Australian Management Consolidated Pty. Ltd.

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Standing Committee on Agriculture, Fisheries and Forestry
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SUBMISSION TO THE STANDING COMMITTEE ON AGRICULTURE FISHERIES AND FORESTRY CONCERNING FUTURE WATER SUPPLIES FOR AUSTRALIA'S RURAL INDUSTRIES AND COMMUNITIES

ABSTRACT

This submission concerns the environmental, administrative, management and scientific issues concerning the planning of future water supplies to Australia's rural industries and communities and refers to the failure of various State and Commonwealth Government agencies to incorporate into decision support the latest scientific findings concerning causes for declining rainfall over Australia. In particular the most recent technologies and research in respect to rainfall enhancement seem to have been ignored. The lack of action in relation to rainfall and snowfall reductions and its impact on Australia's past, present and future water resources is outlined here together with an account of an absence of scientific objectivity, which is detrimental to Australian National Interests. The obstructive and ill-informed conduct of certain officers of the CSIRO and the Bureau of Meteorology in respect to evaluation of this research and application will be referred to.

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1. Introduction

Australia's water supply for rural industries and communities varies in quantity and reliability and is to a great extent dependent on seasonal environmental conditions, including the quantity and timing of natural rainfall and snowfall in the catchments. The amount of the natural rainfall and snowfall is directly related to the success or failure of the Australian rural economy and environment including agriculture, hydro-electricity, snow and water tourism, forestry, plantations, fire safety, land and water salinity, flora and fauna, the water flow of all major rivers and reservoirs and water security for the country's townships and settlements.

Unfortunately, our research reveals that over the last decades there has been a substantial reduction of natural rainfall and snowfall in certain populated and productive regions of Australia in Queensland, New South Wales, Victoria, South Australia and in south-western Western Australia, which has resulted in water restrictions and water shortages, which have adversely impacted on the environment and the economy. Research with which Australian Management Consolidated Pty. Ltd. (AMC) has been involved indicates that the tendency of rainfall reductions can be mitigated by application of methods that has proved to be effective in locations outside Australia's mainland.

2. The Scientific Findings

Our company in conjunction with Prof. Daniel Rosenfeld of the Hebrew University of Jerusalem has, since **May 1999,** been researching the aforementioned rainfall and snowfall reduction and our research has revealed the impact of air pollution on levels of rainfall and snowfall in the following areas:

1. The Grampians, north-western Victoria, the Victorian Alps, Central and East Gippsland in Victoria, Central Victoria north and north-east down wind of Melbourne.

2. The Great Dividing Ranges, the Snowy Mountains, the Blue Mountains, the Hunter Valley and south-western New South Wales.

3. The Great Dividing Ranges, south of Rockhampton, west of Gladstone and Biloela, the Callide Valley, the Burnett Valley catchment, the Condamine River catchment, the Darling Downs, the Warrill Valley and the Lockyer Valley in Queensland.

4. The Perth catchments of the Western Australian Water Corporation and south-western Western Australia.

5. The Mt. Lofty Ranges east of Adelaide, eastern and south-eastern South Australia, east of Adelaide, down wind Port Pirie and Port Augusta in South Australia.

Our findings are based on new scientific and technological methodology recently developed by Prof. Daniel 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 the clear inferences from this work 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 finding both NASA and the American Geophysical Union issued a joint press release on 5 October 1999. **(Attachment 1)**

A third paper by Prof. Rosenfeld, entitled "Suppression of Rain and Snow by Urban and Industrial Air Pollution" was published on the 10 March 2000, by the American Association for the Advancement of Science (AAAS) in the *Science* journal **(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.

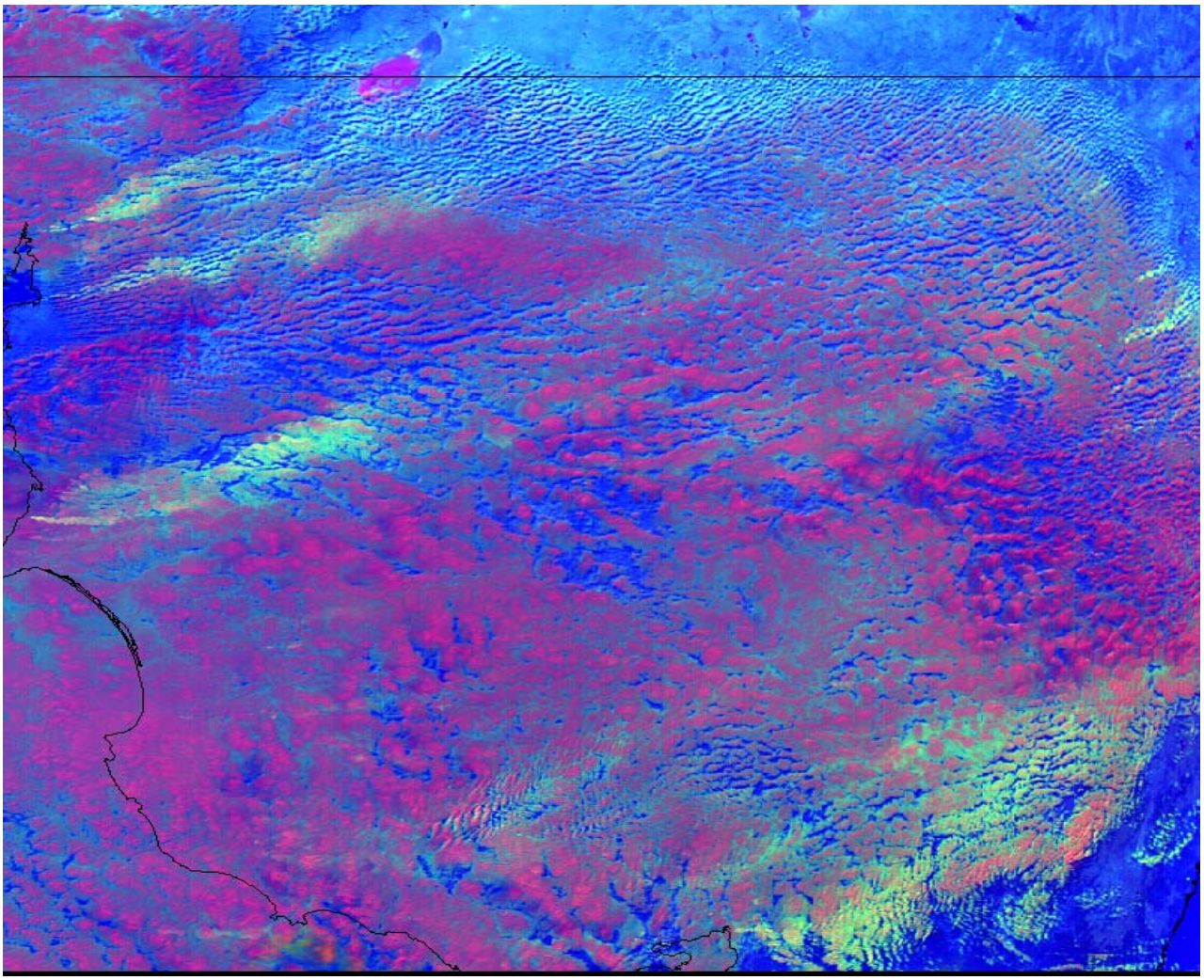


Figure 1

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 30% 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 reservoirs and rivers in the Victorian Alps and the Snowy Mountains of at least 5,000, 000 ML.

A fourth paper by Ramanathan et al. (2001) **(4)** published in *Science* entitled: "Aerosols, Climate, and the Hydrological Cycle" shows that this kind of air pollution is very extensive, and has a major precipitation suppression effect over the most populated areas in both developed and developing countries.

A fifth paper by Prof. Rosenfeld reporting results of sounding of CC clouds (*Nature,* 2000), **(5)** is entitled "Convective Clouds with Sustained Highly Supercooled Liquid Water Until –38^{o}C". Aircraft measurements of supercooled liquid water content indicate the presence of a huge amount of liquid water up to height of 9 to 10 km. This seems to be a common feature of deep vigorous convective clouds in many continental parts of the world (including Australia). The main characteristics of such clouds are substantial air pollution presence, both natural and man-made, strong updrafts exceeding 15 m per second and high droplet concentration of about 1000/cm3 with droplet sizes smaller than the 15 μm of coalescence threshold. Because of failure to reach the coalescence threshold, the potential yield from such clouds remains unrealized, resulting in reduced or complete absence of precipitation.

A sixth paper published in *Geophysical Research Letters* by Prof. Khain A., (2001), **(6)** entitled: "Simulating convective clouds with sustained supercooled liquid water down to –37.5°C using a spectral microphysics model" shows a huge amount of liquid water in convective clouds (1.8 gm-3 at –37.5°C) is predicted by a numerical cloud model that allows explicit microphysical processes and turbulent effects to be simulated.

A seventh paper by Prof. Rosenfeld describes the effect of desert dust on cloud micro-physical structures and precipitation entitled "Desert dust suppressing precipitation: A possible desertification feedback loop" published in *Proceedings of the National Academy of Science (PNAS)* on 22 May 2001, **(7)**.

The satellite methodology of Rosenfeld approach also revealed that glaciogenic seeding (seeding with an ice forming agent, typically silver iodide) created and increased ice precipitation in clouds over west Texas (Woodley et al., 2000) **(8)**, published in *Jour. of Weather Mod*. Vol.32, (37-52), entitled "Identification of a Seeding Signature in Texas Using Multi-Spectral Satellite Imagery"**.**

A ninth paper by Prof. Rosenfeld published in *Science* 6 September 2002 **(9),** entitled "The Role of Sea Spray in Cleansing Air Pollution over Ocean via Cloud Processes" explained the role of sea salt particles in promoting coalescence of cloud droplets and cleansing the atmosphere of the air pollution by enhancing rainfall.

Rosenfeld discovered that precipitation develops readily in clouds that form in polluted air masses over the sea. This is in contrast to the situation over land and in that small sea salt particles from sea spray are responsible for the restoration of capacity to yield precipitation from the polluted clouds. This natural seeding with hygroscopic salts provides a blueprint for what might be done artificially.

The latest paper by Prof. Rosenfeld 2002 **(10)**, submitted to the *J. Appl. Meteor*, on the 12 September 2002, entitled "On Natural and Artificial Hygroscopic Cloud Seeding" describes the role of coalescence and its natural or artificial enhancement by the ingestion of large cloud condensation nuclei (CCN) aerosols, leading to substantially increased rain production from clouds, is investigated through the synthesis of conceptual models, observations, model simulations and the results of hygroscopic cloud seeding experiments. Deep (>10 km) tropical cumulonimbus clouds with active coalescence processes have been shown to produce twice the rain volume of otherwise comparable, but polluted clouds that may remain supercooled to the point of homogeneous nucleation (-38^{o}C) because of suppressed coalescence.

Model simulations using a two-dimensional model with explicit microphysics have replicated these processes. In addition, observations of the transport of cloud condensation nuclei (CCN) from dry salty lakebeds or from the sea surface into clouds demonstrate that this natural seeding can restore coalescence and precipitation to a field of clouds in which these processes had been suppressed. It also appears to enhance ice forming processes. These observations and model simulations suggest that there is a large potential for precipitation enhancement for a cloud seeding method that could modify the microstructure of those clouds with little natural coalescence to mimic a cloud with active coalescence processes, especially for deep (> 10 km) clouds that produce the bulk of the rainfall.

The results from three recent randomised seeding experiments strongly suggest the enormous potential of these clouds to produce substantial increases in precipitation and that this result can be successfully realized by artificial hygroscopic seeding. This view is based on model simulations and field investigations in Israel making use of concentrated brine from the Dead Sea. Both modeling and field studies indicate that the spray system used produces more CCN of desirable size, as specified by model simulations, in greater concentrations, over longer time periods, and at less cost than is possible currently with hygroscopic flare seeding systems.

These scientific findings were published in the most prestigious scientific journals and received wide media coverage. To demonstrate the extent of the publicity, attached hereto are the references and the links to the reports of CNN in respect to the studies. **(Page 38)**

3. Air Pollution and Australian Clouds and Rainfall.

Considering that Australia is the driest continent in the world with frequent dust storms, which elevate huge quantities of soil dust and pollen to the level of clouds, and large quantities of PM2.5 and SO2 air pollution constantly emitted by the Australian urban and industrial developments, by coal power stations, refineries and smelters, and by forest and grass fires, it is not difficult to appreciate that that air pollution is not just disappearing down wind, but affecting our health, our ability to breath and, as it was recently discovered, the health and precipitation efficiency of clouds.

The NASA satellite image of the dust storm and smoke from forest fires in New South Wales and Queensland on 23 October 2002 can be seen in **Figure 2**. The Bureau of Meteorology (BoM) Rain Maps for the period of 24 hrs to 09.00 a.m. 24 October 2002 show suppression of precipitation in areas affected by the dust storm and forest fires in New South Wales and Queensland and the substantially reduced precipitation down wind of urban and industrial air pollution in Victoria is to be seen in **Figures 3, 4**.

Desert dust and smoke from forest fires and urban and industrial air pollution, affects precipitation efficiency of Convective Continental (CC) clouds in some areas and Maritime Convective (MC) clouds in other areas. These clouds are responsible for up to 60% - 80% of annual precipitation west and east of Great Dividing Ranges in Queensland, New South Wales, Victoria and South Australia, the Victorian Alps and the Snowy Mountains. The effect of air pollution is very widely spread and directly threatens Australia's water resources for urban and rural communities and industries.

Dust Storm and Fire Smoke in NSW and Qld on 23 October 2002

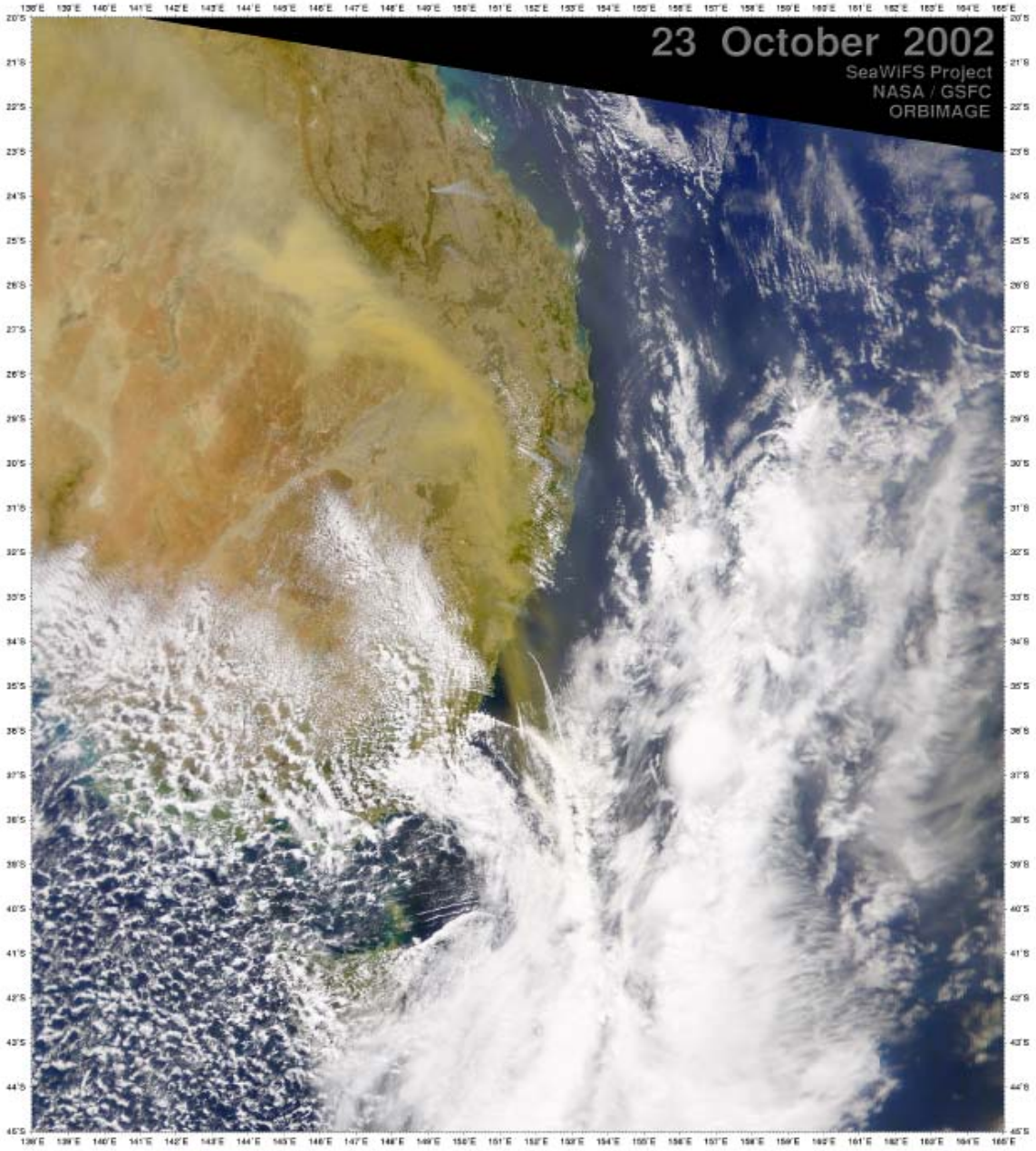


Figure 2

A vast dust storm swept across eastern Australia choking towns and cities including Sydney. Whipped up by winds blowing across drought-ravaged farmlands, the massive dust storm was the worst in about 30 years. Tens of millions of tonnes of valuable topsoil were stripped from bone-dry farms. 65 fires were burning across NSW with strong winds hampering fire fighters efforts to contain them.

http://seawifs.gsfc.nasa.gov/SEAWIFS/IMAGES/NEW/Australia/S2002296014347.L1A_HHOB.EasternAustraliaDustAndSmoke.png

The feedback loop mentioned above (Rosenfeld 2001) springs to mind, when drought enhancing lofting of dust, which suppresses precipitation and spreads drought.

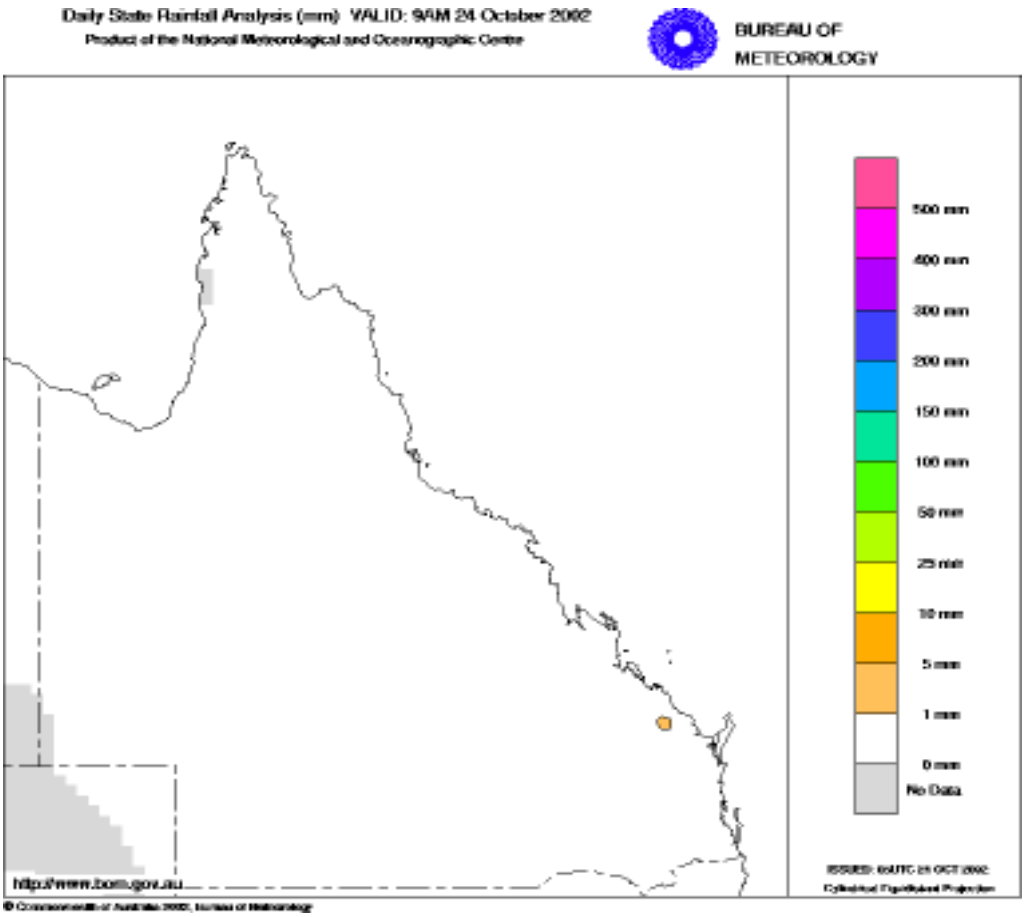


Figure 3

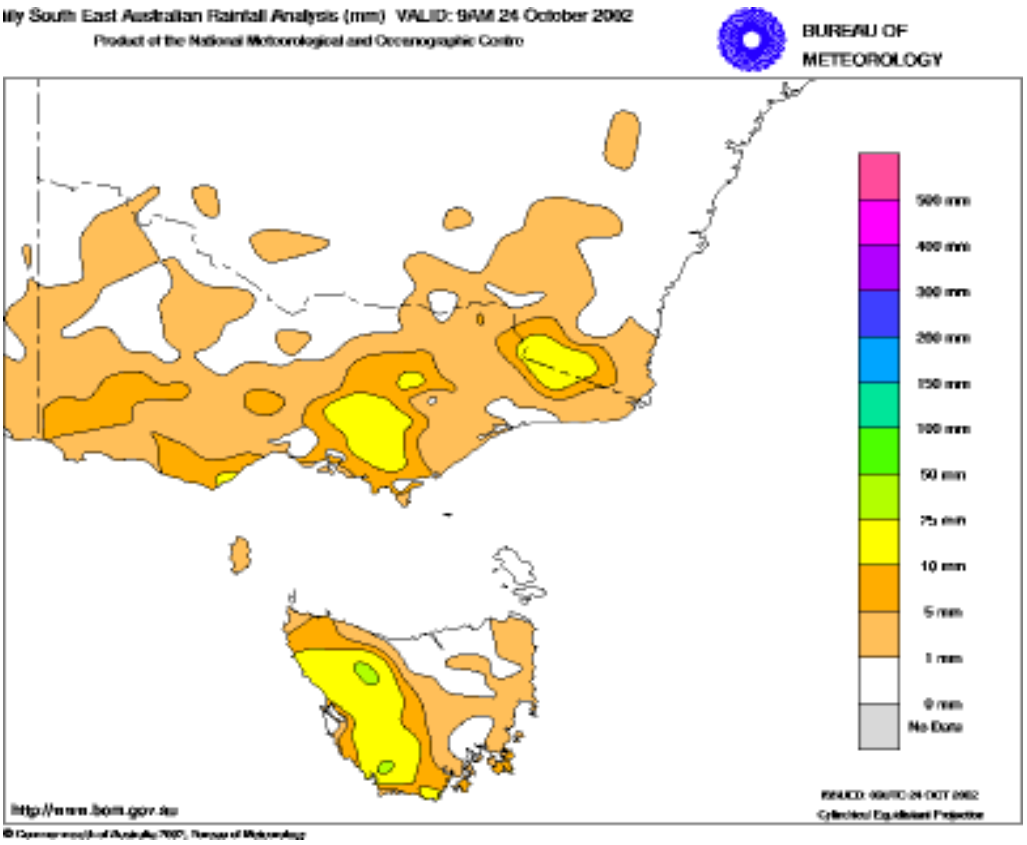


Figure 4

Vertical profiles of the precipitation echo intensities in non-polluted clouds and a complete lack of precipitation echo in polluted clouds as measured by the TRMM

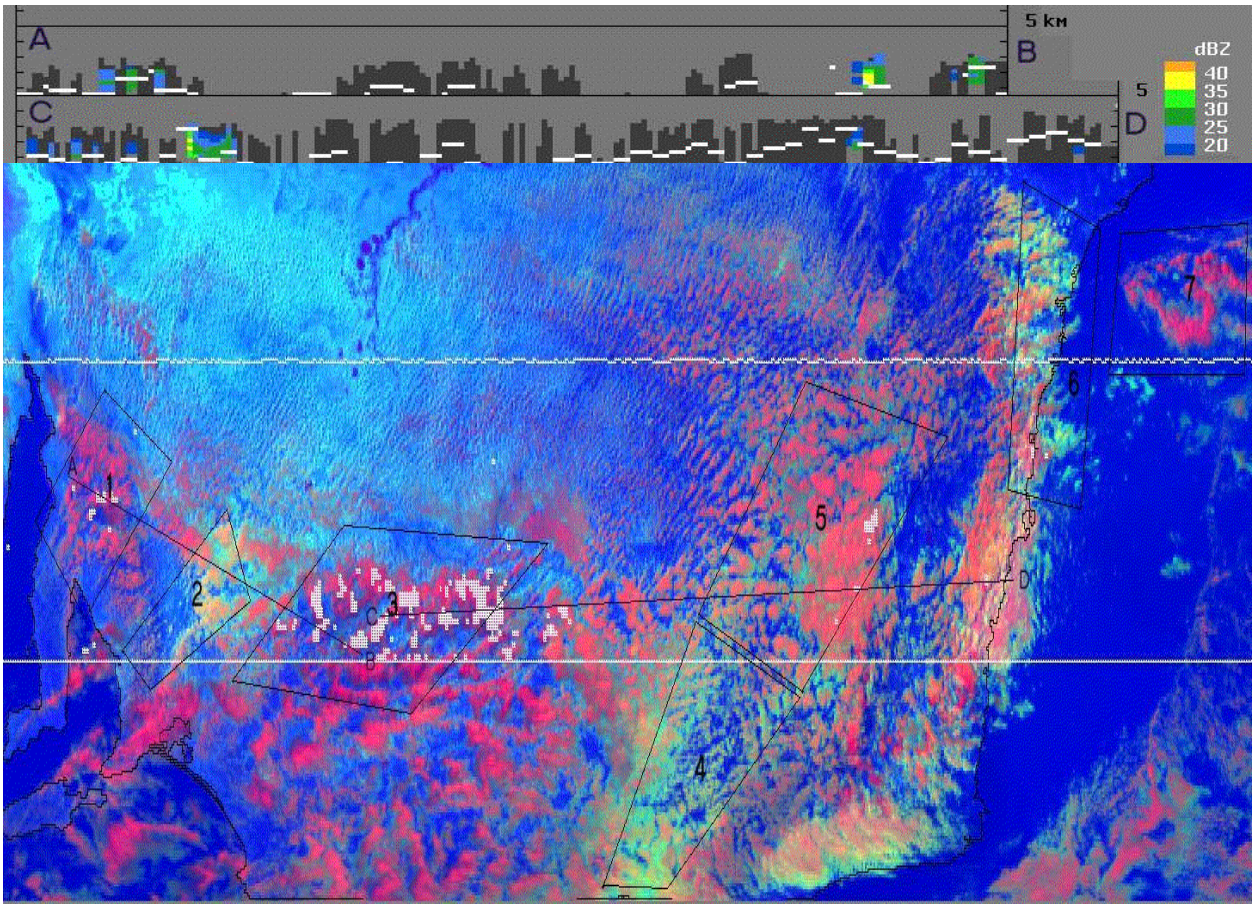


Figure 5 Rosenfeld Science 2000

The image shows pollution plumes in the clouds over southeastern Australia, from 21 Oct 1998, 04:44 UT. The two parallel lines delimit the PR swath of 230 km. The color of the clouds, where red represents clouds with large drops and yellow clouds with small drops.

The NASA TRMM satellite image and observation of south-eastern Australian clouds on 21 October 1998, as seen in **Figure 5,** clearly shows Precipitation Radar (PR) measurements of substantially reduced or completely suppressed precipitation in all polluted clouds, and rainfall in clouds over the areas not affected by air pollution.

Our company estimates an average annual rainfall and snowfall loss resulting in reduction of inflow into the reservoirs and rivers in the Victorian Alps and the Snowy Mountains of at least **5,000, 000 ML** and much more in other catchments of the Murray-Darling Basin, and in other catchments in Queensland, Victoria, South Australia and Western Australia.

4. The Victorian Government

The Victorian Department of Natural Resources and Environment (DNRE) was the first State Government Department to be notified of our work (June 1999).

In August 1999 we informed the Director of Science, Dr. Harry Blustein of the Victorian Environment Protection Authority (EPA) of our work and received support and assistance with access to scientific data concerning air pollution discharges. In September 1999, our company and EPA agreed to cooperate and to investigate the correlation between the historical increases in air pollution over Melbourne and the La Trobe Valley and the substantial reduction of natural rainfall in these areas over the last eight decades. Dr. Peter McAllister, Manager of Air Quality Studies, Victorian EPA conducted a study and modeling of air pollution emissions of PM2.5 and SO2 for Melbourne see **Table 1** and Victoria see **Table 2** for the seven decades from 1920 to 1990.

Our company purchased from the Bureau of Meteorology (BoM) monthly rainfall data for the same period. Prof. Rosenfeld analyzed the data and found a strong correlation between the increase in air pollution emissions and the reduction of rainfall and snowfall in different areas down wind of Melbourne and the La Trobe Valley (**Figure 6)**. Prof. Rosenfeld and Dr. McAllister intended to publish a paper entitled "Possible impacts of air pollution on rainfall in south-eastern Australia, based on historical rainfall records" in early 2000, but the Bureau of Meteorology (BoM) argued that the quality of their rainfall data, which they sold to our company together with quality reassurance report, was not suitable for such a study.

After accepting a BoM suggestion to use three pairs of better quality rain gauges to research the correlation between emissions of air pollution and rainfall, Prof. Rosenfeld found reductions of winter rainfall and snowfall between 20% to 40% in certain locations of the Victorian Alps and the Snowy Mountains **Figure 7**.

After prolonged consultations with BoM staff engaged in the supervision and collection of rain gauge data, and after thorough investigation of historical files in BoM archives for the three pairs of quality rain gauge records, we later discovered that winter snowfall for the first half of the 20th Century had been substantially underestimated in the Victorian Alps and the Snowy Mountains **(Attachment 2)** and because of that the substantial loss of winter snowfall in the latter part of the 20th Century had been masked. The historic data of air pollution discharges showed that the quantities, the chemical content and composition of air pollution discharges over Melbourne and the La Trobe Valley changed throughout the 20th Century.

2.5 Emissions for Melbourne (Mg/yr)

Year	Brown Coal	Brown coal briquettes	Black coal	Petrol Leaded	Petrol Unleaded	Lighting Kerosene	Power Kerosene	Heating oil	ADO	IDF	Fuel oil	Wood	Total
1920	0	0	126	62	0	3	3	0	653	3	273	3918	6962
1930	0	12	192	82	0	4	4	0	857	3	320	4597	8001
1940	0	39	77	95	0	4	4	0	1002	3	342	4910	8418
1950	0	48	36	116	0	5	5	0	1223	4	400	5737	9524
1960	0	170	322	452	0	6	6	0	4748	5	495	7105	15269
1970	0	128	29	570	0	5	2	21	2611	6	972	4798	11112
1980	0	99	1	594	0	4	0	20	4132	3	434	4274	11542
1990	0	59	0	383	319	1	0	3	4235	1	216	4505	11712

SO2 Emissions for Melbourne (Mg/yr)

Year	Brown Coal	Brown coal briquettes	Black coal	Petrol Leaded	Petrol Unleaded	Lighting Kerosene	Power Kerosene	Heating oil	ADO	IDF	Fuel oil	Total
1920	0	0	2360	70	0	16	15	0	567	63	10172	13262
1930	0	108	3607	91	0	19	18	0	743	74	11934	16594
1940	0	342	1442	107	0	20	19	0	869	79	12748	15626
1950	0	422	680	130	0	23	23	0	1061	92	14893	17325
1960	0	1481	616	506	0	29	28	0	4118	114	18446	25339
1970	0	1111	551	845	0	21	8	337	2995	155	36180	42204
1980	0	861	22	1164	0	17	2	319	4317	84	16157	22942
1990	0	513	0	993	260	4	0	41	3205	29	8057	13101

Table 1 PM2.5 and SO2 Emissions for Melbourne

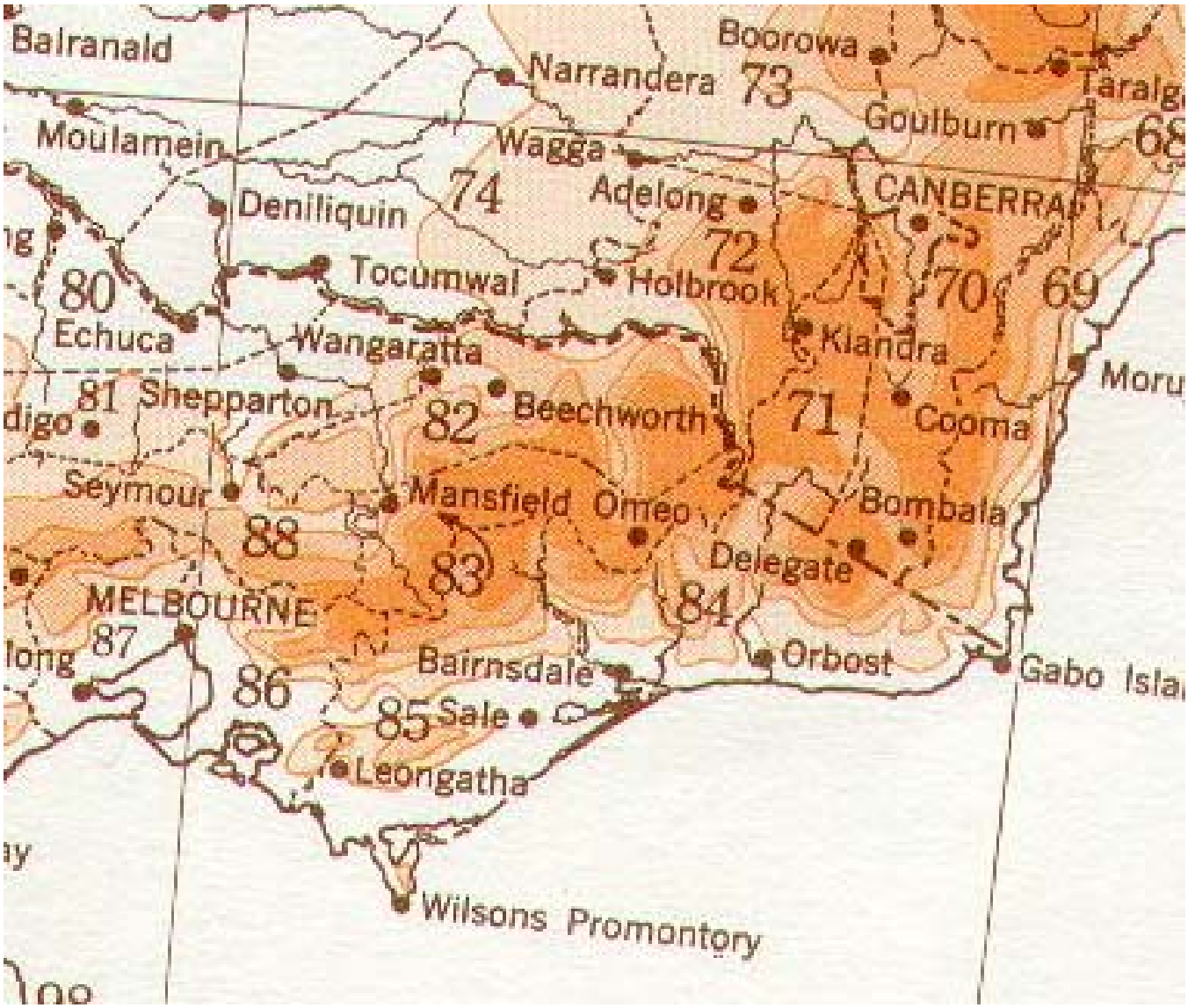
PM2.5 Emissions for Victoria (Mg/yr)

Year	Brown Coal	Brown coal briquettes	Black coal	Petrol Leaded	Petrol Unleaded	Lighting Kerosine	Power Kerosine	Heating oil	ADO	IDF	Fuel oil	Wood	Total
1920	18	0	140	78	0	4	4	0	1307	288	759		9414
1930	351	62	214	102	0	5	5	0	1713	338	890	5746	11356
1940	992	197	85	119	0	5	5	0	2004	361	951	6138	12797
1950	510	242	40	145	0	6	6	0	2446	421	1111	7171	14049
1960	1035	851	358	565	0	8	7	0	9496	522	1376	8881	25060
1970	262	639	33	713	0	6	2	26	5221	707	2699	5998	18276
1980	372	495	1	742	0	5	1	25	8264	383	1205	5343	18817
1990	572	295	0	479	399	1	0	3	8470	131	601	5631	18572

SO2 Emissions for Victoria (Mg/yr)

Year	Brown Coal	Brown coal briquettes	Black coal	Petrol Leaded	Petrol Unleaded	Lighting Kerosine	Power Kerosine	Heating oil	ADO	IDF	Fuel oil	Total
1920	152	0	2622	87	0	20	19	0	1133	6296	25429	35759
1930	3030	540	4008	114	0	24	23	0	1486	7387	29834	46446
1940	8556	1712	1602	134	0	25	24	0	1738	7891	31870	53551
1950	14654	2108	756	163	0	29	28	0	2121	9219	37233	66312
1960	29773	7403	684	633	0	36	35	0	8236	11419	46116	104335
1970	45258	5557	613	1057	0	26	9	422	5989	15471	90450	164852
1980	64206	4304	24	1455	0	21	3	399	8633	8388	40392	127825
1990	98772	2564	0	1241	325	5	0	52	6410	2855	20142	132365

Table 2 PM2.5 and SO2 Emissions for Victoria



Map of Meteorological Districts Victoria (BoM)

Figure 6

The Victorian Alps areas 82, 83, 84 and the Snowy Mountains areas 71,72 are the main catchments of the Murray-Darling Basin Commission

The total volume of air pollution (PM2.5 and SO2) increased until the 1970s. In 1972 the La Trobe Valley power stations introduced electrostatic precipitators and the amount of PM2.5 air pollution decreased **(Figure 8)** during 1970s by 27%. The introduction of natural gas in 1970s and 1980s, and substantial decrease in consumption of fuel oil during 1980s and 1990s, resulted in substantial decrease of SO2 emissions in Victoria. With the decrease in air pollution the level of precipitation in the Victorian Alps and the Snowy Mountains increased. However, since 1980s, with the (slow) increase in PM2.5 air pollution in Melbourne and the La Trobe Valley (7% per decade), rainfall and snowfall in the Victorian Alps and the Snowy Mountains has shown a corresponding decline.

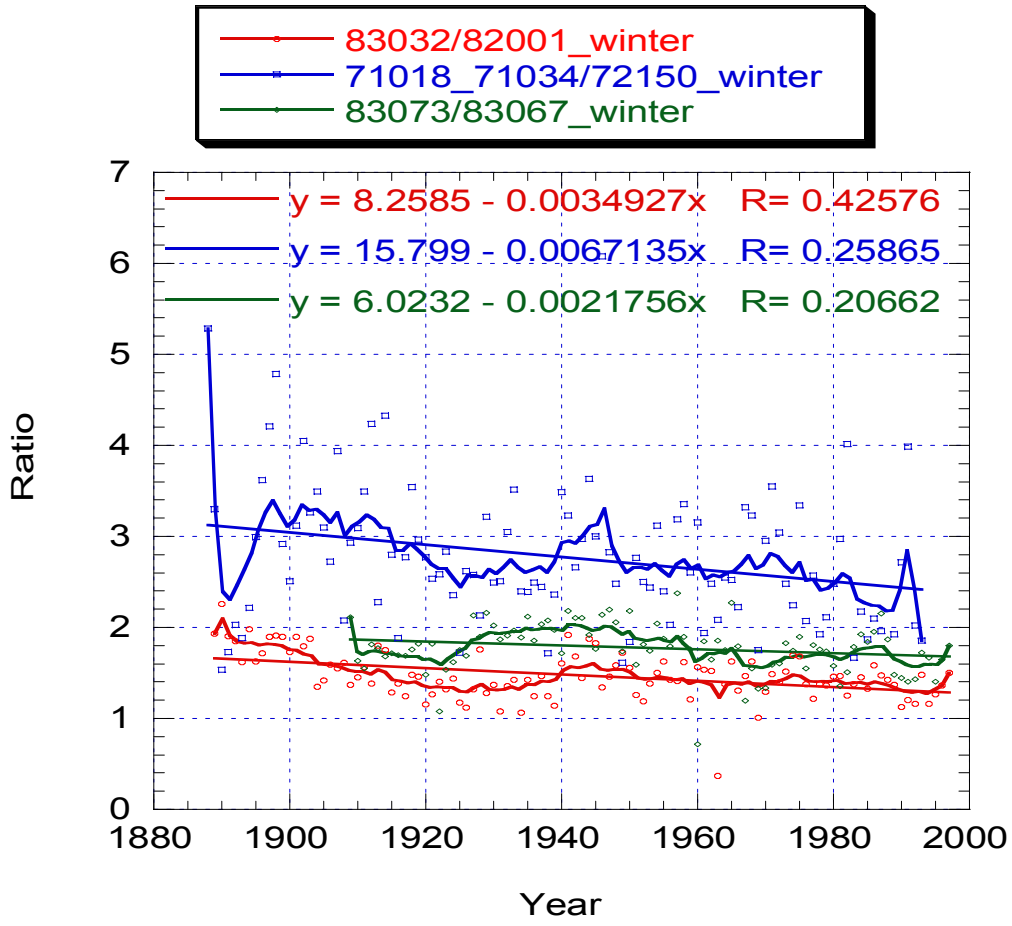


Figure 7

Rainfall trends indicating 20% to 40% reduction of orographic rainfall and snowfall in all three quality rain gauge pairs for the 20th Century.

The loss of rainfall and snowfall has been difficult to notice because of the altering background with increases of rainfall and snowfall in none-polluted areas due to global warming and the increase in evaporation over the ocean surface. The BoM does not have required number of rain gauges with quality historical rain gauge data in the most important catchments areas of the Victorian Alps and the Snowy Mountains (areas 71, 72, 82 83 and 84). Detailed study and analysis by Prof. Rosenfeld of data from three pairs of quality rain gauges conclusively revealed rainfall reductions of 20% to 40% during the winter seasons over the period of the 20th Century. According to physical evidence of the research and investigation by our company and by Prof. Rosenfeld, we believe, that urban and industrial air pollution from Melbourne and the La Trobe Valley **(Figure 5)** is a main cause of rainfall and snowfall reductions in the Victorian Alps and the Snowy Mountains. This analysis does not take in consideration a significant underestimation of winter snowfall in early half of the 20th Century as supported by the BoM Rain Gauge Inspector, Mr. Peter Dawson and therefore it is likely that the real loss is about 50%.

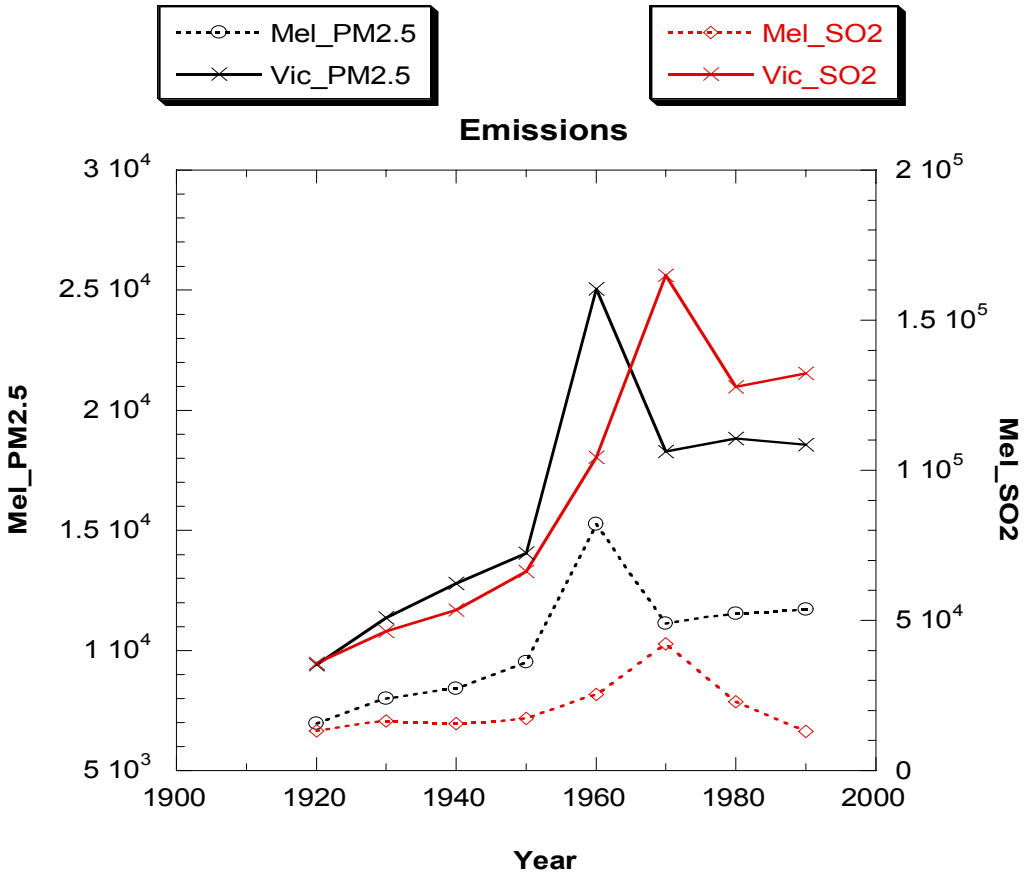


Figure 8

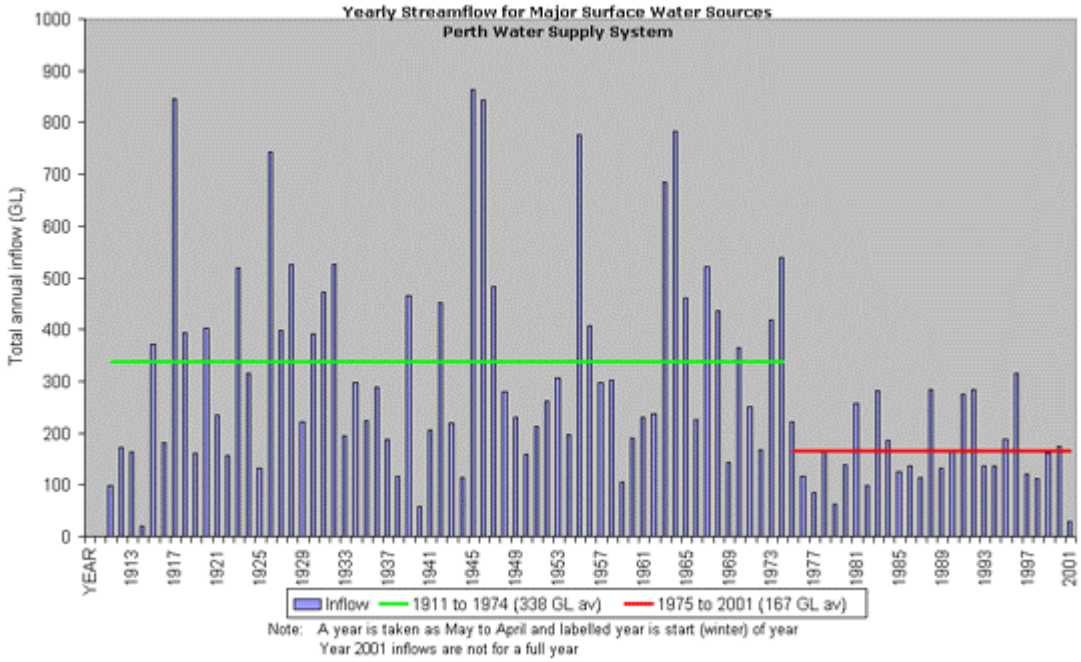
In 1972 the La Trobe Valley power stations introduced electrostatic precipitators and the amount of PM 2.5 air pollution decreased during 1970s by 27% and reduction in consumption of fuel oil reduced amount of SO2 over Victoria during 1980s by 23 %.

From our research, we agree:

a. with (Harasymiw B., J. McGee), 1993, **(11),** in the "Draft EIS Snowy Precipitation Enhancement Project" Snowy Mountains Hydro-Electric Authority (SMHEA) that precipitation during the latter half of the 20th Century is likely reduced in the Snowy Mountains by 52% during the winter season compared to the earlier part of 20th Century and, we believe, that that effect is continuing into the Victorian Alps.

b. that there has been more then 50% reductions of Inflow into the Perth catchments Dams since construction of Kwinana power station in 1972 – 1976, and rapid urban, industrial and mining developments and processing along the coast of WA between Bunbury and Perth **(Figure 9)**.

Yearly Streamflow for Major Surface Water Sources



Click on the graph to view a full-sized version

Yearly Inflow Comparison graph

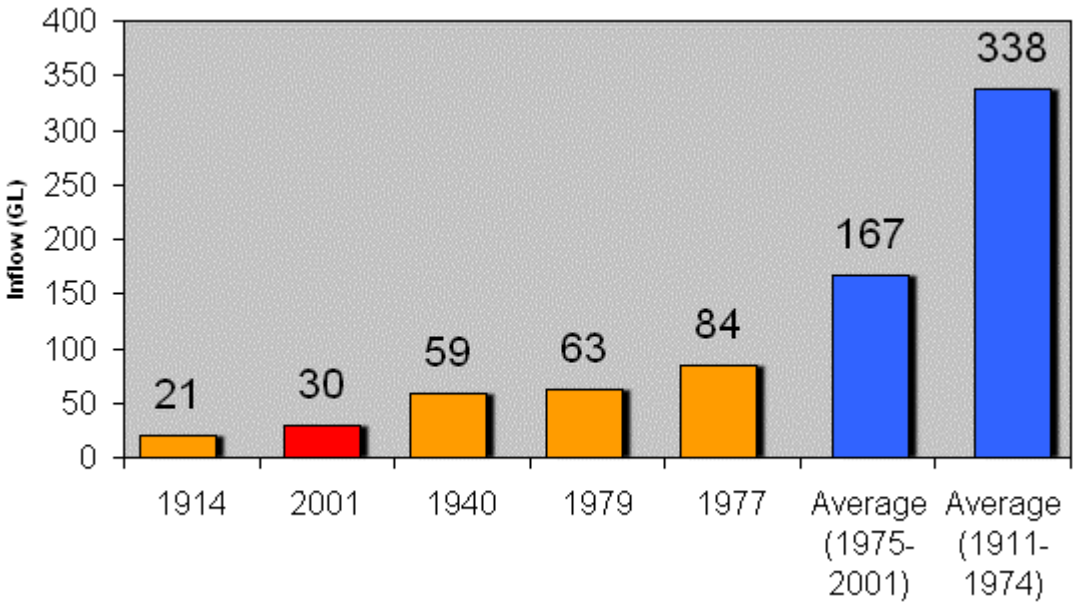


Figure 9

c. with Dr. Karl S. Kruszelnicki, Physicist from Sydney University and ABC Radio and TV Science Presenter **(Attachment 3)** that much of the most dangerous particulate atmospheric pollution, PM2.5 particulate matters comes from burning and smoke has significant effect on human health and environment.

On 28 February 2000, Dr. Peter McAllister, Manager of Air Quality Studies, Victorian EPA advised that he had been contacted by a representative of the CSIRO, who had demanded an end to scientific cooperation and research between the Victorian EPA and us. Dr. McAllister informed me that the reason for such demand was to prevent any Government financial support of our research and he further informed me that the CSIRO's representative was concerned that future funding for our research would be taken from the CSIRO's own budget allowance.

After five months of unfulfilled promises and unexplained delays in October 2000, Dr. McAllister informed me that funding of $45,000 for the initial stage of our collaborative research project had been denied by the Victorian Department of State and Regional Development (DSRD). That fact was later denied in December 2000 by Mr. Steven Nenan, Adviser to Mr. John Brumby, Treasurer.

We believe that the Victorian Government decision was influenced by the advice of certain officers of the CSIRO and the Bureau of Meteorology, who all denied any connection between air pollution and rainfall reduction and who, from about May 2000 had attempted to discredit the findings of our company and of Prof. Rosenfeld.

The Hon. Sherryl Garbutt, Minister for Environment and the Hon. Candy Broad, Minister for Energy and Resources received communication from us on 7 April 2000 and 10 July 2000 concerning the issues of rainfall and snowfall reduction in the Victorian Alps and the Snowy Mountains due to the effects of air pollution. Despite polite letters of reply from Sherryl Garbutt dated 22 May 2000 and 1 August 2000, a response from her Department of Environment (DNRE) and the Victorian EPA to our company's proposals to initiate collaborative research and operational activities to restore the loss of natural precipitation in the Victorian Alps and Gippsland was not forthcoming. After receiving advice from DNRE, the Minister for Energy and Resources, by letter dated 21 August 2000, rejected the link between air pollution and rainfall reduction and called the evidence of such impact "debatable".

Our latest observations clearly show that the impact of air pollution on rainfall is most obvious in the catchments of the Thomson Dam, which is located in close proximity to the La Trobe Valley power stations with reductions in amounts of natural rainfall there from individual cloud systems measured between 30% to 100%. Pollution often results in the complete shut-down of natural rainfall and snowfall precipitation processes for the entire south and southeastern parts of the Victorian Alps, Central and East Gippsland regions as shown, for instance on five rain maps of Victoria for 2002 **Figures 10, 11, 12, 13, 14**.

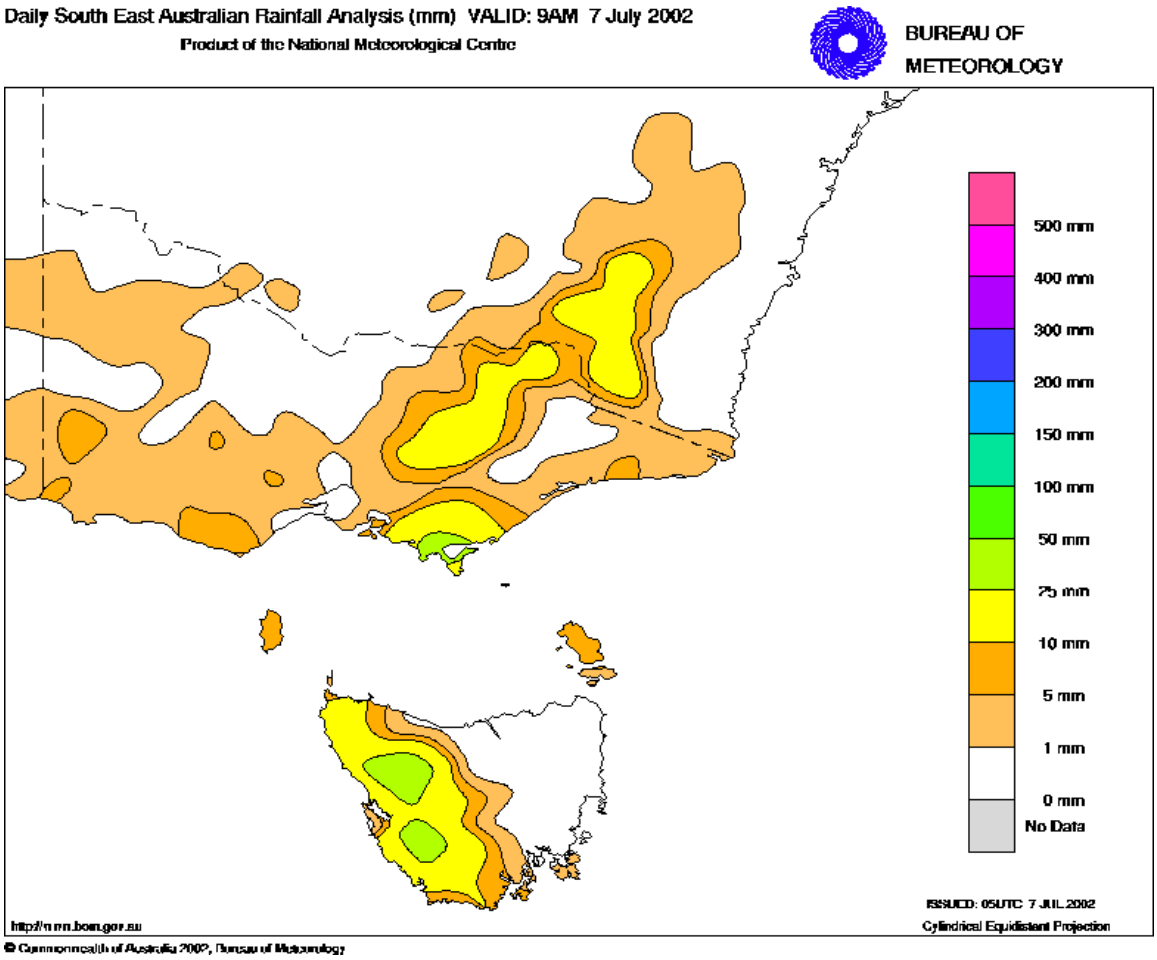


Figure 10

The Rain Map of south-eastern Australia for the period between 9.00 am 6 July 2002 to 9.00 am 7 July 2002 clearly measuring substantial reduction of rainfall and snowfall downwind from the La Trobe Valley power stations, Geelong and Melbourne.

The result of the constant reduction of rainfall and snowfall downwind of Melbourne, the La Trobe Valley, Adelaide, Port Pirie and Port Augusta has been detrimental to Victoria's rural economy and environment, so much that at the end of the wet season:

1. Eildon Lake is only 21% and Hume Dam only 20% full. Environmental water flow of the Goulburn River, irrigation water allocation to the Goulburn Valley Irrigation farmers is only 49%, and water tourism at Eildon Lake is substantially reduced. Goulburn-Murray Water trading water scheme reached $500 per ML for the week ending 24 October 2002.

2. The Wimmera-Mallee Water reservoirs are only 10% full and they have imposed severe water restrictions on the majority of townships and rural communities in the north-western Victoria and have refused any water allocation to irrigation farmers and land-fill dams other than for domestic consumption.

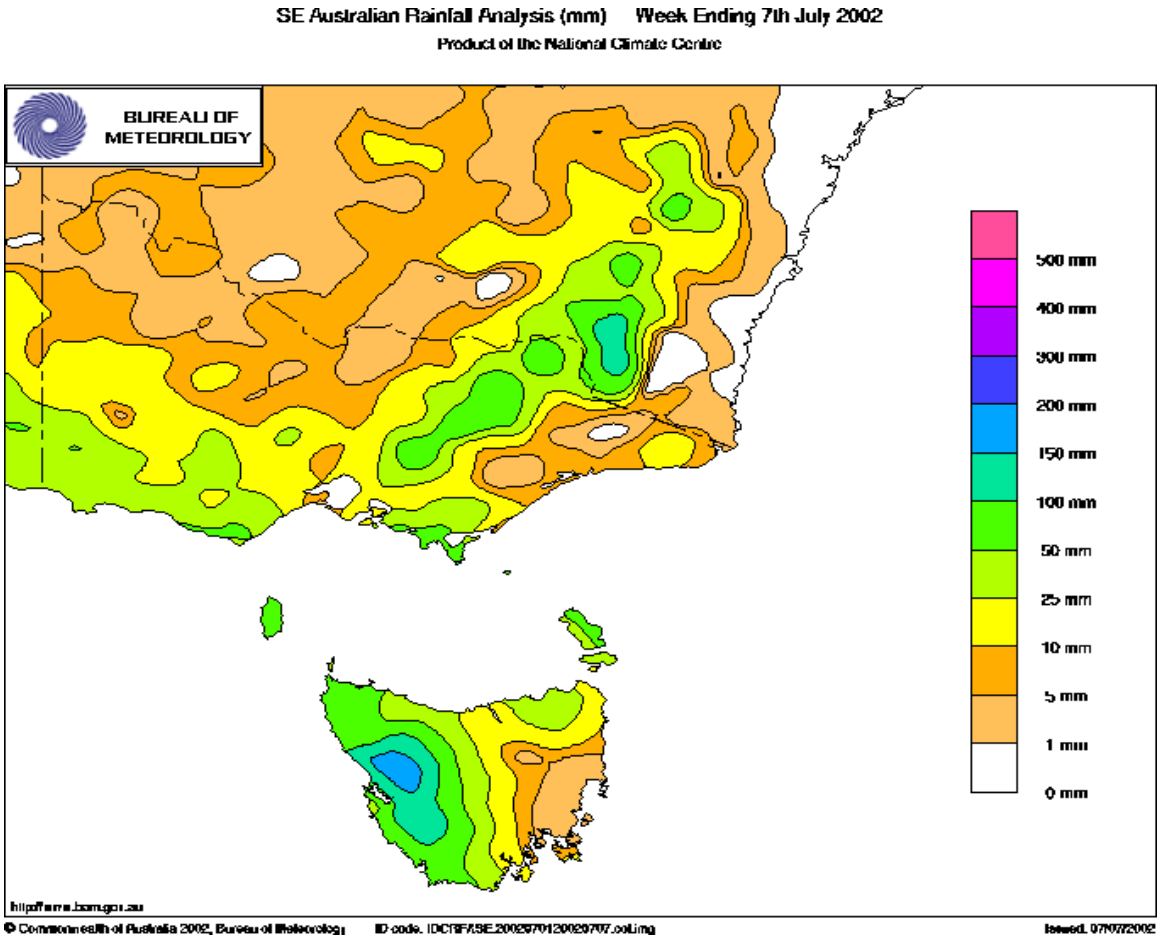


Figure 11

The Rain Map of south-eastern Australia for the period of 1 week ending 9.00 am 7 July 2002 clearly measuring substantial reduction of rainfall and snowfall downwind from the La Trobe Valley power stations, Geelong and Melbourne. Substantial rainfall is measured in unpolluted west coast of Tasmania and south-western Victoria.

3. The Melbourne Water's main reservoir, Thomson Dam is less then 48% full on 19 November 2002. Despite this Melbourne Water has continuously ignored our representations and submissions to rectify the problem. The Authority has imposed water restrictions for the entire Melbourne area from the 1 November 2002, and Melbourne joined 150 other Victorian townships and settlements that are suffering from severe water restrictions, some of them for the sixth successive year. The Melbourne Water Water Resources Strategy Committee, has been taking submissions for the last 12-month and after considering approximately 400 submissions, have decided to ignore all our representations and our comprehensive submission that the inflow into Melbourne Water reservoirs can be increased by at least 30% during an average year of rainfall enhancement.

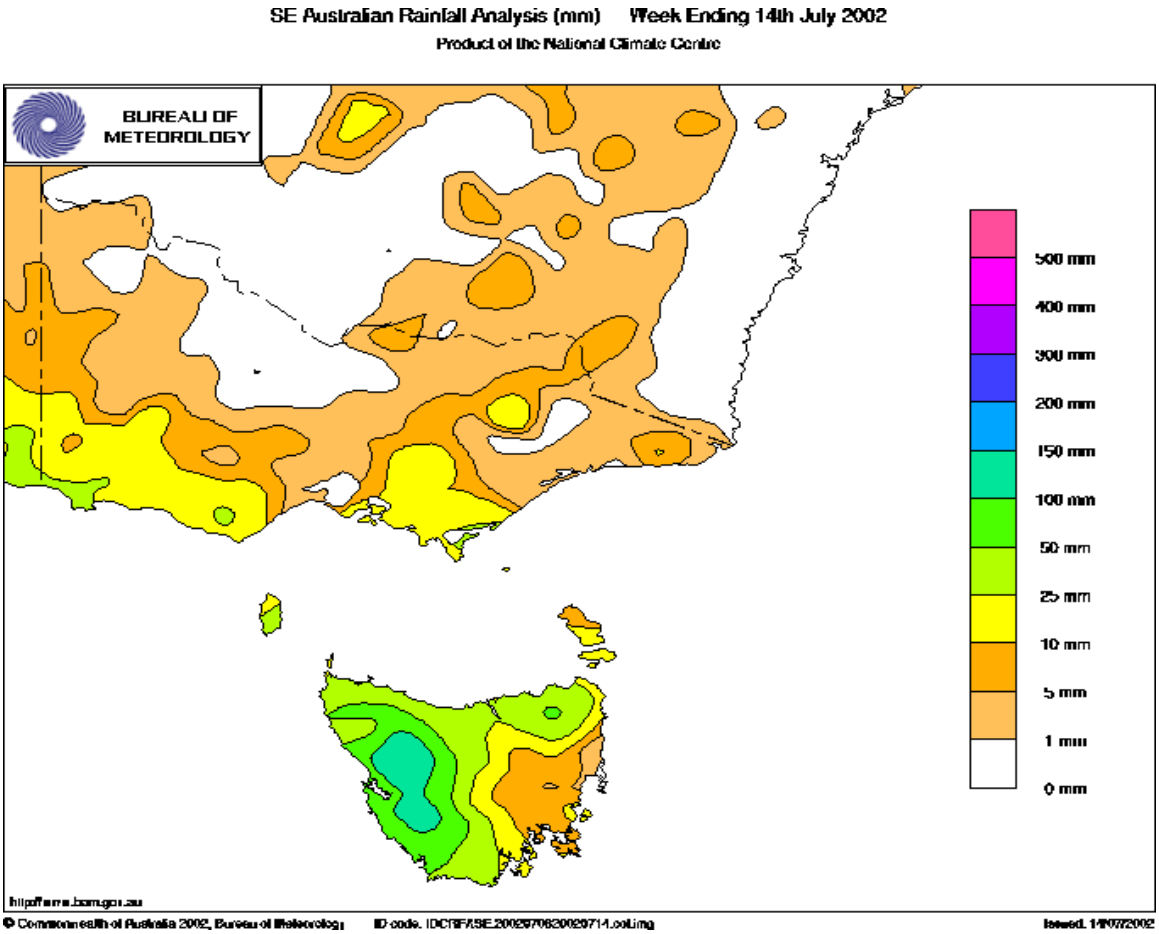


Figure 12

The Rain Map of south-eastern Australia for the period of 1 week ending 9.00 am 14 July 2002 clearly measuring substantial reduction of rainfall and snowfall downwind from the La Trobe Valley power stations, Geelong and Melbourne.

4. Southern Rural Water Authority has imposed water restrictions in respect to all rivers originating in the southern slops of the Victorian Alps.

5. The flow of the Snowy River has been severely reduced because the 160 km long catchment of the Snowy River between Lake Jindabyne and its delta is located directly down-wind of the air pollution of the La Trobe Valley power stations. Its natural rainfall and snowfall from the south-western direction, which is the main direction of rain bearing clouds during the winter season, reduced by 60% to 80%. Expenditure of the $375 Million allocated by the Victorian, NSW and Federal Governments to build new water infrastructure and to save water for the Snowy River, could be allocated for other purposes, if the natural rainfall and snowfall from winter clouds over the Snowy River catchment could be restored and enhanced.

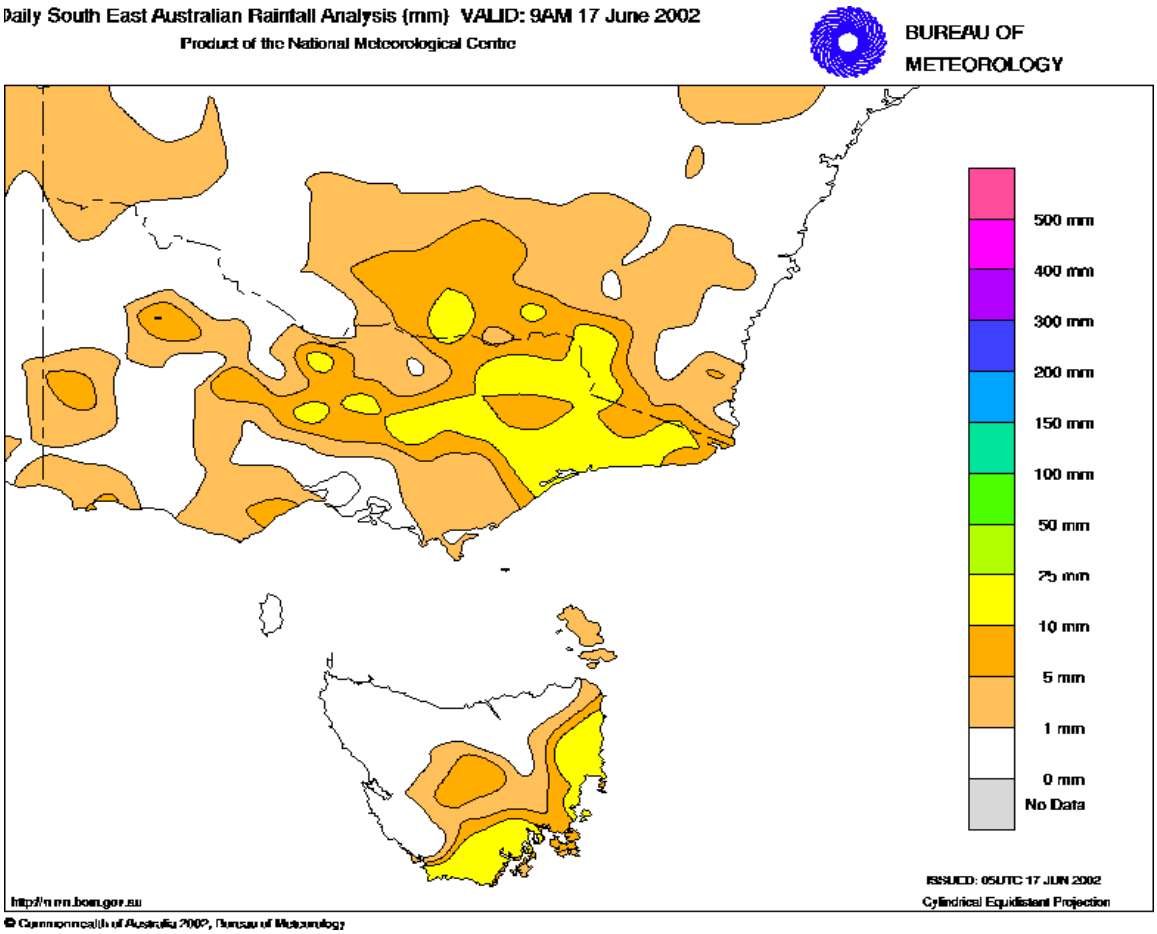


Figure 13

The Rain Map of southe-astern Australia for the period between 9.00 am 16 June 2002 and 9.00 am 17 June 2002 clearly measuring substantial reduction of rainfall and snowfall downwind from the La Trobe Valley power stations, Geelong, Melbourne and Hobart in Tasmania. The direction of rain bearing clouds during this day was unusual, south-eastern flow from the Tasman Sea.

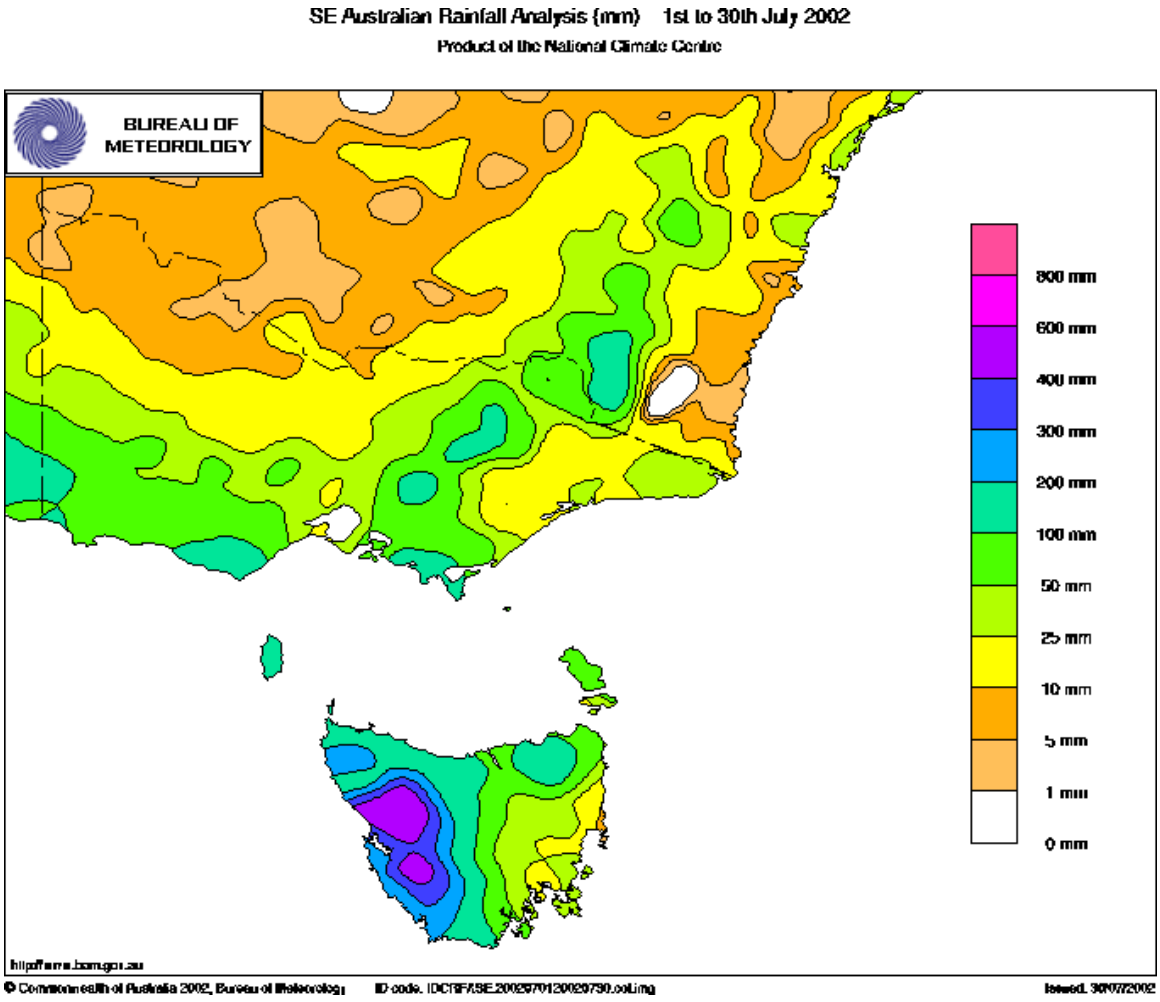


Figure 14

The Rain Map of south-eastern Australia for the period of 1 month ending 9.00 am 30 July 2002 clearly measuring substantial reduction of rainfall and snowfall downwind from the La Trobe Valley power stations, Geelong and Melbourne.

5. The Queensland Government

The Queensland Department of Natural Resources and Mines (DNRM) and the Hon. Minister, Mr. Rod Welford have been informed of our company's and Prof. Rosenfeld's findings in November 1999. In October 2000 we also informed Mr. Peter Noonan, Executive Director of SunWater Corporation and in December 2000 we conducted a seminar in Brisbane for staff of the DNRM and SunWater Corporation at which we fully explained Prof. Rosenfeld's work published in Science in March 2000, and the use of satellite images and measurements of clouds damaged by air pollution in the areas west of Brisbane and Gold Coast areas **(Figure 15)**. Mr. Peter Noonan Chief Executive Officer of SunWater Corporation has not responded to our letters and phone calls since January 2001.

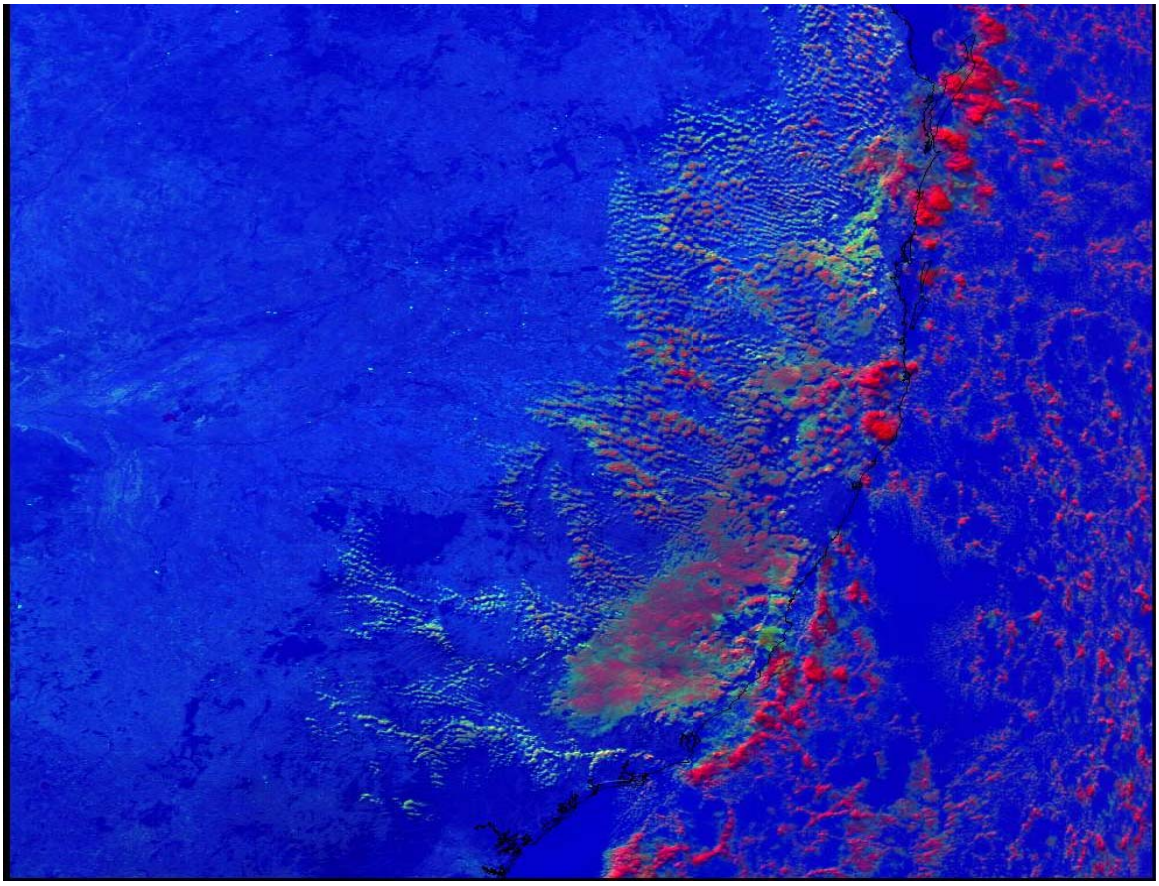


Figure 15

Satellite image of south-eastern Queensland and north-eastern NSW showing pollution from Brisbane and Gold Coast inhibiting rainfall and unpolluted clouds in north-eastern New South Wales producing substantial rainfall.

The new Minister for DNRM, Mr. Robinson, informed us that DNRM relies on the CSIRO and the Bureau of Meteorology for independent scientific assessment of research in this area. Officers of Queensland Environment Protection Agency on behalf of the Hon. Minister for Environment, Mr. Dean Wells, advised us that the Queensland EPA does not require air pollution monitoring services offered by our company and stated that weather modification to increase precipitation does not fall within the portfolio of the EPA.

Our company and Prof. Rosenfeld conducted a preliminary analysis of rain gauge data in three sections west of Bundaberg and in every case, it was found that rainfall trends for the 20th Century showed 25% reductions. Rainfall decreases in all polluted areas located west of Bundaberg were seen in all those rain-gauge stations established up to 200 km in land, whereas 200 km in-land and away from the trajectory of air pollution from Bundaberg, the rainfall trends of inspected rain gauges did not show reduced rainfall. The Rain Maps in **Figures 16, 17** show reduced rainfall west of urban and industrial pollution from Brisbane, Ipswich, Kingaroy, Biloela and Gladstone power stations.

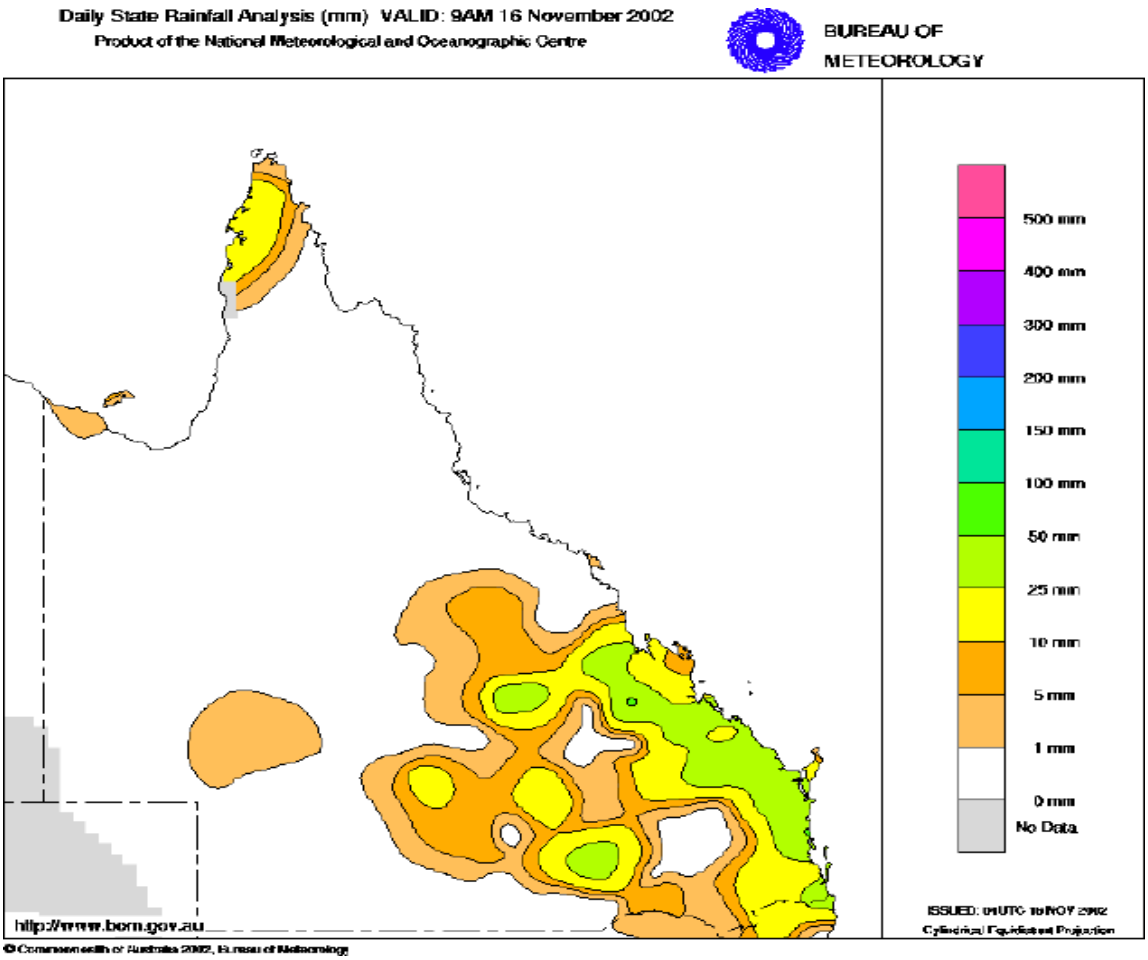


Figure 16

The Rain Map of Queensland for the period between 9.00 am 15 November 2002 and 9.00 am 16 November 2002 clearly measuring substantial reduction of rainfall downwind of Brisbane, Ipswich, Kingaroy, Biloela, Gladstone and Rochhampton power stations

During our most recent observations of rainfall in parts of Queensland, we identified, observed and measured that 3 of the most productive agricultural areas, up to 200 km west of the sources of urban and industrial air pollution, are affected by rainfall reduction accompanied by reduced water levels in the following dams:

1. West of Brisbane, Gold Coast urban air pollution and Ipswich power station, catchments of Atkinson Dam 3%, Lake Clarendon 0%, Bill Gunn Dam 2%, Moogerah Dam 3%, Leslie Dam 9%.

2. West of Bundaberg urban and industrial areas with air pollution emanating from Sugar Cain Refineries and Sugar Cain burnings catchments of Fred Haigh Dam 4% and Wuruma Dam 2%.

3. West of Gladstone power stations and aluminum smelters and Callide power stations in Biloela catchments of Cania Dam 4%, Callide Dam 8 %, Kroombit Dam 0%.

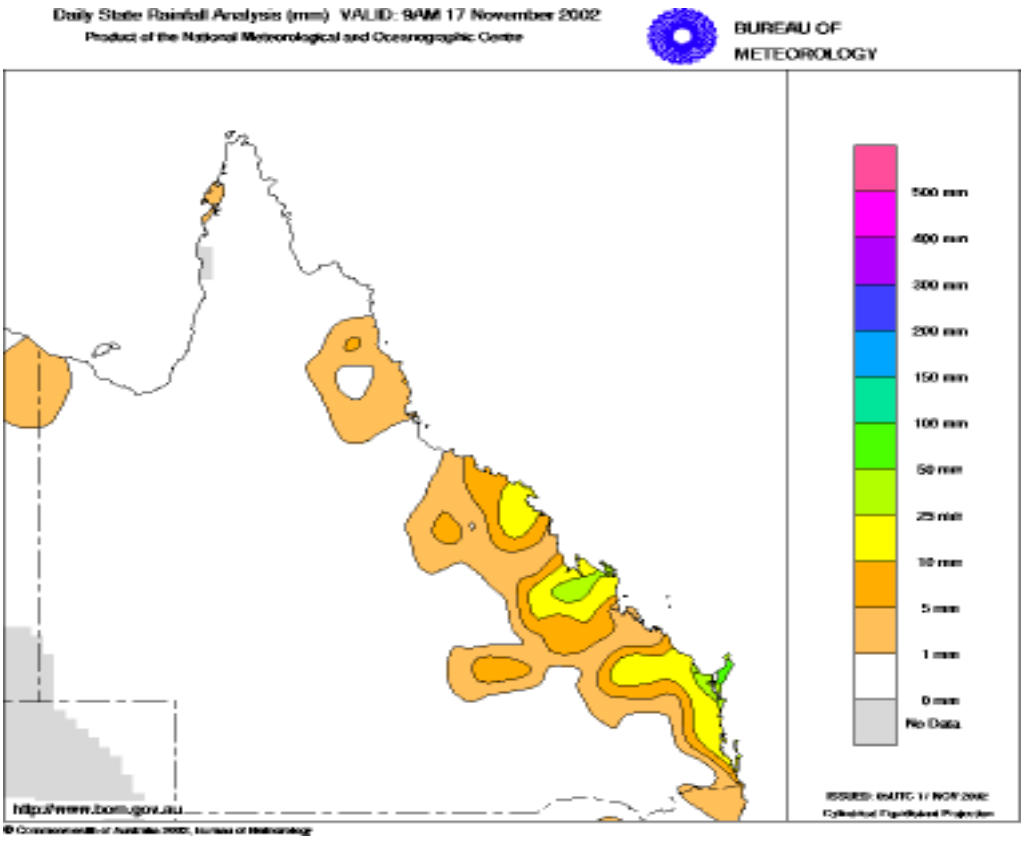


Figure 17

The Rain Map of Queensland for the period between 9.00 am 16 November 2002 and 9.00 am 17 November 2002 clearly measuring substantial reduction of rainfall downwind of Brisbane, the Ipswich, Kingaroy, Gladstone and Rochhampton power stations

6. Western Australian Government

The Western Australian Water Corporation (WAWC), Water and Rivers Commission and the Hon. Ministers for the Environment, Mrs. Cheryl Edwardes and Dr. Judy Edwards were informed of our company's and Prof. Rosenfeld research findings in October 1999, November 1999, January 2000 and in 2001 and 2002.

The WAWC was notified by us and has been aware, that since the construction of the Kwinana power station in 1972 (stage 1) and 1976 (stage 2) and of the associated power consuming industrial developments, Kwinana BP refinery, and numerous aluminum smelters, along the WA coast, that the average inflows into the catchments of the WAWC have been reduced by 50%, from 338 GL between 1911 to 1975 to 167 GL between 1975 to 2001 **(Figure 9).** At the end of the 2001/2002 summer season the Perth water catchments of WAWC had a mere 17% of its capacity, leading to severe water restrictions in Perth and an almost total crop failure in the southern wheatbelt east of WAWC water catchments and in the south-west of Western Australia as seen in **Figure 18**.

The inflow into the Perth catchments for 2001 was only 30 GL and even after the considerably wet winter season of 2002, the Perth catchments of WAWC are only 29% full.

Water Storage in Perth Dams

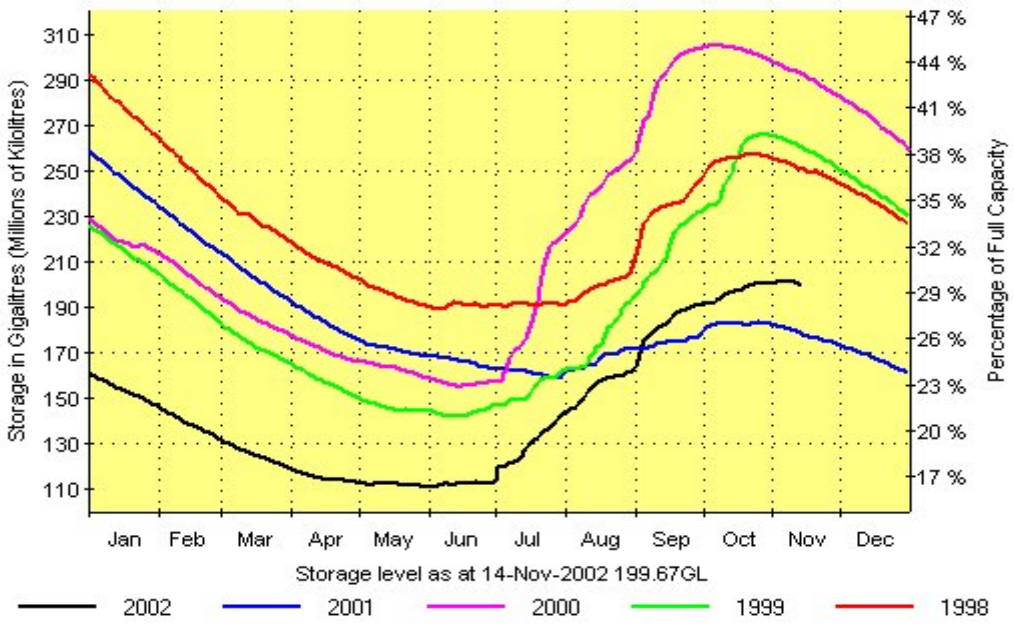


Figure 18

The graph above shows the total volume of water stored in the dams supplying water to the Integrated Water Supply System of Perth catchments.

The WAWC and WA Government Ministers continue to rely on the speculative findings of the Indian Ocean Climate Initiative (IOCI) research program, in effect managed by the CSIRO and by the Bureau of Meteorology, who have been unable to produce any plausible explanation and scientific reasons for the 50% reduction of the average annual inflows into the Perth catchments since 1975.

The research findings of IOCI that "there has been an abrupt shift and clearly defined trend in the frequency of the synoptic patterns that influence rainfall occurrence in the south-west of Western Australia" is not plausible, if regard is had to the fact that all other similar and unpolluted coastal areas on mainland Australia and which are subject to the same synoptic patterns had experienced an increase in winter precipitation of 5% to 18% for the period of 1910–1995 and which has been attributed to global warming, increase in ocean temperature and evaporation levels (Suppiah, Hennessy 1999),**(12)** Aust. Met. Mag. **Figure 19**.

Australian rainfall changes, 1910-1995

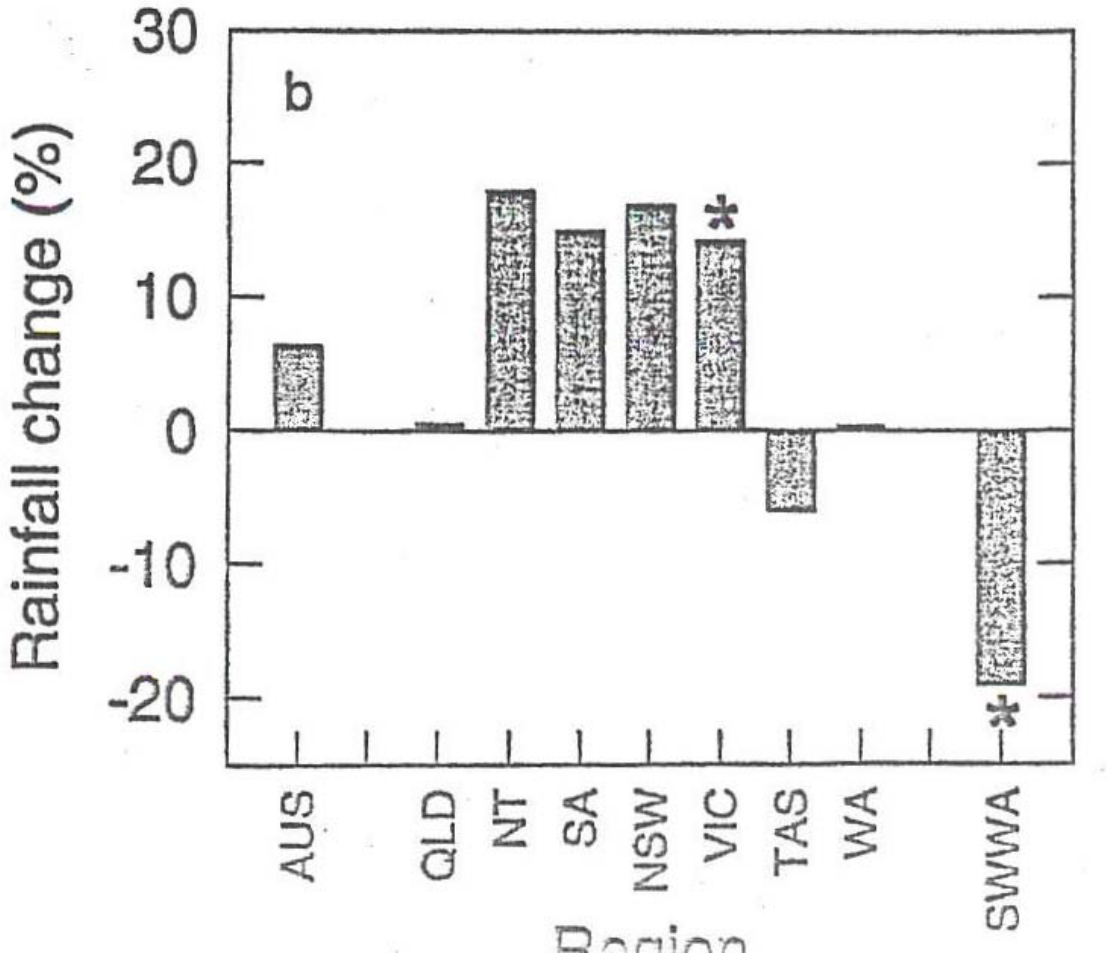


Figure 19

Further IOCI findings that "long climate model simulations" must be considered unreliable if they do not take into account factors such as localized effects of climate changes caused by urban and industrial air pollution and changing microphysics of the clouds. The proposed theory of the IOCI "natural climate variability" does not explain the sudden reductions in precipitation and inflow from 1975 and onward. Comparison with the preceding trends from 1911 to 1975 show similar climatic variations as in the period after 1975. The above average rainfall and inflows in Perth catchments have occurred 12 times in the 30 years, between 1972 and 2002, and also occurred 12 times in the 30 years from 1942 to 1972, and 12 times in the period from 1912 to 1942. What has occurred in the latter period is a significant increase in air pollution, which coincides with the building of the Kwinana power station in 1972 (stage 1) and 1976 (stage 2). Our company's findings show the correlation between the increase in air pollution and changes in the micro-physical structures of the clouds and the decrease in rainfall.

The Rain Map of WA in **Figure 20** shows rainfall reduction down wind of the polluted coast between Perth, Kwinana and Bunbury.

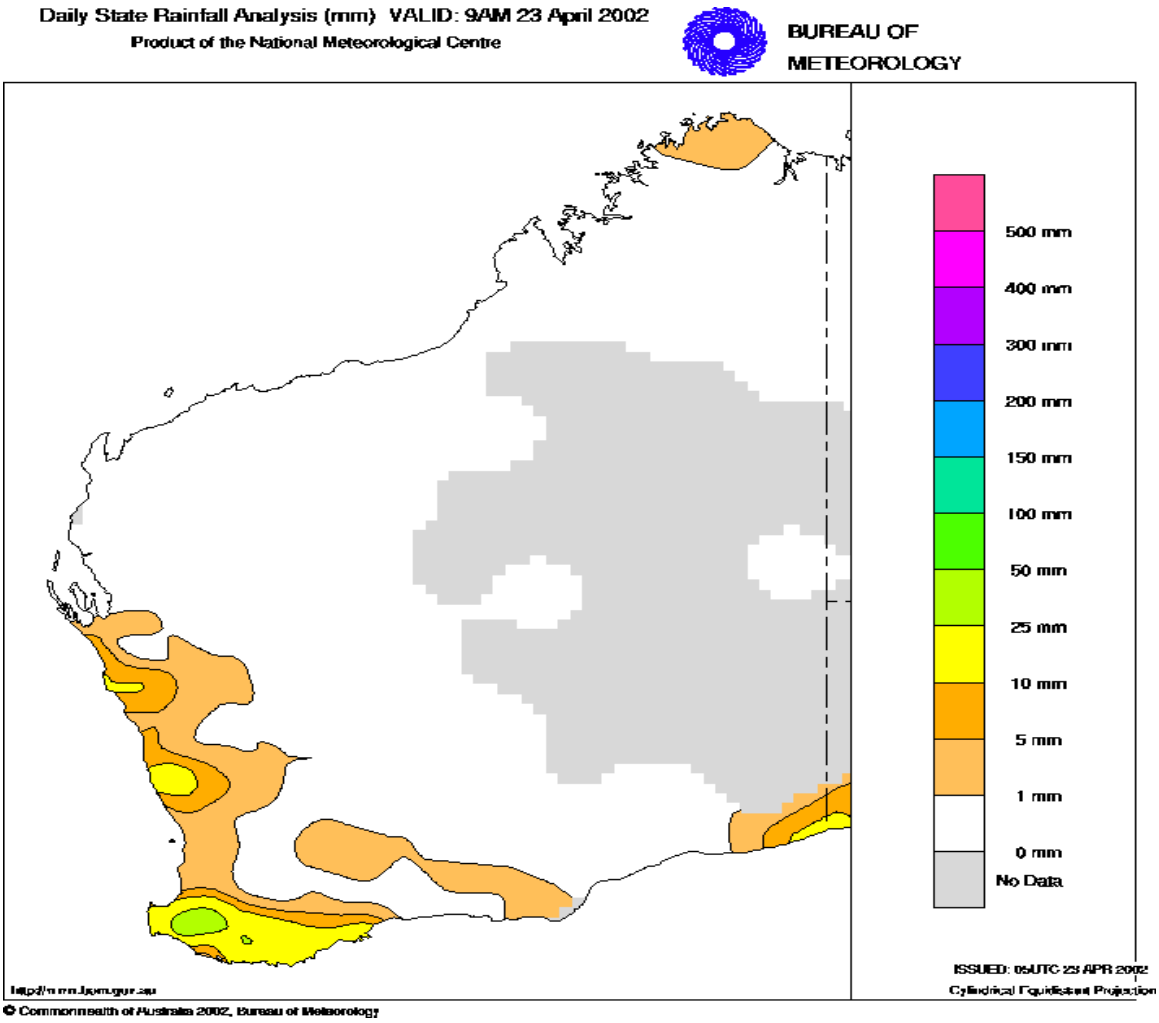


Figure 20

We suggested to Dr. Jim Gill, Chief Executive Officer of the Western Australian Water Corporation that his organization should take a fresh look at all available research including the latest developments in atmospheric science and the successful application of those developments by Prof. Rosenfeld in Texas, Thailand, Canada, Argentina, Israel and other countries. Such applications could offer substantial economic and environmental benefits to the WCWA and to the Western Australian Government. Regrettably, Dr. Gill referred our findings to the IOCI, which is managed by the CSIRO and by the BoM, and which have continually opposed the adoption of our research and proposals to the WA Government.

7. The New South Wales Government

The New South Wales (NSW) Department of Land and Water, Parks and Wildlife, NSW EPA, NSW Agriculture and their respective Ministers for the Environment, the Hon. Bob Debus, Agriculture, the Hon. Richard Amery and Premier, the Hon. Bob Carr and the Treasury officials were notified of our company's and Prof. Rosenfeld's scientific findings in 1999, 2000, 2001 and 2002. NSW is in the midst of a severe drought and fire hazard conditions. NSW Government Department of Land Water has decreased levels of environmental flow to the majority of NSW Rivers, which will have serious adverse environmental and economic impact on the entire Murray-Darling Basin.

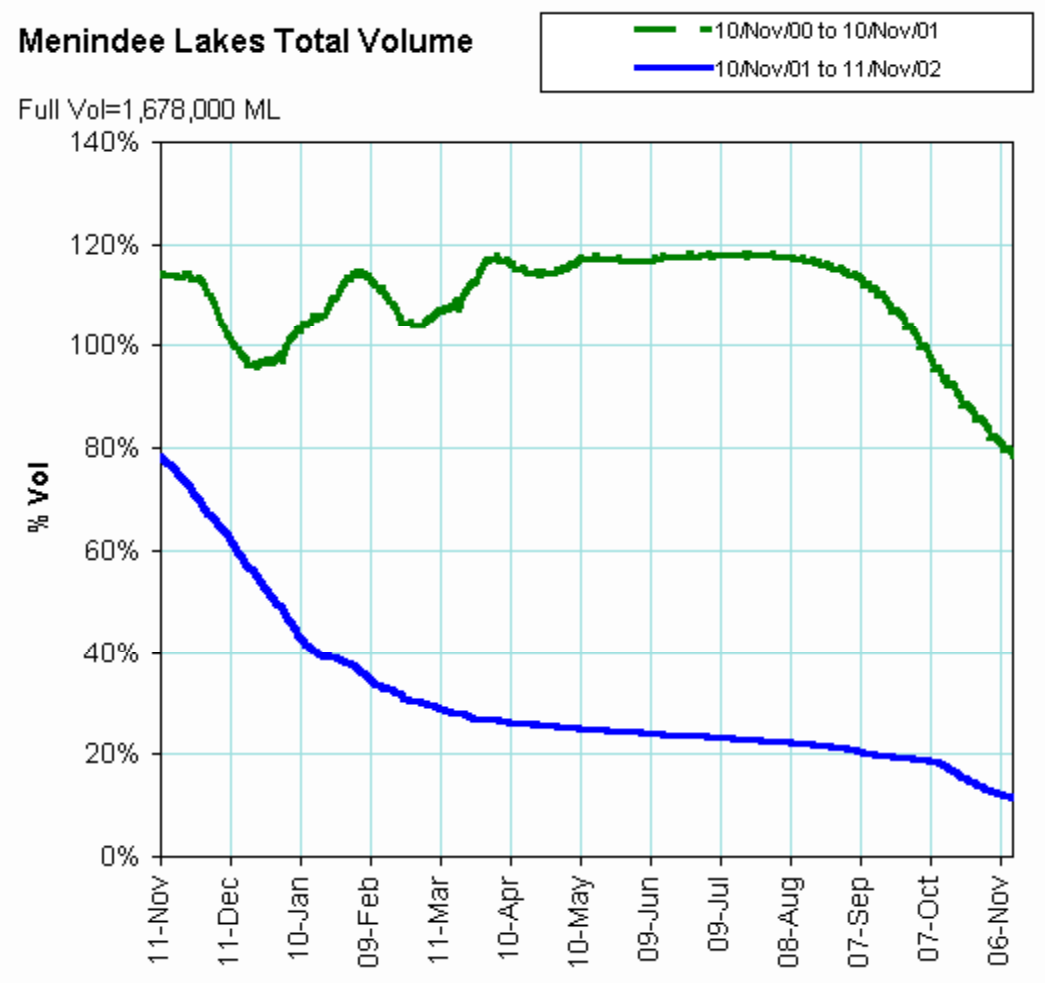


Figure 21

At the end of wet season, the flow of the Darling River was substantially reduced and Menindee Lake is only 13% full (**Figure 21)**, imposing severe water restrictions on the New South Wales and South Australian farmers.

Our company believes that the NSW Government would profit by allocating funds to introduce projects to restore natural rainfall in NSW through scientifically proven rain harvesting programs. The cost of these programs will be only a small fraction of the economic expense and loss presently being incurred by the NSW Government in relation to the drought problem.

8. The Murray-Darling Basin Commission.

The Murray-Darling Basin Commission (MDBC) was specifically established to address the environmental, economic and inter government communication issues associated with the management of land and water of the Murray-Darling Basin, which includes the most populated and productive areas of Queensland, New South Wales, Victoria and South Australia. In July 1999, Mr. Don Blackmore, the Chief Executive Officer of MDBC was approached by our company with a view to examining and supporting our research and operations. After meeting with Mr. Aron Gingis on 26 August 1999 and on 18 May 2000 at Melbourne, he was given copies of scientific publications. The significance of our company's and Prof. Rosenfeld findings to the operation and management of the Murray-Darling Basin Commission was fully explained to him.

Unfortunately, Mr. Blackmore did not appreciate the importance of what was presented to him by us and he failed to meet with Prof. Rosenfeld during his visit to the Office of the Hon. Nick Minchin, Minister for Industry, Science and Resources in April 2001. In August 2000, Mr. Blackmore stated in his e-mail: "I am going to wait until I see how the Victorian project unfolds before I take any proposal to the Commission". While Mr. Blackmore waits Australia's water situation continues to deteriorate.

9. The Bureau of Meteorology Research Center and C.S.I.R.O.

Prof. Rosenfeld informed Dr. Mike Manton, Chief of the Bureau of Meteorology Research Center (BMRC) of his scientific findings concerning the detrimental impact of air pollution on precipitation in Australia and he provided satellite images showing and supporting his findings. Dr. Manton did not reply for about three months and in about July 1999 he advised Prof. Rosenfeld that BMRC does not currently have the capacity to follow his interesting ideas, as the work was a little outside the main focus of BMRC.

When Aron Gingis organized meetings with BMRC officers to discuss our work and our findings, BMRC officers revealed that less then 10% of the Bureau of Meteorology rain gauges had quality historical rain gauge data. Important catchment areas of the Victorian Alps and the Snowy Mountains did not have any quality rain gauge measurements for the first half of the 20th Century. It was likely that the historical data available to BMRC for that period substantially underestimates rainfall and snowfall quantity for the first half of the century and underestimates the loss of rainfall and snowfall caused by air pollution in the latter part of 20th Century.

After several months of scientific discussions concerning rainfall and snowfall in the south-eastern Australia, and rainfall reductions due to air pollution, and after thorough investigation of historical rain gauge files, it became apparent that Prof. Rosenfeld and our company had serious disagreements with the BMRC officers. These disagreements concerned climatology and the origin and trajectory of the rain-bearing clouds affecting south-eastern Australia, and the effect on rainfall in the Victorian Alps and the Snowy Mountains caused by air pollution.

Dr. Mike Manton, Chief of the Bureau of Meteorology Research Centre rejected our findings in private and publicly, on radio and at public seminars and at meetings presented by Prof. Rosenfeld and by Mr. Gingis, and he has written several reports to the Minister for the Environment and to the High Level Steering Group on Water (HLSG) for the Standing Committee on Agriculture and Resource Management (SCARM) denying any connection between pollution and the reduction of rainfall and snowfall in Australia.

A transcript of Dr. Manton ABC interview concerning his comments on Prof. Rosenfeld's science is seen as **Attachment 4**. In his comments during radio and public seminars, Dr. Manton often referred to more then 5,000 rain gauges around Australia and to about 300 of them as "High Quality Rainfall Stations" (HQRS), and that he looked at some of them "down-wind" from Melbourne and they did not show any rainfall reductions.

He neglected to explain that not one of those mentioned (HQRS) is located in the most important catchment areas of the Victorian Alps and the Snowy Mountains, where, we believe, we have identified reductions of rainfall and snowfall due to urban and industrial air pollution from Melbourne and from the La Trobe Valley power stations. Map of Eastern Victorian High Quality Rainfall Stations is shown in **Figures 22**.

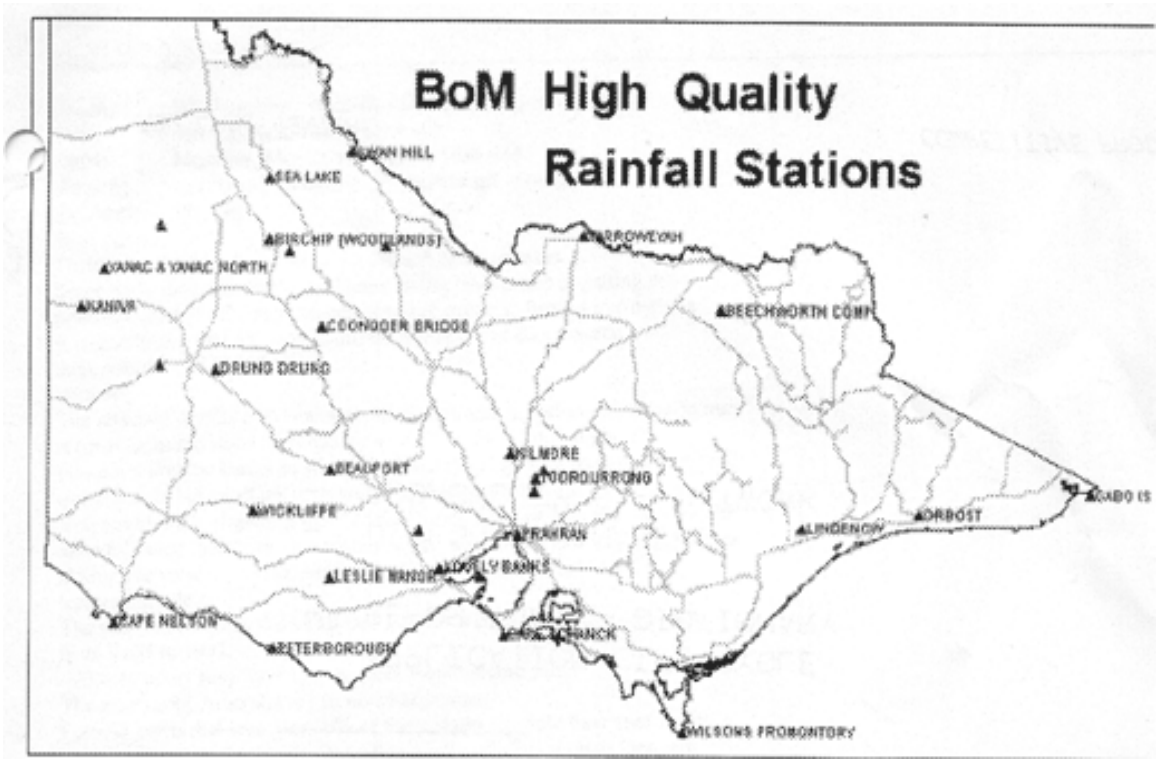


Figure 22

Map of East Victorian High Quality Rainfall Stations " down-wind" from Melbourne (Wilsons Promontory, Lindenow, Orbost and Gabo Island according to Dr. Manton)

Dr. Brian Ryan, Senior Principal Research Scientist of the CSIRO Atmospheric Research Division was informed of our findings in about September 1999. His reaction to Mr. Gingis's presentation was to the effect that it was not new and that it was 20-years old technology and that the CSIRO was capable of achieving the same results. Dr. Greg Ayers, Aerosol Program Leader of the CSIRO Atmospheric Research Division appeared, without invitation, at a seminar at Monash University, arranged and addressed by Mr. Gingis to the staff of Monash University, DNRE and Victorian EPA on 9 May 2000. Since that time, Drs. Ayers and Ryan have attended several presentations and seminars conducted by Mr. Gingis and by Prof. Rosenfeld, and they disputed and denied the validity of Prof. Rosenfeld's findings, but did not produce any alternative scientific publications to support their non-acceptance of the causal relationship between air pollution and rainfall depletion in certain parts of Australia.

Transcripts of Drs. Ayers and Ryan speeches at Sale seminar presented by Aron Gingis on 16 May 2001. **(Attachments 5 and 6)**

However, in August 2002, CSIRO researcher, Dr. Leon Rotstayn, who was one of those who had denied the validity of Prof. Rosenfeld's research findings, accepted the link between air pollution and rainfall reduction. In an article in which he admitted that air pollution had contributed to the catastrophic drought in the Sahel desert in north Africa and in which he referred to small particles and sulfate aerosols, which cause rainfall reduction of between 20-49%. The findings are similar to our findings in respect to south-eastern Australia, (Rotstayn and Lohmann) **(13).**

Over the last three years the response by Dr. Manton, BMRC and by Drs. Ayers and Ryan, of the CSIRO to our scientific findings and presentations has been hostile and, we believe, misguided and designed to discredit the scientific work of our company and Prof. Rosenfeld. We believe that the BMRC and the CSIRO opposition to our presentation is based, in part, on personality issues, and on faulty premises, and that they either fail to comprehend the cause of the loss of natural precipitation due to air pollution, or choose not to acknowledge the connection.

We believe that the BMRC and the CSIRO, whether out of ignorance or for other undisclosed reasons, have denied and continue to deny the benefits of the latest and best scientific developments presently available to restore and enhance precipitation in Australia by the control and monitoring of air pollution and by restoring and enhancing natural rainfall. Their stance cannot be justified when account is taken of current scientific findings, research, and experience in the field.

The response of the Victorian, Queensland, WA, NSW and Commonwealth Governments has been disappointing, in no small measure due to the opposition of the CSIRO and the BoM, which appear to regard our work as a threat or insult to their own activities. We consider their attitude to be misconstrued, unjustified and, we believe, antithetical to Australia's economic and environmental interests. Their opposition has to date helped to ensure that our representations to various organizations and Governments have been unsuccessful.

10. The Snowy Mountains Hydro-electric Authority

In 1993, the Snowy Mountains Hydro-Electric Authority (SMHEA) commissioned an Environmental Impact Statement (EIS) to evaluate the feasibility of increasing snow precipitation over the Snowy Mountains area. The 1993 EIS was prepared by a team of independent consultants including Dr. Joseph Warburton, Director, Desert Research Institute, Nevada USA, Dr. John Lease, Director, Water Augmentation Group, and Dr. Arlin Super, US Government Bureau of Reclamation. They concluded that cloud seeding in the catchment of the SMHEA is an economically attractive option for increasing precipitation (Harasymiw and McGee 1993)**(11)**.

Figure 23

"Windy Creek, Snowy Mountains, Checking iced-up transmission towers Hydrology Station 1959". Evidence that ample supercooled cloud water is available for cloud seeding.

However, following advice given to Government by Dr. Brian Ryan, Senior Principal Research Scientist, CSIRO, the project was disallowed. We are unaware of any scientific reasons having been advanced to support the CSIRO and the BoM stance.

The Snowy Mountains approximately 2,500 km2 of mountain country are the highest mountains in Australia. They offer the best topographically elevated catchment of the Murray-Darling Basin. We believe that annual loss of snow precipitation due to air pollution in the Snowy Mountains amounts to 1,000,000 ML. Evidence of the magnitude of this loss is obvious by observation of the huge amount of supercool water in clouds that are passing through the area during the winter season without being converted into precipitation. **Figure 23**

You will be aware of the importance which the Victorian, NSW and Commonwealth Governments attach to the successful resolution of the Corporatisation of the SMHEA and to the need to find new sources of water for the proposed increase in the levels of the environmental flow of the Snowy River, and the financial, political and environmental consequences to the Murray-Darling Basin management, and you are no doubt aware of the complexities of those issues.

For the reasons presented in our submission to the Department of Industry, Science and Resources (DISR) on the Corporatisation of the Snowy Mountains Hydro-Electric Authority (SMHEA) dated 26 July 2000 **(14)**, the Department of Industry Science and Resources, Electricity Reform Branch in the Supplementary EIS on the Corporatisation of the SMHEA **(15)**, recommended, in September 2000 that the Government should consider the opportunity to pursue cloud seeding in order to provide increases in the flows to the Snowy River.

11. Recommendations and Suggestions.

You will no doubt agree that fresh water resources and land and water salinity issues will be economic and political issues of the greatest importance to most rural Australian voters and to many others, and that these issues will include the effect of water allocation reforms, reduction of property values and issues of Government compensation to farmers for the losses which they and rural communities, in general, will sustain.

We believe that together with Prof. Rosenfeld we can offer vital and inexpensive assistance in addressing the above-mentioned problems, because we have developed unique satellite-based technology to monitor the impact of air pollution on precipitation in clouds from satellites, and furthermore, we can offer research and operational activities aimed at monitoring, measuring and restoring the environment and precipitation efficiency of clouds which will assist in alleviating the water shortages in the catchment areas of MDBC and others.

In 1964 the Tasmanian Hydro-Electric Corporation introduced and then successfully implemented rain-enhancement programs in Tasmania, producing significant increases in rainfall in autumn and winter. The beneficial results, in the order of 20-30% increases in rainfall, are well recognized and regarded by the scientific community.

Prof. Rosenfeld is a world-renowned expert in the field of Cloud Physics, Meteorology and Rain Enhancement and is scientific team member of the National Aeronautics and Space Administration (NASA) and the National Space Development Agency of Japan (NASDA) and the European Space Agency (ESA) Tropical Rainfall Measuring Mission (TRMM). Among other achievements, Prof. Rosenfeld identified the cause (and helped to eradicate) the notorious forest fires in Indonesia in 1998. From this work Prof. Rosenfeld is at present supervising numerous weather-modification research and rain and snow enhancement and hail suppression projects in USA, Canada, Argentina, Israel, Thailand and other countries.

For his achievement in cloud physics, measuring global rainfall, discovering detrimental effects of air pollution on global precipitation and, in particular, his findings concerning Australia, as published in "Science" March 2000, Prof. Rosenfeld was on the 17 January 2001 awarded the prestigious "Verner E. Soumi Award" by the American Meteorological Society. The World Weather Modification Association awarded Prof. Rosenfeld the "Thunderbird" award for 2001 for his substantial contribution to weather modification science and rain enhancement operations around the globe.

Our company and Prof. Rosenfeld recommend that the Commonwealth Government should take a role in funding the initial stage in cloud-seeding research and operational projects, and should promote the latest and the most scientifically advanced findings in atmospheric research in Australia. We suggest that the Commonwealth Government should fund and urge State Governments to conduct permanent and wide spread cloud-seeding and research programs of restoration of natural rainfall and snowfall in Australia throughout the entire Murray Darling Basin, including west of and along the Great Dividing Ranges in Victoria, New South Wales and Queensland, the Grampians Mountains, the Snowy Mountains, the Victorian Alps, the Mt. Lofty Ranges east of Adelaide and the Perth catchment of WAWC, and south-western Western Australia. We confidently believe that such projects will greatly assist in combating the economic and environmental issues concerned with dwindling fresh-water resources, river flows, and land and water salinity.

We would be happy to meet with you and the Hon. Members of the Committee to present them with full details of our research and proposals and to answer any questions they may have. We would appreciate meeting with you in Melbourne or Canberra.

Yours faithfully,
Australian Management Consolidated Pty. Ltd.

Aron Gingis
Managing Director
MBA, Dip. Eng.

12. 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

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13. ATTACHMENT - 1

News Release

National Aeronautics and
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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/

14. ATTACHMENT – 2

The Rosenfeld D., 2000: "Suppression of Rain and Snow by Urban and Industrial Air Pollution". *Science*, **287** (5459), 1793-1796 provoked much discussion (some of it somewhat acremoneous) and debate. Documentation of these discussions has been archived at AMC and amounts to 10-20 thousand words. Here follows the final reply from Prof. Rosenfeld and myself to Dr. N. Nochols. It concerns the arguments for and against the use of BoM data for time-serious analysis of rainfall and snowfall patterns and trends.

Email letter dated 6 April 2000 by Prof. Daniel Rosenfeld to Dr. Neville Nichols of BMRC summarizing our scientific discussions on the issue of lost precipitation in the Victorian Alps and the Snowy Mountains areas.

Dear Neville,

We agree totally with Dr. Peter McAllister that now is the time to look forward and not backward and this will be our last communication concerning the issues of the past. We look forward to discuss with you what needs to be done next.

We still need to identify where we agree and disagree with the determinations that you have made, and leave it at that. We do not have to agree on everything. Diversity in scientific opinions is not necessarily a bad thing and your voluntary participation in our open discussion is appreciated. We have all spent a lot of our valuable time and we believe that it was time well spent.

Your personal involvement and the valuable statement offered to us by Peter Dawson have assisted us to understand on the following:

1. That the monthly district average rainfall data that we purchased from BoM in district 71 is not reliable and cannot be used to conduct any analysis of rainfall with any certainty and should not be offered to the public without at least a note of caution. It was we who initially inquired from National Climate Centre as to the quality of district rainfall data.

2. The monthly district rainfall data for district 83 can still be relied on to identify significant downward trends in ratios of high/low stations and that fact can be supported by observing downward trends on Kiandra and Whitlands pairs proposed by you as the two best individual stations available for Alpine districts, when considered for the full time serious from 1910 to 1999.

3. We have only indirect evidence for statistically insignificant decline of snow cover. The comments offered by Alan Duus in his assessment of 3 graphs supplied for our consideration on 9 February 2000 leave no doubts as to why statistically insignificant decline of snow cover was established. Alan said: "The cumulative graph is interesting in that, by casting your eye along the graph, you can see the steady flattening-off since about 1960. Note also the enormous scatter in the main diagram. It is that amount of scatter that leads to the lack of significance of the linear trend".

4. That Alpine precipitation measurements have recently improved (from 1960's as supported by Peter Dawson BoM official rain gauge inspector) regardless that the installation of heated rain gauges did not take place at the stations that we have been considering as it was discovered by Aron.

5. Your interpretation of those numerous letters found by Aron in Mt. Buffalo's archival file could be the point of disagreement between Aron and yourself and because we decided not to include Mt. Buffalo as reliable station in our discussions there is no point to dispute their contents. The fact that under-measurement and under-reporting of solid precipitation data was common in earlier years prior to 1960's have been discussed between us in length and all direct and indirect evidence considered. We are not qualified to make a determination on that and we relied on Aron with respect to the data quality issues. However, we both highly value the report of Peter Dawson, BoM inspector and we trust his qualified statement and professional opinion. Always the people who are actually doing the things must be listened to.

6. The twice daily measurement that was requested by the BoM inspector in his September 1962 letter can clearly be understood as a request and instruction that was to be implemented. Your own assertion in your email dated 22 March 2000, suggested that "Many Bureau sites report routinely at 3pm as well as 9am".

7. The "wishful thinking" that you referred to was in our opinion a common sense proposition of natural progression and improvement that everyone would expect from BoM staff performance between 1910 and 1999. We do not agree with your proposition that observation of snow and rain can be compared, and we suggest that snow measurements is much more susceptible to quality problems. This opinion is strongly supported by Peter Dawson. Rainfall measurement does not need nearly as much care as snow measurement to achieve the same level of accuracy. The ratios would be affected by the under-measurement and under-reporting of solid precipitation in earlier years.

8. We do not agree with your selection of 1920 as starting point as it is a point of time of local minimum. If you change your starting point by 20 years backward or forward in time or for that matter to almost any other point of time, you will obtain decreasing trends. Therefore, your selection of 1920 is biased.

9. In relation to your suspicions as to pre 1920's data quality, we do not agree with your proposals. The lack of sufficient information about the pre-1920 data is not a reason to ignore that data altogether, especially when the results of their incorporation are the same for both stations.

We do not agree with your assessment of the relationship of Hobart pressure and the ratios. I (Danny) also assessed the relationship between the pressure and the winter precipitation. The Hobart winter pressure is negatively correlated at about the R=0.6 level, with the winter precipitation, at both the highland and lowland stations, with the same slopes. The equality of the slopes is the reason for no relation of the pressure with the highlands/lowlands ratios.

Given our standing disagreement on the science issues, it might seem that our point of views are different as we all are only human, and it seems that we both tend to see the points that interest us and overlook (mostly unintentionally) the other points. That is why interactions such as we have been between us are so very valuable, for all of us. We are grateful for your willingness to enlighten us on these issues, which have certainly contributed much to our knowledge and guarded us from relying on a large part of the data that cannot be relied on.

We fully support the suggestion of Dr. Peter McAllister, that now we should look forward to what needs to be done next. In fact, all those discussions about the past were aimed mainly for establish the need for future action. We have quite a few ideas about what need to be done, using the most advanced spaceborne, insitu and ground based measuring techniques and using regional and explicit cloud models.

THAT IS WHERE OUR ATTENTION SHOULD BE AIMED FROM NOW ON.

Best regards

Danny Rosenfeld

and

Aron Gingis

15. ATTACHMENT - 3

Dr. Karl S. Kruszelnicki concerning Smoke and Air Pollution and how its affecting our health and environment

Wood Smoke Part 1

We humans have been making fires to cook meat and keep ourselves warm for over 400,000 years. But one of the troubles with a fire is that it gives off smoke. This smoke has bothered people for a long time. In 1661, Charles II of England commissioned John Evelyn to write a pamphlet called "Fumifugium: or the inconveniencie of the aer and smoak of London dissipated".

It was only after thousands of people died in the killer smogs in England in the early 1950s, that the Clean Air Act was passed in 1956. But it seems as though we haven't gone far enough. We now know that dirty air doesn't just take your view away, it also takes your breath away.

Some people might argue that we humans have burning wood fires for hundreds of thousands of years, and they haven't done us any harm, so what's all the fuss? Well the whole point is that they have been causing lots of harm all that time - lung diseases have always been one of the major killers.

According to the New South Wales Health Department, tiny particles in the air kill about 400 people each year prematurely, in that state. In the USA, it's thought that dirty air, mainly from burning stuff, kills tens of thousands of people each year.

Many of us have had the experience of being unable to open a window, because of the smoke from our neighbour's fire. But the effect of wood smoke goes beyond having your hair and clothes smell of your neighbours' smoke. And it goes beyond asking, "Where did the view go?". Wood smoke can cause irritations of the nose, throat and sinuses. It can trigger coughs, asthma, bronchitis, emphysema, pneumonia, middle ear infections, cardiovascular disease, and even lung cancer. An EPA study in 1991 concluded that volume for volume, the smoke from a wood fire is 12 times more carcinogenic than the smoke from cigarettes!

The smoke from a wood fire has tiny particles floating in the air. There's a special jargon used to describe these tiny particles. They're called "PM" or "Particulate Matter". PM10 are particles that are smaller than 10 microns in size (a micron is a millionth of a metre, and 10 microns is roughly the size of a bacterium, or one seventh of the size of a human hair). Today, PM10s are defined as particles between 2.5 and 10 microns in size. PM10s come both from natural sources (such as dust from soil and roads, and tiny droplets of seawater) and from artificial sources (such as trucks and buses, and the wood processing industry). The PM10 particles tend to fall to the ground fairly rapidly.

There are even smaller particles called PM2.5 - they're smaller than 2.5 microns. They mostly come from burning. They're made up of various sulphates, nitrates, tiny particles of carbon, or other condensed organic stuff. PM2.5 particles tend to hover for days, if not weeks. The real problem with the PM2.5 particles, is that they're so small that they can penetrate very deeply into your lungs. They can interfere with your respiratory system, and as a result, with your cardiovascular system as well. A recent article in Nature says that these tiny PM2.5 particles make smog and ozone.

We know that polluted air contains large amounts of various oxides of nitrogen. We also know that during the night, some of these oxides of nitrogen are turned into nitrous acid (HNO2), and that in sunlight, the nitrous acid turns into smog and ozone. Where did the nitrous acid came from? The Nature article says that suspended soot particles can turn nitrogen dioxide (NO2) into nitrous acid, 10 million times faster than other catalysts. Yep, soot from fires turns oxides of nitrogen into smog and ozone.

These dangerous particles are not being released from some giant industrial chimney complex hundreds of kilometres from where you live - they come from badly-tuned motor vehicles, barbecue grills and wood fires in the streets and backyards where you live.

In much of our society, wood fires are the main source of these tiny dangerous particles. But don't think that a brand-new latest-technology wood stove is a clean burner. In fact, such a wood stove will put out as much particle pollution in one day, as a car running for 15,000 kilometres, or one year. What can we do about it? Well, that's what I'll discuss next time"

16. ATTACHMENT – 4

ABC Radio interview with Dr. Mike Manton on 4th April 2001

G.C. Dr. Michael Manton is a Head of the Bureau of Meteorology Research Center. How does he respond to Prof. Rosenfeld claims?

M.M. "As you know, the Bureau of Meteorology gets rainfall from about 5,000 stations at any time across the country and over the last decade colleagues in BMRC and the Bureau of Meteorology Research Center have put together a very high quality set of rain gauges from around the country **and four of those lie down wind of Melbourne at Orbost, Lindenow, Wilsons Promontory, Gabo Island and we looked at those stations, these are high quality stations down wind of Melbourne, and over the last century. We do not find any evidence of a decrease in rainfall."**

G.C. What farmers concern that the dry spells are getting longer and that the rains are getting less frequent.

M.M. "Yes, it's one of the things for a long time we and even professionals thought of climate as something that you can take an average over a few decades and it just roll on the same, but just like going back and looking at these long term records, which is something we have been doing particular because of climate change. It becomes quite clear that there huge variations from decade to a decade. And for example during 1970s the rainfall across Australia was higher that it has been the decades before and higher that it has been since**. And so this decadal variations changes from the decade to the decade make it appear as those things may be changing in a systematic fashion, but in fact in general they seems to be going up and down."**

G.C. Dr. Michael Manton, who is the Chief of Research at the Bureau of Meteorology in Melbourne, is speaking there with Gerard Callinan.

17. ATTACHMENT - 5

Transcript from a tape recording of the seminar at Sale Victoria on 16 May 2001
Dr. Greg Ayers, 16 May 2001 Sale, Victoria. Seminar conducted by Aron Gingis

My name is Greg Ayers, I am also from the CSIRO Department of Atmospheric Research. I lead the research program on which we do remote sensing and satellite sensing and cloud physics research. Also part of that is that I know a lot about cloud seeding. The difficulty I have got, lets leave the cloud seeding aside, I just want to make one comment. Aron for some reason thinks that CSIRO quite against him. It is not a sound view. The CSIRO does not have a commercial interest one way or another. Our charter requires us to deal with a new knowledge and application for the benefit of Australia, economically, environmentally safe and if we can see somebody who got an idea to advance such a thing, we shall stand right behind him and in the middle of it and saying go for it and we doing a lot of these things there is no issue here of some conspiracy. The thing about the Thomson experiment that is interesting that we have been given permission do that cloud seeding experiment 6 month before Aron first approach. It is absolutely wrong to claim that he initiated that cloud seeding that is plain wrong. I put that aside that is not what I want to tell. When we put that air pollution suppressing rainfall, Danny Rosenfeld is a very, very good scientist, but he is not, he is not any better then many other scientists who are very good around the world. So you have to put him within the context of the whole lot of other people. I could show you my work and it would not prove anything, I could show you my list of 140 publications and Danny only has a 100, that is ridiculous staff and I only going to say it once because Aron brought it up. You cannot do this sort of staff. So the context here is air pollution suppressing rainfall over Australia, not over Indonesia, not over South America, not in West Texas. We saw images of satellite picture, remember the satellite images down over Adelaide and over Victoria, Suppression of Rainfall and Snow this paper in Science. That is absolutely that paper is flowed scientifically. We went back and did the ground truthing to determine the truth. Danny Rosenfeld does not work in Australia, he put a few satellite pictures and he decided that there is suppression of rain and snow by the pollution. So, what you are going to do? You've got to go and see if it rain. We've got Bureau of Meteorology Research Center provided us with National Rainfall maps on those days and figures were not proved in those days. Those days between East Coast and Adelaide. The are a lot of documents that are public that using aircraft is not new, we known about air pollution, we known how its affects the clouds, its all public, we known about it years ago, but Aron has not mentioned that, he knows that.

Anyway, it was absolutely no rain in that staff and it does matter in the regions, where you have polluted clouds or not polluted clouds if it is no rain.

They claim rainfall suppression on days when it did not rain anywhere, because it was very shallow clouds beside the pollution. It is the most strange logic to claim rainfall suppression if there is no information. Figure Two. Pollution…… we know where the pollution sources are. I will sit down in one minute, I just wanted o say that rainfall suppression is claimed on the basis of satellite photographs which it was no rain anywhere, second thing that they claim pollution when it was no pollution, third thing is that if we look at another satellite image where yellow clouds over the whole of Australia and if you don't pop them in and present just the center as it was done for those images shown by Prof. Rosenfeld you will actually find that this is a natural phenomenon that clouds yellow…… That is all.

18. ATTACHMENT - 6

Transcript from a tape recording of the meeting at Sale Victoria on 16 May 2001.
Dr. Brian Ryan 16 May 2001 Sale, Victoria.
Seminar conducted by Aron Gingis

My name is Brian Ryan from CSIRO and I am also a member of the committee that advises the World Meteorological Organization on the cloud seeding advice. We, in fact, just recently devised the document that can be used to advise the countries and I would like to put that on the background. And in fact Aron mentioned Jorgan Jenson and he worked in my program in late 1980's the program of the CSIRO, he made measurements in Indonesia and over the Thomson Dam. What I would like to say about the cloud seeding and in particular, at least from the point of view of the World Meteorological Organization there is no certainty in any operational cloud seeding. It requires a substantial experiment as recommended by the CSIRO and by the World Meteorological Organization. As a clear example that is being carried out in Australia, Aron is perfectly right that in Tasmania the experiment is being carried out and is probably the most successful cloud seeding experiment in the world. The only one that I know of that is not controversial that includes the Israeli experiment that had their controversy mistakes and there is no doubt that when we looked at the clouds statistics there are strong evidence that rainfall increases. CSIRO in the 1980s carried out similar designed experiments in the Western Victoria and statistically it did not succeeded. The Thomson River experiment again did not show statistically significant increases in rainfall. Each of those experiments took about 7 years to do and they had a long time to prove, whether cloud seeding works or not, so saying to carry out the operation without experiment is very, very difficult. I just want to answer one of Aron's questions from the point of view that we have seen these experiment in Taxes, I will just read you what WMO comments on these point experiments are. Experiments involved with glaciogenic seeding with warm based continental convective clouds have produced mixed results. Some experiments has suggested positive effects on individual convective cells, but conclusive evidence that such seeding has increased rainfall for multiple convective clouds still yet to be established. Many steps were upon the chain of events have not been sufficiently documented with observations to simulate the numerical model. Aron referred to a new technique, that again I am well aware of and again I will read you a summary what WMO think of the new technique is. Despite statistical evidence of the radar precipitation an individual cloud systems in both glaciogenic and hydroscopic seeding there is no evidence that such seeding will improve rainfall over significantly area economically.

The point I am making that will of this it required very careful experiment and very careful design and the CSIRO in its documentation to advise the Government and the Authorities as how the work to be carried out. We are not against seeding, we are for seeding, but we are advocating very strongly that what ever is done it is done in a very open and careful scientific way, which has independent evaluation. It have to be set up in such a way that there is a scientific documentation with the pier review internationally and there is independent people coming and telling if it is successful or not. All of this must be very carefully documented that requires a lot of work and a lot of expense. And that is the point I want to make and I am not for or against it, but it is not an operation that you can undertake some work without scientific evaluation.