Australian Management Consolidated Pty. Ltd.

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10 September 2008

The Secretary
Senate Standing Committee on Rural and Regional Affairs and Transport
Parliament House
Canberra ACT 2600

VIA Email: rrat.sen@aph.gov.au

Inquiry into water management in the Coorong and Lower Lakes

Dear Sir/Madam

Our company and our consultants, Professor Daniel Rosenfeld, Chair of Atmospheric Research at the Hebrew University of Jerusalem, Israel and Associate Professor Jim Peterson, Founding-Director, Center for Geographical Information Systems (GIS), School of Geography and Environmental Science, Monash University of Clayton, Victoria are involved in scientific research into the causes of substantial reduction of inflows into the Murray River catchments.

In March 2000, the research findings of Professor Daniel Rosenfeld and myself were published in Science Journal. The findings showed that increasing amount of PM2.5 particles of air pollution originating in Adelaide, Port Pirie, Port Augusta, Geelong, Melbourne and the La Trobe Valley power stations reduced rainfall and snowfall in the Victorian Alps and the Snowy Mountains. In 1999 I have informed the Victorian, NSW, SA and Qld Governments and water authorities, including the Murray Darling Basin Commission, of the significant implications of our research on the Australia's water resources and the flow of the Murray River and subsequent water shortages in the future.

Rosenfeld D., 2000: Suppression of Rain and Snow by Urban and Industrial Air Pollution. Science 287 (5459), 1793-1796.

http://earth.huji.ac.il/data/pics/Science_Smoke.pdf

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Our findings are based on new scientific and technological methodology recently developed by Professor Danny Rosenfeld and which has been endorsed and adopted by the National Aeronautics and Space Administration (NASA) and the National Space Development Agency of Japan (NASDA) to measure the microphysical structures of clouds through satellite observations. The satellite observations and measurements on board of the National Aeronautics and Space Administration (NASA) and the National Space Development Agency of Japan (NASDA), Tropical Rainfall Measuring Mission (TRMM), showed that warm and cold rain-forming processes in the Maritime Convective (MC) clouds and the Continental Convective (CC) clouds are sensitive to air pollution. The sources of air pollution affecting rainfall and snowfall precipitation are urban and industrial air pollution, desert dust, smoke from burning vegetation, forest and grass fires.

The physical evidence indicates that air pollution affecting rain processes in certain areas of Australia is man made, with the impact reducing the levels of natural precipitation of individual MC and CC clouds to the level of total suppression under certain meteorological conditions. Thus, clouds that could be expected to yield precipitation yield little or none at all.

The principles of the methodology are described in a paper by Rosenfeld and Lensky (1998): "Spaceborne sensed insights into precipitation formation processes in continental and maritime clouds*". The Bulletin of American Meteorological Society, 79, 2457-2476.* **(1)**
Since 1998, Rosenfeld has shown that pollution-induced reduction of cloud-droplet size reduces precipitation in certain types of clouds.

Another paper by Prof. Rosenfeld identifies direct evidence that precipitation is inhibited in clouds affected by smoke: *Rosenfeld D., 1999*: "TRMM Observed First Direct Evidence of Smoke from Forest Fires Inhibiting Rainfall"*. Geophysical Research Letters. October 15, 1999*. **(2)**
In recognition of the significance of these findings both NASA and the American Geophysical Union issued a joint press release on 5 October 1999. **(Attachment 1)**

The paper by Professor Rosenfeld, entitled "Suppression of Rain and Snow by Urban and Industrial Air Pollution" was published on the 10 March 2000, in the *Science* journal issued by the American Association for the Advancement of Science (AAAS) **(3)** and focuses on south-eastern Australia and shows the following:

a. Pollution tracks are clearly visible in the clouds and can be pinpointed to urban and industrial developments, and individual pollution sources, such as power stations, smelters and refineries as seen in **Figure 1**.

Satellite Image of south-eastern Australia with urban and industrial air pollution tracks emanating from Adelaide, Melbourne, Port Pirie lead smelter, Geelong refinery, Port Augusta, La Trobe Valley and Hunter Valley power stations, Portland aluminum smelter.

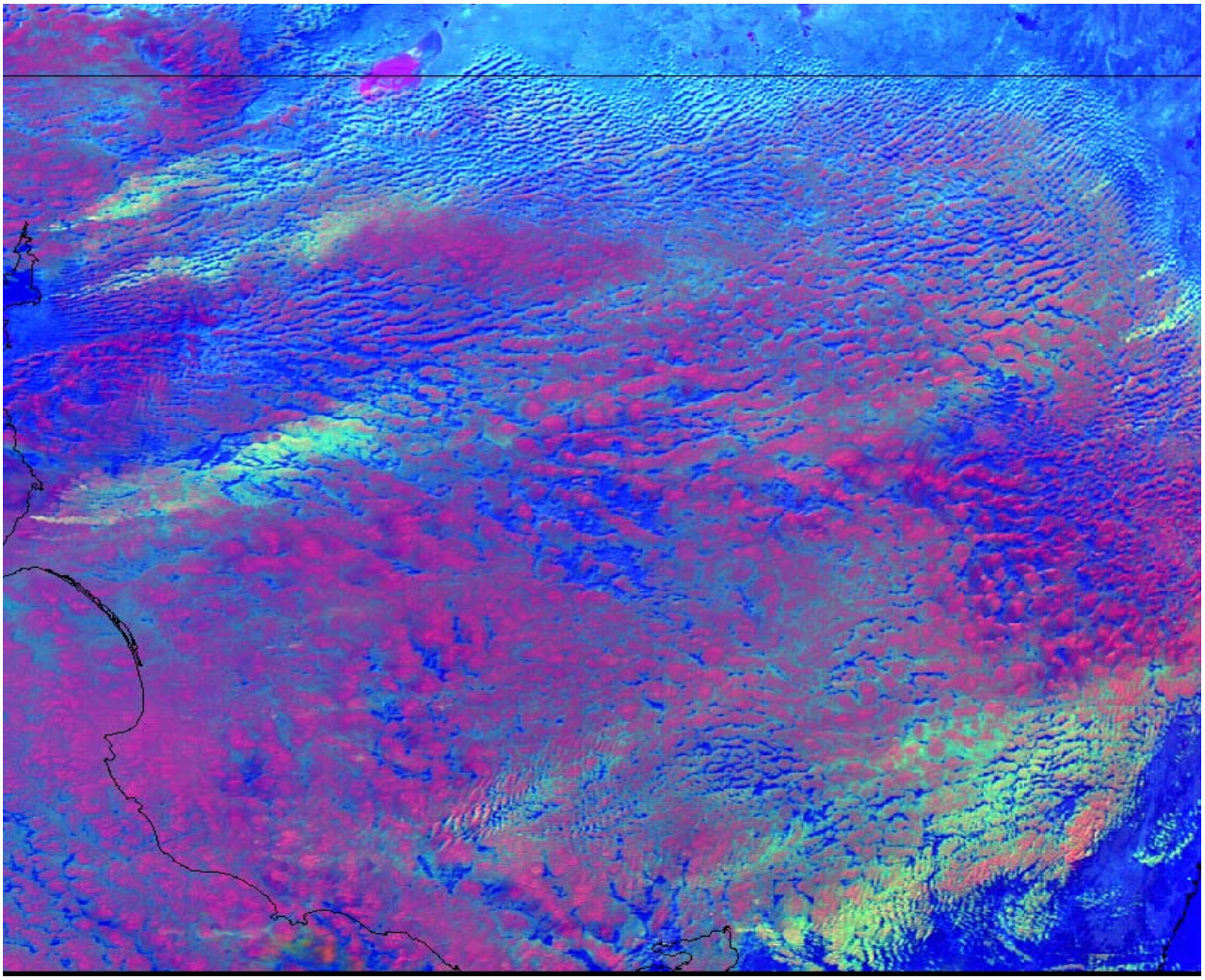

Figure 1

b. The precipitation from clouds impacted by the pollution is markedly inhibited, to the point of total suppression.

c. The pollution inhibits the production of snow in the clouds and it is estimated that precipitation in the Snowy Mountains and the Victorian Alps is reduced by at least 50% on average each year.

d. That urban and industrial air pollution causes substantial reductions of rainfall and snowfall and, as a consequence, substantial reductions in flow of the Murray, Darling, Goulburn, Murrumbidgee and other Rivers in New South Wales and Victoria and, of course, impacts on the economic decline in certain rural communities of the Murray-Darling Basin.

Our company estimates that there is an annual rainfall and snowfall loss resulting in reduction of inflow into the catchments of the Murray River located in the Victorian Alps and the Snowy Mountains of at least 5,000, 000 ML.

In June 2002, as the result of my representations to John Forrest MP, Federal Member for Mallee and Warren Truss MP, Minister for Agriculture, Fisheries and Forestry, the House of Representatives Committee on Agriculture, Fisheries and Forestry established Inquiry into the Future Water Supplies for the Australia's Rural Industries and Communities. **(4)**

In November 2002, Australian Management Consolidated Pty. Ltd. with the assistance from Associate Professor Jim Peterson of Monash University prepared comprehensive submissions to the above Committee of Inquiry:

http://www.aph.gov.au/house/committee/primind/watering/sub113a.pdf

http://www.aph.gov.au/house/committee/primind/watering/sub113b.pdf

Our submissions clearly showed that PM2.5 particles of air pollution constituted the main cause of the reduction of rainfall and snowfall in the Victorian Alps, the Snowy Mountains, the Blue Mountains in NSW and the Great Dividing Ranges in southeastern Queensland and the MAIN CAUSE of the reduction of inflows into the Murray-Darling Basin catchments, rivers and dams including Murray, Goulburn, Murrumbidgee, Darling and other rivers managed by the Murray Darling Basin Commission.

In May 2006, Professor Rosenfeld, Associate Professor Peterson, Dr. Lensky and I again published scientific evidence in Clean Air and Environmental Quality Journal issued by Clean Air Society of Australia and New Zealand (CASANZ) which showed that air pollution suppressed precipitation in Australia's main catchments:

D. Rosenfeld, I. M. Lensky, J. Peterson, A. Gingis. Potential impacts of air pollution aerosols on precipitation in Australia. Clean Air and Environmental Quality, 40, No.2. 43-49, May 2006. **(5)**

http://www.earth.huji.ac.il/data/pics/06_226_CAS_May_06_rosenfeld2.pdf

The Murray Darling Basin Commission, Victorian, Queensland, New South Wales and South Australian Governments have all ignored the scientific evidence provided by us when considering the causes of Australia's water crisis because of misleading advice they received from the CSIRO and the Bureau of Meteorology Research Centre.

The CSIRO Division of Atmospheric Research and the Bureau of Meteorology Research Centre actively undermined our representations to the various State Governments and Water Authorities and undermined the value and credibility of our findings. Chief of CSIRO Atmospheric Research, Dr Greg Ayers and Chief of Bureau of Meteorology Research Centre, Dr Mike Manton publicly rubbished our scientific evidence without publishing any refuting material in peer-reviewed journals. By doing so, they have curtailed innovative and good scientific research which is readily available to alleviate drought and water shortages in Australia.

Scientifically based Cloud Physics and Cloud Seeding technology is the most readily available and cost effective remedy for the restoration of adequate rainfall and water inflows into Australia's catchments.

The estimated cost of water produced by scientifically based Cloud Physics Research and Cloud Seeding operation is about $50 per 1 ML and a program could be implemented immediately in the catchments of the Murray River in the Victorian Alps and the Snowy Mountains and in Queensland and New South Wales catchments by December 2008.

Our science is highly regarded around the world and used by industry and Governments as exemplified by what you would find by visiting the following website: http://www.energy.ca.gov/2007publications/CEC-500-2007-008/CEC-500-2007-008.PDF **(6)**

The report to the Californian Energy Commission and the Californian Government by the Federal Government of USA Bureau of Reclamation is in large measure based on the research and findings of our consultant, Professor Danny Rosenfeld. It is our opinion that the members of CSIRO Executives have unjustifiably refused to accept our findings and in our view the result has been the failure of the National Water Commission and the Murray Darling Basin Commission to implement a policy which would serve to introduce proven scientific solutions and innovation to critical issues of water shortage in Australia.

Out technology can be readily utilized to increase precipitation substantially in the Snowy Mountains and the Victorian Alps by at least 3,000,000 ML per average winter season and will provide enough water for the catchments of the Murray River to meet water targets and water requirements of irrigators and the environment including the needs of the Coorong and the Lower Lakes.

I would be interested to present our latest scientific findings and solutions during Committee Hearings in Melbourne and to meet with Senators. My power point presentation is designed to answer questions concerning the issue of cloud micro-physics and implications for cloud seeding, based on most recent paper published by Professor Rosenfeld, (Rosenfeld D., & others), Science, September 2008). "Flood or Drought: How Do Aerosols Affect Precipitation?" **(7)**

We submit that application of "The Rosenfeld Science" would greatly assist in solving the present water shortages in southeastern Australia, including those of the Murray Basin, and more specifically, in solving the crisis of the Coorong and the Low Lakes.

Yours faithfully,

Australian Management Consolidated Pty. Ltd.

Aron Gingis
Managing Director
MBA, Dip. Eng.

References

1. Rosenfeld D. and I. M. Lensky, 1998:"Spaceborne sensed insights into precipitation formation processes in continental and maritime clouds". The *Bulletin of American Meteorological Society,* **79**, 2457-2476 http://www.earth.huji.ac.il/data/pics/RosenfeldLendsky_BAMS98.pdf

2. Rosenfeld D., 1999: "TRMM Observed First Direct Evidence of Smoke from Forest Fires Inhibiting Rainfall". *Geophysical Research Letters*. **26,** (20), 3105-3108. http://www.earth.huji.ac.il///data/pics/GRL_TRMM_Smoke_99.pdf

3. Rosenfeld D., 2000: "Suppression of Rain and Snow by Urban and Industrial Air Pollution". *Science*, **287** (5459), 1793-1796. http://earth.huji.ac.il/data/pics/Science_Smoke.pdf

4. Submission to House of Representatives Committee on Agriculture, Fisheries and Forestry Inquiry into the Future Water Supplies for the Australia's Rural Industries and Communities (2002). http://www.aph.gov.au/house/committee/primind/watering/sub113a.pdf http://www.aph.gov.au/house/committee/primind/watering/sub113b.pdf

5. D. Rosenfeld, I. M. Lensky, J. Peterson, A. Gingis. "Potential impacts of air pollution aerosols on precipitation in Australia". Clean Air and Environmental Quality, 40, No.2. 43-49, May 2006. http://www.earth.huji.ac.il/data/pics/06_226_CAS_May_06_rosenfeld2.pdf

6. The report to the Californian Energy Commission and the Californian Goverment by the Federal Government Bureau of Reclamation (2007). http://www.energy.ca.gov/2007publications/CEC-500-2007-008/CEC-500-2007-008.PDF

7. Daniel Rosenfeld, Ulrike Lohmann, Graciela B. Raga, Colin D. O'Dowd, Markku Kulmala, Sandro Fuzzi, Anni Reissell, Meinrat O. Andreae, "Flood or Drought: How Do Aerosols Affect Precipitation?" Science, September 2008.

ATTACHMENT - 1

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October, 1999
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NASA SPACECRAFT PROVIDES DIRECT EVIDENCE - SMOKE INHIBITS RAINFALL

Smoke from forest fires has, for the first time, been proven to inhibit rainfall, according to an extensive analysis of data taken from NASA's Tropical Rainfall Measuring Mission (TRMM) spacecraft.

The TRMM data, published in the Oct. 15th issue of Geophysical Research Letters, shows that the warm rain processes in tropical clouds, polluted with heavy smoke from forest fires, are practically shut off. In clouds that have been "contaminated" with smoke, scientists found that the clouds tops must grow considerably above the freezing level (16,000 feet or 4.8 kilometers) in order for the clouds to start producing rain by the alternative mechanism of ice. In the typical rainfall process in cleaner air, rain can form in significantly smaller clouds without ice.

Raindrops in the atmosphere can grow by two means. The first is by coalescence or "collision." In this process, the Warm rain process, a few cloud drops get large enough to start falling. As they fall, they pick up the other clouds drops until they become big enough to fall to Earth as rain drops. The second way needs ice particles and supercooled water (water colder than 32 deg. F). Ice particles surrounded by supercooled water may grow extremely rapidly as water freezes onto the ice core. These large ice particles fall and eventually melt and become raindrops as they fall towards the warmer surface.

Scientists have known for some time that smoke from burning vegetation suppresses rainfall, but it was not known to what extent until now. Because of TRMM, scientists are able to observe both precipitation and cloud droplets over large areas, including clouds in and out of smoke plumes.
"We've seen evidence of decreased precipitation in clouds contaminated by smoke, but it wasn't until now that we had direct evidence showing

that smoke actually suppresses precipitation completely from certain clouds," said Dr. Daniel Rosenfeld, TRMM science team member and the author of the paper, TRMM Observed First Direct Evidence of Smoke from Forest Fires Inhibiting Rainfall" the research paper in which this information was published.

Scientists have a keen interest in the changes in global precipitation not only because of its impact on human activities, such as crop production, but also because of its role in deriving the global rainfall weather pattern.

Tropical rainfall is responsible for about two-thirds of the energy required to power the global atmospheric circulation. The recent El Nino serves as a perfect example of the atmospheric circulation changes that can result from a displacement of the normal precipitation patterns in the central Pacific. Similarly, the modification of precipitation by aerosols (particles of liquid or solid dispersed as a suspension in gas, such as air) might also affect the global climate. More precise information about this rainfall and its variability is crucial to understanding and predicting global climate and climate change.

In the paper, Rosenfeld highlights one specific area - Kalimantan, Indonesia. During a TRMM overpass on March 1, 1998, the southeastern portion of the Island was engulfed heavily by smoke while the northwestern portion was relatively smoke free. The TRMM radar detected precipitation in smoke-free clouds while almost none in the smoke-plagued clouds, thus showing the impact of smoke from fires on the rain forest rainfall processes.

"It's important to note that this is not a unique case," said Rosenfeld of the Hebrew University of Jerusalem, the Institute of Earth Sciences, Israel. "We observed and documented several other cases that showed similar behavior. In some instances even less severe smoke concentration was found to have comparable impacts on clouds."

This research further validates earlier studies by Rosenfeld on urban air pollution showing that pollution in Manila in the Philippines has an effect similar to forest fires, according to Rosenfeld.

"Findings such as these are making the first inroads into the difficult problem of understanding humankind's impacts on the global precipitation process," said Dr. Christian Kummerow, TRMM project scientist at NASA's Goddard Space Flight Center, Greenbelt, MD.

The Tropical Rainfall Measuring Mission (TRMM) carries microwave and visible/infrared sensors, and a spaceborne rain radar - the first rain radar ever launched into space. The three primary instruments used for this research were the TRMM Precipitation Radar, the TRMM Microwave Imager, and the Visible and Infrared Sensor.

TRMM is NASA's first mission dedicated to observing and understanding tropical rainfall and how it affects the global climate. The TRMM spacecraft fills an enormous void in the ability to calculate world-wide precipitation because so little of the planet is covered by ground-based radars. Presently, only two percent of the area covered by TRMM is covered by ground-based radars, Kummerow said.

TRMM is a joint U.S.-Japanese mission that was launched on Nov. 27, 1997, from the National Space Development Agency at Japan's Tanegashima Space Center. The TRMM satellite has produced continuous data since Dec. 8, 1997. Tropical rainfall -- that which falls within 35 degrees north and 35 degrees south of the equator -- comprises more than two-thirds of the rainfall on Earth.

TRMM is part of NASA's Earth Science Enterprise, a long-term research program designed to study the Earth's land, oceans, air, ice and life as a total system. Images from the TRMM mission are available on the Internet at URL: http://trmm.gsfc.nasa.gov/