# Objection to
# Woodlawn Advanced Energy Recovery Centre

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**This proposal should be comprehensively rejected on grounds argued hereinafter, mainly relating to inadequate capture of the local topography in the pollution plume study and health dangers from fine particulates and persistent organic pollutants for the population of Tarago and workers on the Woodlawn site.**

## (1) Pollution plume study highly questionable

Woodlawn and Tarago are on the Great Dividing Range, Woodlawn at an altitude of 720m and Tarago at 700m. There are two substantial N-S trending ridges between the two locations. From W to E: (i) a major NNW-SSE ridge, between Crisps Creek and Bongaralaby Creek, reaching about two hundred metre above surroundings; and (ii) a substantial N-S ridge, between Bongaralaby Creek and the Mulwaree River and directly to the west of Tarago, reaching about a hundred metre above surroundings.

The prevailing wind pattern is E-W with dominantly eastward winds during winter [1, p29]. The N-S ridges will have a substantial impact on the prevailing eastward winds, with formation of eddies stationed parallel to and on the leeside of the ridges. The eddies will dump accumulated pollution in the valleys behind the ridges. Tarago, directly adjacent to the N-S ridge, is likely to be heavily affected by pollution dumped from the eddies. Likewise affected by pollution will be agricultural land around Bongaralaby Creek and around Lake Bathurst. Lake Bathurst, with no natural outlet, is likely to keep accumulating pollutants drained into it.

The CALMET modelling uses a topographic grid with a resolution of 250m [1, p31]. This grid is far too coarse to adequately represent the pronounced ridge-and-valley topography of the region and in particular the ridge directly west of Tarago. The 250m grid spacing of the CALMET modelling substantially exceeds the grid spacings of 150m to 90m nowadays recommended by the NSW EPA [2, p18]. A 1-second DEM (Digital Elevation Model) with a resolution of about 30 metre is available at low cost from Geoscience Australia [3] [4].

Given the pronounced valley-and-ridge topography of the region, the about perpendicular trends of prevailing wind and topography, and the location of Tarago directly at the leeside of one of the two substantial ridges, it is imperative that the CALMET study be rerun with the highest

resolution DEM available. That is the 1-second SRTM-derived DEM from Geoscience Australia (30 m resolution) or possibly the LiDAR-derived DEM (5 m resolution) [5]. Modelling using coarser grids than the 1-second DEM most likely will under-represent the pollution imposed on Tarago by a Woodlawn incinerator.

## (2) Best practice incinerator causes substantial POP pollution

The air quality impact assessment [1, p51] hints at twice yearly stack sampling of dioxins and furans. This is the legal requirement of most European countries [6, pp 140, 160] [7], although Germany requires sampling four times a year [8].

Occasional measurement of emissions of highly toxic Persistent Organic Pollutants (POPs) such as dioxins and furans is less than reassuring and yearly averages mean nothing because people do not breath in air with yearly-averaged pollution, they actually do breath in air all the time when pollution occurs and surely also when pollution levels are above allowed limits. Recent studies on continuous monitoring and bio-monitoring of dioxins originating from a modern, best practice, incinerator installed in 2011 near Harlingen in the Netherlands [9]-[13] clearly show that occasional measurement of dioxins can lead to seriously flawed outcomes: *"Currently only short-term flue gas sampling is mandated by the authorities; based hereupon, under normal operating conditions, the incinerator appears to be compliant with emission standards. This short-term sampling scheme is seriously flawed, however, in that it only demands one continuous 12-hour sampling period* ***per annum*** *– an extreme grab sampling transgression in the time domain. In starkest possible contrast, significantly elevated dioxins emissions were measured in flue gas during events of unstable combustion conditions by continuous* ***long-term*** *measurements. The dioxin congener patterns from long-term flue gas sampling show* ***similar*** *patterns as the congeners found in backyard chicken eggs and grass, evidence that elevated dioxins in eggs is due to emissions from the incinerator. These results make it mandatory to perform long-term, continuous measurements for all sources where similar high-temperature combustion/emission processes take place."* [12, extract from abstract].

Incinerators generally emit POPs at far lower levels than other pollutants, but POPs are toxic at concentrations in the order of parts per billion (ppb, $10^{-9}$) and even parts per trillion (ppt, $10^{-12}$) compared with parts per million (ppm, $10^{-6}$) for other pollutants [14, p18). POPs do not naturally break down and accumulate in the body's fatty tissue, rendering them highly dangerous. People's chemical sensitivity to pollutants and toxins can vary considerably and necessitates stringent application of the Precautionary Principle [15] as enshrined in International and European law. Effects of the unknown and known unknowns may well be more important for people's health and well-being than from the known knowns!

An opinion tendered by the NSW EPA to the ACT's FOY Health and Environmental Inquiry made it clear that in case of mixed waste feedstock it is very difficult to separate out potential sources of dioxins (eg PVC) [16] and furans (eg teflon) [17]: *"In the NSW EPA's experience, it is very difficult to ensure contamination free feedstock from mixed waste sources. Exclusion of PTFE and PVC plastics and heavy metal contamination for the feedstock may prove to be very difficult. Inclusion of even very small amounts of such contaminants could call into question the conclusions drawn in the EIS and Health Risk Assessment. With the high toxicity of these pollutants, and the proximity of surrounding residential areas, it would be prudent to take a precautionary approach to this assessment.".*

Sydney-generated feedstock for the Woodlawn incinerator will unavoidably vary in composition. An occasional probe on POP emissions is highly likely to miss emissions from PVC and PTFE plastics that have not been separated out from the feedstock prior to incineration.

Given the mixed feedstock for a Woodlawn incinerator, the interaction of prevailing eastward winds with pronounced N-S ridges leading to leeside pollution accumulation, there are substantial dangers of toxic POP accumulation on agricultural land around Tarago and in Lake Bathurst. The population of Tarago and surroundings may not only accumulate POPs through constant breathing in, but may also further accumulate POPs through consumption of locally produced feedstock, fish, eggs and animals that may contain enhanced levels of POPs.

**(3) Woodlawn's altitude and hot summers aggravate incineration pollution effects**

The proposed incinerator at Woodlawn will be located at an altitude of 720 metre and will operate across an expected temperature range from -5°C to 40+°C. Air at an altitude of 720 metre is about 9% less dense than air at sea level [18] [19] [20]. Air at 40°C is about 13% less dense than air at 0°C [19] [21]. The two effects are cumulative. On a hot summer afternoon, and there will be plenty with accelerating global warming, air around the Woodlawn incinerator could be about 22% less dense than air at sea level at night. Yet, the incinerator will emit similar quantities of most pollutants, and probably more for carbon monoxide, as at sea level. Air that is 22% less dense will thus become some 28% (22*100/78%) more polluted compared with "standard" air. People breathing the less dense air will have to breathe greater volumes for the same oxygenation, thus may have to breathe in up to 28% more pollution! It simply makes no sense to operate a polluting incinerator located at Woodlawn's altitude and with its hot summers [22]. People will experience its pollutants more severely than at the eastern seaboard and it will be harder to sustain incineration within allowable pollution limits.

If the NSW EPA rejects the notion of an incinerator in Sydney's Eastern Creek [23] at an altitude of less than 50 metre then they also should reject the notion of an incinerator at Woodlawn at an altitude of 720 metre where aggravated pollution from the incineration process would severely impact on the health of local workers. It simply makes no sense to transport Sydney waste from sea level up to Woodlawn and burn it there at altitude.

**(4) Waste-to-Energy industry preying on Australia**

Let there be no doubt. The global waste-to-energy industry is preying on Australia as its next, easy, market for PIG's (Pyrolysis, Incineration, Gasification) [24] [25]. The industry has to, if it wants to survive, being phased out in the US and Europe. Dumping incinerators on to Australia is as unconscionable as dumping tobacco on to developing countries.

The waste-to-energy industry has lost its market in the US where no incinerators have been built since the 1990's [26] [27], with public sentiment turning against public funding of the industry [28] [29]. The European Commission has urged phasing-out of public funding for waste-to-energy projects [30]-[33]. The French Minister for the Environment labelled incinerators *"outdated technology"* [34]-[37] – a remarkable statement for the country with by far the most incinerators in Europe. Voices are rising in the UK to rethink its policies on incineration [38] [39]. The Danish Ministry of the Environment has urged a rethink on its exorbitant waste-to-energy industry [40] [41] and that for the country with the world's longest history of incineration and district heating [42].

With phasing out of incineration underway in Europe and the US, Veolia is quite misleading to

state in its EIS for a Woodlawn incinerator [56, p ES1] *"Energy from Waste is a new technology in Australia. However, it is well used overseas, with some 450 plants currently running in Europe. Veolia operates over 65 Energy Recovery Facilities (ERFs) overseas and will soon manage two more under construction in Perth, Australia."*.

With countries that went through a waste-to-energy, industry-led, push for incineration, changing course and now calling for an end to public funding of the waste-to-energy industry, it is highly regrettable, but not unexpected given Australia's dreadful record of political lobbying, that the Morrison government did row against the tide in having opened-up ARENA and the CEFC for funding of waste-to-energy projects [43]. The sooner the Albanese government reverses these dreadful decisions the better. Meanwhile it is a great pity that the NSW liberal government has fallen prey to the waste-to-energy industry.

**(5) Energy from waste incineration is waste of energy**

Incineration amounts to a waste of energy:

- for the loss of embodied energy in products that can be recycled;
- for producing only a fraction of the energy that can be saved through recycling [44];
- because gasification through anaerobic digestion and composting provides more energy than obtained through incineration which has low thermal efficiency [45]-[50] [51, p8] [52, p20];
- because NSW adheres to a waste management hierarchy favouring retaining of embodied energy through reuse and recycling over mere energy recovery [53, p4].

It is instructive to visit the 2010 slide presentation about incineration by Dr Paul Connett [54, slides 32-47] [55], wherein he argues that composting and recycling is 46 times more efficient in reducing greenhouse gases than incineration with power generation.

Rather than just burning end-of-life waste, Veolia should do well to sort, store, and GPS-locate currently unwanted waste and treat it as a future resource.

**(6) Incineration has low energy efficiency**

The Woodlawn EIS [56, p ES3] is confused about use and meaning of the terms "power" and "energy". Energy is power produced over time. Power is commonly expressed as MW(-e) and energy is expressed as MWh [57] [58]. It is not correct for Veolia to state *"a power plant with a nominal capacity of 30 MWh to generate up to 240,000 MW of electricity per annum".* With such a basic error in the Executive Summary of its crucial Environmental Impact Statement it makes one wonder about the correctness of Veolia's other information.

Waste to energy incinerators have low energy efficiency, rated in the order of 12% - 24% [59, p37], 155 - 25% [60, p9], 20% - 25% [61], 19% - 27% [62, p2] and 17% - 30% [63, p84]. This is gross efficiency, ie total electricity generated. Net efficiency, ie gross efficiency minus energy consumed by a plant for its own operation, is generally in the order of 20% – ranging from 15% to 25% [64, p22]. Energy efficiency can be improved to 50%-60% by re-using residual heat from the steam used for power generation for other applications such as cooling and district heating [61] [65]. This however, is not envisaged for the proposed Woodlawn incinerator.

## (7) Air pollution damages from incineration outweigh added value

A 2011 study by US environmental economists looking into air pollution damages from a wide range of industries, summarized their findings [66, p1649] as: *"This study presents a framework to include environmental externalities into a system of national accounts. The paper estimates the air pollution damages for each industry in the United States. An integrated-assessment model quantifies the marginal damages of air pollution emissions for the US which are multiplied times the quantity of emissions by industry to compute gross damages.* ***Solid waste combustion, sewage treatment, stone quarrying, marinas, and oil and coal-fired power plants have air pollution damages larger than their value added****. The largest industrial contributor to external costs is coal-fired electric generation, whose damages range from 0.8 to 5.6 times value added."*.

They also found [66, p1651] that: "***... the ratio of GED*** [Gross External Damages] ***/VA*** [Value Added] ***is greater than one for seven industries*** *(stone quarrying,* ***solid waste incineration, sewage treatment plants****, oil- and coal-fired power plants, marinas, and petroleum-coal product manufacturing).* ***This indicates that the air pollution damages from these industries are greater than their net contribution to output.****"*. Their table 2 [66, p1665] shows that solid waste combustion and incineration has the highest GED/VA ratio of all industries analysed at 6.72, followed closely by sewage treatment facilities at 4.69. (Bold added)

The NSW government should take careful note of the very high damage versus value ratio attributed in this study to solid waste incineration.

## (8) Questionable public subsidies for PIG's

It is not surprising that the global waste industry is stepping up its Australian lobbying efforts at a time when US incinerators are closing down, when European countries are having second thoughts about the wisdom of incineration, and when the European Union is phasing out subsidies for incineration [51] [67]-[70]. What is surprising is that the Australian government continues to having problems learning from overseas experiences and has proven itself once again as an easy prey for skilfully targeted lobbying efforts.

It is regrettable that respected national institutions like the Australian Renewable Energy Agency (ARENA) and the Clean Energy Finance Corporation (CEFC) have fallen victim to lobbying pressures from the incineration industry and that this has resulted in newly concocted government remits for ARENA and the CEFC to include PIG projects (Pyrolysis, Incineration, Gasification) within the waste-to-energy projects eligible for its financing [71, p4]: *"…. Energy recovery usually involves collecting and using heat generated through controlled combustion (by thermal treatment, pyrolysis or gasification) of waste material. Recovered heat can be used for electricity generation."*.

Overseas experience has shown that this will lead to incineration of organic waste and to wasting of their considerable compost value in return for a limited calorific value [51, p3]. ARENA and CEFC remits should avoid this trap and should be focussing their bioenergy financing on, if not restricting to, supporting non-toxic, low temperature, anaerobic digestion and composting endeavours.

A recent report by Zero Waste Europe/Ecocycle.org comparing *"the environmental impacts of the three most common disposal methods used globally"* concluded that *"the best approach to protecting the public health and the environment isn' mass burn waste-to-energy."* [51, p 8] [70] . The report found instead that *"after aggressive community-wide recycling, reuse and composting, the most environmentally-sound disposal option for any waste that may still remain is a third option: Materials Recovery, Biological Treatment (MRBT), or in other words, pre-treat the waste, recover as much as possible, biologically stabilise and landfill."*. *"Ultimately, the waste*

*that today can't be recycled or composted amounts to 5 to 20% of total household waste -depending on the community-.". "This is a very small percentage of waste which does not justify any further investment in waste-to-energy incineration.".* The Australian government should take note of this European experience, and not get burned once again.

**(9) Power from waste incineration produces more $CO_2$ than coal-fired power stations**

Waste incineration has been shown to emit up to twice the amount of $CO_2$ per MWh-e compared with a coal-fired power station [72, p37] [73, p21] [74] and more than a gas-fired power station.

Why should one bother about a paltry 30 MW of non-renewable and non- dispatchable base load power – less than the power output of three GE Haliade-X wind turbines at 12 MW [75] each, when the ACT has seen delivery by 2020 of up to 640 MW of truly renewable wind and solar power combined [76]. Furthermore, there is good potential for the National Energy Market to achieve, on a ten year roadmap, to being run on a 100% truly renewable basis with wind and concentrated solar power, with salt storage [77], and/or with pumped hydro energy storage and a high voltage DC/AC grid [78]-[80]. That even without considering Australia's plentiful wave and geothermal energy potential [81].

Rather than recklessly indulging in an incinerator with all its health and climate change dangers, the NSW government should evaluate the many opportunities for pumped hydro in the state [82] [83]. In contrast to incineration, pumped hydro has great potential for delivering truly renewable, dispatchable, base load power [84].

**(10) Incineration creates about 30% of waste as toxic ash**

The Woodlawn incinerator will create up to 5% of burned waste as fly ash. Fly ash is highly toxic. Depending on the composition of Sydney's waste the fly ash will contain dioxins (PCDD's), furans (PCDF's) and PAH's (Polycyclic Achromatic Hydrocarbons), which are highly toxic in minute quantities, and also substantial levels of chlorine, lead, copper, tin, bromine, cadmium, chromium, arsenic, molybdenum and mercury [85, chapters 4 & 5, table 3, pp 42-56]. The allowable limit for dioxins and furans is 0.1 nanogram per cubic metre of gases ($ηg/m^3$) emitted by incinerators [86, p9] [87]. Collection of fly ash through filters in the chimney can never be guaranteed at 100%. Likewise, the highly dangerous $PM_{2.5}$ particle fraction [88] as well as ultra-fine nano-particles of unclear health implications [89] [90] are likely to escape and travel widely.

The incinerator will produce also substantial quantities of bottom ash and likely small quantities of boiler ash [27, p8] [63, p134] [91, p14] which are less toxic compared with fly ash. Incinerators generally produce bottom ash at 25% of processed waste mass [85, p53] [27, p7].

Toxic fly ash needs to be immobilized before it can be stored at landfill in specially prepared waste cells to avoid leaching and leaking [85, pp 42, 50] [63, p134] [92] [93]. Fly ash has a low specific density,... it flies up the chimney, so its volume percentage is likely to substantially exceed its mass percentage. For instance the BSEM (British Society for Ecological Medicine 2008) study states [14, p42]: *"The incineration of waste produces a large amount of ash, amounting to 30% of the weight of the original waste; 40-50% of the volume of compacted waste."*. However, filling waste cells,

that are often precariously positioned in landfill precincts, with substantial volumes of highly toxic fly ash makes little sense, the more as the toxins created upon incineration would not have existed, leave alone posed problems, if residual waste had gone straight to landfill where it could be preserved as a future resource.

Fly ash may be immobilized into carbonated bricks [94], to be used for building purposes [63, p134]. It remains to be seen however, whether this amounts to a time bomb in the making, with acid corrosion of the carbonated bricks over time potentially bringing toxins into direct contact with residents.

Veolia might like to sell the less toxic bottom ash for road cover [95, p19]. It remains to be seen however, how fast the bottom ash will weather and decompose, with toxins likely to leak into road verges and ultimately into waterways. Concerns about leaching of bottom ash used as road aggregate have been documented extensively [64, pp 29, 30] [96]-[100].

### (11) Establishing waste incineration counters development of circular economy

China's ban on contaminated foreign waste has had substantial impact on the Australian waste industry. The Waste Management Association of Australia (WMAA) regards the ban as an opportunity to establish a proper circular economy in Australia [101]. However, development of recycling processes, recycling plants, retail networks and promotion of uptake of recycled products will take considerable time. Meanwhile there will be a glut of cheap burnable waste.

Establishment of incinerators in the current void will thwart attempts to develop a proper circular economy in Australia. The NSW government should show the same long-term strategic vision that the ACT government espoused in securing cheap and reliable renewable energy for the ACT, and should promote development of a circular economy and not allow shortsighted burners in its bureaucracy to get away with murder. The WMAA is urging the federal government, and indirectly the state, territory and local governments [102] *"to assist in establishing a circular economy by helping industry and encouraging consumers.".* Likewise, the chief executive of Green Industries South Australia, Vaughan Levitzke, said *"it was time the Government stepped in and supported innovation in a move to a circular economy."* [103].

### (12) Incineration creates dangerous $PM_{10}$ $PM_{2.5}$ $PM_{0.1}$ particles

The Air Quality Impact Assessment [1] provides some data on modelled stack emission concentrations of $PM_{10}$ and $PM_{2.5}$ particles, but not on fine $PM_1$, ultrafine $PM_{0.1}$ particles or nanoparticles $PM_{0.0}5$ [104, pp 3-6] [105, p15]. The finer the particles, the harder they are to detect, the longer they may circulate [106], the further they can travel in air, the deeper they can penetrate in lungs and the blood stream and can cause health issues in children [107] and the unborn child [108]-[110] in particular. A USA EPA 1999 study on, among others, the health effects of nitrogen oxides [111, p 7] states: *"Some research indicates that even insoluble particles much smaller than 2.5 microns in size can exhibit severe toxic effects. The smallest particles that have shown toxicity have a diameter of about 3% to 5% of the wavelength of any color of visible light. Therefore, these particles are too small to even scatter light and cannot even be detected optically."*. It is widely accepted that both long-term exposure and short-term increases in exposure to particles can damage health [112, p3].

A prevailing view seems to be that the contribution of incinerators to levels of particles is small

compared with prevailing background levels, that health effects would be small [113], that they would be hard to detect and to separate from other effects using conventional epidemiological studies, and that a precautionary approach should be continued [114, pp 3-7] [115, p ii]. Yet an X-ray fluorescence study on the sources of $PM_{2.5}$ particles in a southern Swedish town identified the modern incinerator in that town, burning municipal solid waste (MSW) and industrial waste, as a major source of the $PM_{2.5}$ pollutants [116]. As stressed in [117, p11] *"Still, evidence from the waste incineration industry shows that filter bag systems used to collect the Particulate Matter and other toxic emissions have a much lower efficiency rate with fine PM <2.5: "...baghouse filter collection efficiency was 95-99% for $PM_{10}$s, 65-70% for $PM_{2.5}$s, and only 5-30% for particles smaller than 2.5 microns, even before the filters become coated with lime and activated carbon.".* These findings put a big question mark to the much lauded efficiency of flue filtration systems in modern incinerators.

### (13) Prenatal $PM_1$ and $PM_{2.5}$ exposure reduces health and longevity

New and credible research on a Chinese cohort of well over a million participants has established a positive correlation between premature births and exposure to prenatal $PM_1$ pollution [118], with premature births leading to a reduced health expectancy [119]. Likewise a recent study of some six hundred mother-newborn babies pairs [120] has established a positive correlation between the level of the mother's exposure to $PM_{2.5}$ pollution and the babies' reduced telomere length and therefore reduced life expectancy.

Most pollutants will bio-accumulate in humans [121, p8] and livestock [9]-[12]. Of particular concern is transfer of bio-accumulated dioxins in a mother's body fat to her unborn foetus [54, slides 80-84].

The highly disturbing message is that particulate pollution from a Veolia Woodlawn incinerator will not only be damaging to the health of nearby and further away residents, but also will have long-lasting effects on health and life expectancy of our as yet unborn children through prenatal exposure.

### (14) Finest particles, hardest to scrub, most to bio-accumulate, with least known effects

With incineration the smaller particles with the larger surface-to-volume ratio will absorb most of the heavy metals that are released and most of the toxins that are formed. Yet the finer the particles the harder they are to collect in scrubbing filters and the more difficult their concentrations are to measure [14, p9]. Serious health effects from the fine fraction ($PM_{2.5}$) of particles are becoming increasingly known, but less so the long-term effects of ultrafine ($PM_{0.1}$) particles or nanoparticles ($PM_{0.05}$). Yet it is becoming increasingly clear that *"the smaller the size of the particles the more dangerous the health effects"* [14, p11] [54, slides 70-78]. It is concerning therefore, that the effectiveness of bag filters in the flue gas treatment section drops substantially for the smaller ultrafine $PM_{0.1}$ and nanoparticles [63, p105].

A further concern is that secondary $PM_{2.5}$ particles can form in the stack, beyond the filters, and that these will be emitted unabated [14, p9]. Heavy metals emitted in the combustion process will attach themselves by preference to the smallest particles. Heavy metals like cadmium and mercury are highly toxic even in very small doses [14, p10].

The British Society for Ecological Medicine 2008 study summarizes their findings on particulates

as follows [14, p16]: *"In summary there is now robust scientific evidence on the dangers to health of fine particulates and of the substantial health costs involved. Recent studies have shown the risk to be considerably greater than previously thought. For these reasons it is impossible to justify increasing levels of these particulates still further by building incinerators or any other major source of $PM_{2.5}$ particulates. The data makes it quite clear that attempts should be made to the reduce levels of these particulates whenever possible."*.

**(15) Heavy metals emissions of incinerators are concerning**

In the combustion and flue processes of incinerators heavy metals will adhere preferentially to the finest particles as these offer proportionally the largest surface areas. Once attached to the finest particles they can travel from the lungs into the bloodstream and from there into body cells and brain tissue [14, p28]. Bio-accumulation of these particles over people's lifetime, and in particular children, breast-fed babies and foetuses, is a major health concern. The more so as heavy metals and POPs can have synergistic effects in the body [14, p21].

Particularly concerning heavy metals are the highly toxic cadmium and mercury, also chromium, lead, nickel, arsenic and beryllium. Simple filtering is not effective to remove them from the flue system and activated carbon is used to try to absorb them [91, p9], transferring their obvious dangers [14, p17] from air emissions to leaching of and leakage from stored landfill [98] [100].

Monitoring of heavy metals is usually done a few times a year in the stack, which is pertinently inadequate for proper monitoring of incineration of mixed waste with highly varying composition (Section 2).

**(16) Long term toxicity problems of incinerator ash**

Dioxins generated in the incineration process will not be destroyed in the flue system but will be captured in flue filters. Modern incinerators may well be far more effective than older incinerators in limiting toxic emissions, but this essentially means they are far more effective in capturing toxic pollutants in their fly ash and bottom ash. Lesser emissions to air simply means higher toxicity of the ashes. The ashes are voluminous, making their disposal a serious problem [27]. Highly toxic fly ash generally constitutes 3% - 4% in weight of processed waste, the less toxic bottom ash generally constitutes about 25% in weight of processed waste (20% - 35% [63, p186], with boiler ash constituting another about 0.1%. The about 30% in weight of all ashes [100] equates to about 40% - 50% in volume of original processed waste [14, p43] and, once compacted, to 30% - 50% in volume [117, p10], even though [63, p2] specifies 10% in volume. Some studies quote even higher weight percentages of the ashes, 26% - 40% [27, p8]. The substantial volumes of toxic ashes pose a serious problem for disposal in landfill. The original waste volume may well have been halved but the resulting ashes are now highly toxic. Disposal of these toxic ashes to landfill is highly problematic as exposed succinctly in the BSEM report [14, p43]:

*"There is a basic problem with modern incinerators. The less air pollution produced, the more toxic the ash. Early incinerators emitted large volumes of dioxins. These emissions have been significantly reduced, but at the cost of a corresponding increase in the fly ash, with similar increases in heavy metals and other toxic chemicals. An incinerator burning 400,000 tonnes of waste annually for its 25 years of operation would produce approximately half a million tonnes of highly toxic fly ash. Apart from vitrification, no adequate method of disposing of fly ash has been found. The EU Commission have stated that leaching from landfill sites may be one of the most important sources of dioxins in the future. Heavy metals are known to have high leachability. The US Environmental*

*Protection Agency considers that all landfills eventually leach through their liners. As most of these pollutants are persistent, probably lasting for centuries, they will sooner or later threaten the water table and aquifers where their removal would be near impossible. Allowing this to take place is an abdication of our responsibility to future generations.*

*"Fly ash needs to be transported away from the incinerator and this can involve lengthy journeys. These represent an important hazard. An accident could potentially make an area uninhabitable...."*.

*"Bottom ash is a less severe hazard, but still contains significant quantities of dioxins, organohalogens and heavy metals. It is extraordinary that whereas regulations have tightened in recent years to reduce dioxin emissions to air, bottom ash, which contains 20 times more dioxin, is unregulated and bizarrely is regarded as inert waste. This mis-classification had allowed it to be charged at the lowest rate at landfill sites. We believe this is wrong: it is not inert and should not be classified as such. It should be charged at a rate that is in keeping with its toxicity."*.

*"The Stockholm Convention* [on Persistent Organic Pollutants [122] *makes it clear that dioxins and furans should be destroyed, which currently means using vitrification. In Japan, this is done responsibly and much of the fly ash is now treated by plasma gasification but this essential safety step has been neglected in the UK. Because of the toxicity of bottom and fly ash there should be a full assessment of the cost of a clean-up operation for both water and land contamination. Environmental clean-up costs should be shown as part of the cost of incineration, and, when relevant, of other waste disposal strategies."*.

Selling the bottom ash as construction material [56, ES15] or road cover, rather than disposal in landfill, would be a dangerous practice as the toxins in the bottom ash-road cover and constructions over time undoubtedly would leach out into road verges and would end up eventually in adjacent agricultural lands and waterways [27, pp 17, 18] [100].

**(17) Wide spread of emissions, more than a local pollution problem**

The smaller the particulates, the more toxic they are and the wider they can spread [14, p45].

An extensive report on *"Waste Incineration & Public Health"* by the National Research Council of the US National Academy of Sciences states [123, p74]: "*Persistent air pollutants, such as dioxins, furans and mercury can be dispersed over large regions – well beyond local areas and even the countries from which the sources emanate. Food contaminated by an incinerator facility might be consumed by local people close to the facility or far away from it. Thus, local deposition on food might result in some exposure of populations at great distances, due to transport of food to markets. However, distant populations are likely to be more exposed through long-range transport of pollutants and low-level widespread deposition on food crops at locations remote from an incineration facility.*".

The British Society for Ecological Medicine (BSEM) report [14, p45] further states: *"Most chemical pollutants are lipophilic and are therefore not easily washed away by the rain after they settle. When they land on crops they enter the food chain where they bioaccumulate. It has already been admitted that most dioxin in food today in the UK came from the older generation of incinerators. All chemicals capable of entering the food chain will sooner or later reach their highest concentration in the foetus or breast fed infant."*.

**(18) Recycling and composting creates more jobs than waste incineration**

The Woodlawn EIS [56, pp ES14, 3] promotes the creation of some 40 jobs for its operation as a major attraction of its proposal. However, a Woodlawn incinerator would prevent further development of recycling and composting in NSW for a long time to come [124]. Notwithstanding irrefutable evidence that composting is a no-brainer [125] [126].

An extensive US-centric study by the Tellus Institute and Sound Resource Management has been summarized as: *"The findings indicate that waste disposal generates the fewest jobs per ton of waste at 0.1 jobs per 1,000 tons of waste, while recycling generates 2 jobs per 1,000 tons."* [127] [128]. Obviously the jobs that would be created in developing NSW waste recycling and composting to its fullest potential would dwarf the jobs created in case of a Woodlawn incinerator [129].

GAIA in *"Incinerators: Myths vs. Facts about "Waste to Energy"* [62, p2] states: *"Incinerators require huge capital investment, but they offer relatively few jobs when compared to recycling. Recycling creates 10-20 times more jobs than incinerators."*.

**(19) Eastern Creek incinerator comprehensively rejected**

Ian Malouf's proposed monster Eastern Creek incinerator was comprehensively rejected by Federal Labour [130], the NSW Greens [131], the NSW EPA [23], and in an extensively argued recommendation to the NSW parliament by the Portfolio Committee Inquiry No. 6 [132] [133], and in a recommendation by the NSW Department of Planning & Environment [134][135] [136], and in initial and final recommendations by the Independent Planning & Assessment Commission/Panel [137] [138]. Clearly, Veolia's renewed attempts for construction and operation of incinerators at Minchinbury and Woodlawn should be comprehensively rejected on ground of previous, comprehensive, universal, recommendations for rejection of such proposals.

**(20) Airfill versus Landfill**

It is amazing how grown-ups who should know better, can argue that rubbish-to-landfill is undesirable and then act as if filling the air with pollutants from burning the rubbish would not be so. A position that is hard to sustain on health grounds for reason of the pollutants that are freed and formed in the burning process, and many of them dangerously toxic, but might be argued on economic grounds in the free-for-all created with the Abbott government's shortsighted and disastrous abolition of the carbon tax. There is no hiding behind the "out of sight - out of mind" twister, not even literally now that it is well known that potentially dangerous ultrafine and nanoparticles from incinerating rubbish, do travel widely, can enter the bloodstream through the lungs, can reach the brain, and can affect local residents and their offspring for generations to come (Sections 2, 3, 12-17). With such obvious dangers to the long term health of populations near incinerators, a responsible NSW government should not let some greedy capitalists burn off rubbish for profit and distribute the pollutants across the unlucky population struggling for a living nearby.

**(21) WtE ...WtF.**

All too often when WtE appears on the screen I wonder whether the F-key has been missed on the qwerty.

It is a sad indictment to our society that some elements in the waste industry are all too keen to promote the, often paltry amounts of, energy obtained from waste as god's gift to mankind, and that some unscrupulous investors are all too keen to monetize that gift.

Never mind the embodied energies in the cardboard and plastic waste that are lost;

Never mind the lost impetus to establish a vibrant recycling industry;
Never mind the GHGs that have to be sequestered again at great cost;
Never mind the dioxins, furans, PAHs, POPs and other toxic pollutants strangling the air we breathe;
Never mind that unborn and children exceedingly accumulate the toxins;
Never mind the host populations being often lower socio-economic, of lesser health and lacking the wherewithal to fight off incinerator proposals;
Never mind the few profiteers leaving it to the government to socialize the health costs;
Never mind the talkfest about circular economies while trudging along linear paths to nowhere.

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