin immediately. Because dust falls out naturally, if the delivery of dust were stopped, mitigation effects would cease within about 6 months for dust (or soot) delivered to the tropopause and within a couple of years for dust delivered to the midstratosphere."

"Sunlight screening systems would not have to be put into practice until shortly before they were needed for mitigation, although research to understand their effects, as well as design and engineering work, should be done now so that it will be known whether these technologies are available if wanted."

"Perhaps one of the surprises of this analysis is the relatively low costs at which some of the geoengineering options might be implemented."

(end of excerpts)

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and the Science Base

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