NATIONAL TOXICS NETWORK

Gunning Down the Spin.
The Dirty Reality of Pulp Mill Pollution.

Introduction

The proposal by Gunn's Pty Ltd to establish the world's largest single process line ECF Kraft Pulp mill in Bell Bay, brings with it a very real threat to the local environment. Despite the proponents claims Elemental Chlorine Free (ECF) pulp mills are not 'chlorine free' or 'world's best practice' and they are certainly not closed loop processes. State of the art Totally Chlorine Free (TCF) pulp mills with closed loop systems are world's best practice – but Guns have chosen not to develop such a pulp mill. The current proposal by Gunns is for a pulp mill that relies upon the environment to disperse and dilute its wastes and pollutants to air, sea and land.

When the pulp mill is duly assessed by the Tasmanian authorities it is important that they consider this proposal not only within a narrow legalistic and regulatory framework but also against the far more critical framework of Ecologically Sustainable Development (ESD). When introducing a large, complex and potentially hazardous technology such as a pulp mill into a fragile ecosystem (such as that which surrounds Bell Bay) it is essential to assess it against principles of ESD such as the 'precautionary principle' and 'intergenerational equity'.

It is clear that the Gunns proposal fails assessment against both of these criteria. If the precautionary principle were adopted the proposal would be for a TCF closed loop mill that eliminated or minimized emissions of chlorinated pollutants that will remain persistent in the ecosystem and cause impacts over long periods of time.

If intergenerational equity were important for Gunns then a different feedstock for the mill would have to be considered and only plantation timbers used instead of native forests. Similarly the massive water resource that will be consumed by this mill could have been greatly minimized by use of a closed loop system.

For those authorities interested in the big picture for Tasmania the principles of ESD should be paramount when assessing this pulp mill proposal. Even the most rudimentary examination of the IIS indicates that a precautionary approach has been sidelined in favour of maximizing profits and intergenerational equity has been ignored.

This report draws out the key pollution impacts that are likely to occur if the proposal to establish the pulp mill proceeds. The National Toxics Network is disappointed that Gunns have not taken the opportunity to adopt closed loop Totally Chlorine Free (TCF) bleaching technology that is being used successfully in other developed nations. Gunns decision to adopt ECF pulp mill technology will result in significant toxic emissions to air, land, and marine environments and eventually to groundwater and appears to be based on cost considerations. NTN is particularly concerned about emissions of organochlorines such as the highly toxic dioxins and furans that result from ECF pulp mills in significant quantities and other persistent emissions that can cause impacts upon marine life.

National Toxics Network (NTN) is a NGO (non-government organisation) network working for pollution reduction, protection of environmental health and environmental justice for all. As the Australian focal point for the International POPs Elimination Network (IPEN), NTN hosts the international IPEN working group on community monitoring and body burden and has worked towards the full implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs) 2001 and other relevant international and regional chemical treaties. NTN has a particular focus on children's environmental health

Why is NTN involved?

The Stockholm Convention obliges countries "to reduce the total releases of the byproducts dioxin and furans from man made sources with the goal of continuing minimization and, where feasible, their ultimate elimination". Article 5 refers to the production of pulp "using elemental chlorine or chemicals generating elemental chlorine for bleaching" as a source of dioxin and furans. Best available techniques and best environmental practices are required, while promoting use of ***substitute*** materials.

Executive Summary

This report examines the claims presented by Gunns in its IIS for a massive ECF pulp mill plant in Bell Bay on the Tamar River, Tasmania. The focus of this report is upon the pollution aspects of the pulp mill and its ancillary infrastructure.

There are many potential pollution sources at the pulp mill including boilers, incinerators, effluent treatment processes, chemical manufacturing operations, waste dumps and an ocean outfall for waste liquids.

The process is complex and uses a range of hazardous chemical in its pulping process which generate a myriad of chemical pollutants to air land and sea. Many of the compounds present in the effluent have not been able to be identified in laboratories.

The key issues are that;

- groundwater will eventually be contaminated at the waste dump site and under the pulp mill itself
- The marine dumping of effluent is likely to have a deleterious effect upon marine life and ecosystem integrity. Evidence from similar pulp mills has confirmed impacts on aquatic life and the mechanisms of impact are poorly understood by science. Sub-lethal effects from endocrine disruption and bioaccumulation of chlorinated compounds are believed to play a major role.
- Air quality in population centres around the mill will be negatively impacted. Georgetown already has pollution levels from particulate in excess of the national standards for many days of the year. There will be odor problems from the mill that cannot be resolved.

Detailed analysis of resource consumption (water, timber etc) is beyond the scope of this report, but it is clear from the IIS that this proposal fails key tenets of ecologically sustainable development such as the precautionary principle and intergenerational equity.

NTN is particularly concerned about Australia's obligations under the Stockholm Convention to eliminate and minimize persistent organic pollutants and would like to reiterate its disappointment that Gunns have chosen to propose a chlorinated pulping process that will lead to the formation and disposal of dioxins and furans into the Tasmanian environment. Alternatives such as Totally Chlorine Free plants with virtually closed loop systems could have been proposed to assist Australia in meeting its international obligations.

Groundwater Pollution

Apart from the mill site itself where chemicals will be manufactured and stored two other key areas of the Gunns proposal have been identified as being of high risk for groundwater contamination. These are the **effluent pipeline** and the **industrial waste landfill**. The mill will also be manufacturing and storing significant volumes of hazardous process chemicals on-site which have the potential to leak into the ground, spill into the river or generate toxic gas clouds as a result of fires, spills or explosions. The quantities of these chemicals are listed in Appendix 1 of this report.

Pulp Mill Spills and Leaks

The frequency and magnitude of chemical spills from the mill site, that may impact upon groundwater at the mill site or upon the Tamar River, will depend upon;

- the degree of primary containment security provided (i.e. engineering of storage and process vessels, effluent treatment systems etc)
- the provision and permeability of secondary containment mechanisms (concrete bunding, diversion drains etc)
- the degree and standard to which these containment systems are maintained over time and;
- sufficient regulatory compliance auditing of these systems.

Very little detail is provided on these factors in the IIS and would be best assessed in the detailed engineering specifications for the mill and license/consent requirements. However, my experience of most complex industrial sites containing bulk volumes of hazardous chemicals is that, over time, leaks and fugitive emissions (and therefore groundwater contamination) do occur on a regular basis and can also be expected at a facility such as the pulp mill. This is particular evident where highly corrosive process liquors are used such as caustic and chlorine dioxide. As the plant ages such spills become more common.

Those features of the mill that are able to be addressed in more detail within this report are the effluent pipeline and its marine impacts and the industrial waste landfill and its likely environmental consequences. These are addressed below.

The Effluent Pipeline – Potential Groundwater Impacts.

The effluent pipeline is designed to permit direct deposition of partially treated wastewater to the marine environment through an ocean outfall mounted diffuser about three kilometers off-shore. The IIS indicates that the effluent flow from the mill through the pipeline will be between 73 and 77 million litres per day (Ml p/d) and will include biologically treated mill effluent and sanitary sewage from the mill. This equates to around 70 000 tonnes per day of effluent.

The outfall pipeline will run through two prohibited areas including private recreation areas and low density residential and will be buried to a depth of 700mm making third party leak detection almost impossible. Environmental regulators and the community will have to rely upon Gunns to inform them if the pipeline is leaking and where the leak is occurring. Any large spills from the pipeline will undoubtedly cause environmental harm.

Impacts of effluents leaking from the pipe at different points have largely been dismissed by Gunn's with the claim that the effluent is 'non-toxic'. Scientists studying mill effluent disagree, noting that despite improvements in effluent since substitution of elemental chlorine has been introduced, biotic receptors are still reporting sub-lethal effects such as reproductive abnormalities, bioaccumulation of toxins and liver enlargement.

The pipeline construction is currently not permitted in two areas under the George Town Planning Scheme 1991.[1] The Planning Scheme will have to be amended to allow the pipeline to be constructed in its current form.

More discussion of the toxicity of pulp mill effluent can be found below in the section ***Marine Pollution.***

The Pulp Mill's Toxic Waste Dump

A purpose built waste dump for solid mill wastes (which contain 50% moisture) will be dug 1.5 km north-east of the proposed mill on the far side of the East Tamar highway. The landfill will accept solid waste at a disposal rate of approx 200 tonnes to landfill per day for the life of the pulp mill.[2] The George Town planning scheme would need to be amended to allow this landfill to proceed. It is not a permitted use under the current agricultural zoning.

As for other forms of emissions in the IIS it is difficult to obtain a reliable data about actual waste volumes. While Volume 9 of the IIS quotes a figure of 200 tpd of solid waste (with 350 operational days per year this equates to 70,000 tonnes per annum) Volume 12 (p15) indicates the waste dump will only accept a maximum of 55,000 tpa. Over the lifetime of the mill the IIS estimates that the waste dump will take 1.1 million cubic metres of waste. This is assuming a lifetime for the landfill of twenty years. Under this scenario the footprint of the landfill will be 9.1ha.[3]

Gunns have raised an alternative scenario in which the landfill will expand and operate for the design life of the mill (50 years) and will encompass a footprint of 15.1ha.[4]

Both of these options will require the destruction of over 14 ha of a State Threatened Ecological Vegetation Community. Where it is intended to construct the dump, Gunns have identified High Sensitivity Flora (Sensitivity Rank 3)[5] and at least 3 species of rare plants.[6]While it is beyond the scope of this report assessment of the destruction of threatened vegetation is an issue requiring urgent evaluation.

What Will Be Dumped?

According to Gunns IIS Executive Summary, the following waste types and volumes will be dumped each year. The wastes are described as 'non-hazardous' and are defined either as putrescible or controlled wastes. Some controlled wastes are deemed as hazardous wastes within different jurisdictions depending on the concentrations of given contaminants within them.

Ash from boilers and incinerators and dust from pollution control devices such as electrostatic precipitators (ESP's) concentrate hazardous compounds to high levels requiring careful controls in handling and disposal. Gun's claim that hazardous wastes

[1] IIS 2006 Vol 3 Table 11-1 p 403
[2] IIS 2006. Vol 9 Appendix 20.
[3] IIS 2006. Vol 12 p163
[4] IIS 2006 Vol 12 p163
[5] IIS 2006 Vol 12 Fig 8
[6] IIS 2006 Vol 12 Fig 5

will be sent elsewhere to existing hazardous waste landfills but it is worth noting that the wastes listed in Table 5-1[7] below are likely to be hazardous in their own right.

Table 1 - Waste Types destined for the landfill.

Waste type	**Waste classification**	**Approximate maximum quantity per year**
Solid waste – domestic type	Putrescibles	760 t/y (5,040 m^3/y)
Solid waste – boiler ash	Controlled waste	8,500t/y (11,000m^3/y)
Solid waste - green liquor process dregs, slaker sands and lime kiln electrostatic precipitator dust	Controlled waste	40,000 t/y (40,000 m^3/y)
Total		49,000 t/year (56,000 m^3/year),

Boiler ash will contain dioxin and furans and the concentrations will only be verifiable after the mill has been established. Lime kiln ESP dust will also contain significant quantities of dioxin and furans as well as other persistent chemicals.

Chromium bearing sludge from the chlorate plant of the chlorine dioxide manufacturing facility will also go to the landfill (if this ClO_2 manufacturing option is developed).

Gunns give a brief broad characterization of the mixed solid wastes (with moisture content of up to 50%) above as consisting *primarily of calcium and sodium hydroxides and silicates carbonates with some phosphates and unhydrolysed oxides*[8]

Scrubber Wastes Concentrate Toxins.

A range of other persistent chemicals are known to be present in the production sludges[9] that will be incinerated at different points in the mill processes. The incineration processes serve to redistribute toxins into different forms but cannot destroy them altogether. In order to control airborne emissions from incinerators flue gas scrubbing equipment is installed. The 'scrubbers' utilise a variety of means (wet and dry) to extract toxic particles and gases before the flue gas is expelled to atmosphere. While the scrubbers do not capture all of the toxins and materials, they

[7] IIS 2006 Executive Summary p.23
[8] IIS 2006 Vol 2 p 361
[9] A 1998 analysis of sludge from a British Columbia ECF pulp mill by Enviro-Test Labs in Canada using appropriate QA/QC requirements and analysis methodology (modified EPA method 8240 with automated headspace and GC/MSD/SCAN analysis) found at least forty complex volatile and semi-volatile contaminants including ploy-aromatic hydrocarbons, phenols, benzaldehydes and chlorinated napthalenes.

do collect and concentrate a considerable amount of toxic material. It is this material that is intended for disposal to landfill.

Gunn's have also flagged that they will seek future approvals to spread this contaminated ash and other solid wastes as 'fertiliser' on plantations[10]. Communities in British Columbia and other parts of Canada have been fighting to prevent local pulp mills from spreading sludges and ash on agricultural land due to the contamination risks. The Canadian pulp companies have not released detailed analysis of their sludge characteristics and have withdrawn from public stakeholder processes when pressured to reveal the detailed contents of the mill sludges.

Pollution Risks from the Waste Dump.

Historically landfills in Australia and around the world have been found to leak contaminants from the liquid residues that gather in the bottom of the landfill into groundwater supplies. The liquid residues are known as leachate and are a complex toxic cocktail of chemicals. The liquid is derived from the wastes in the landfill and through additional stormwater infiltration of the landfill. In the past landfills have often been unlined (i.e. no barriers between the waste and groundwater) allowing rapid contamination of local groundwater which is virtually impossible to clean up.

From the 1980's onwards it was believed that the solution to this problem was to install leachate collection systems to drain the toxic liquid out of the landfill for disposal elsewhere and to line the bottom of the landfill with 'impermeable' materials such as High Density Poly Ethylene (HDPE), natural clay, or geosynthetic membranes (or a combination of the above).

Gunn's are proposing to line the dump site with HDPE with a geosynthetic membrane below.

Specifically it is claimed by Gunns that the construction of the landfill will eliminate any potential groundwater contamination. The two main design characteristics to achieve this are;

- leachate collection systems
- liner design.

The leachate collection system design is not discussed in detail here but would normally involve a series of slotted pipes laid in a herringbone pattern on top of or between different liner layers for the dump. The chemical cocktail of leachate drains into the slotted pipes and is collected at a sump or evaporation pond external to the landfill. In this case Gunn's plan to collect the leachate in an external sump and pipe the leachate back to the mill where it will be incorporated into the effluent treatment processes before discharge to the ocean outfall.

Gunns state that the cells of the landfill will be lined with a *'geotextile encased, needle punched geosynthetic clay liner overlain by an impermeable HDPE membrane creating a composite liner that provides containment security'*.

[10] IIS 2006 Vol 1 p368-369

It has to be asked why a '*geotextile encased, needle punched geosynthetic clay liner'* is required if the HDPE liner is impermeable? The answer is quite simply that HDPE is not impermeable and Gunns know it.

In addition the clay liner which are also considered by industry to be impermeable –are anything but that. The reasons that these liners fail are outlined below.

Why Clay Liners Leak.

It has been known since the late 1980's that certain toxic chemicals which are commonly found in leachate (such as such as benzene, toluene, trichloroethylene, and ethylbenzene) can rapidly penetrate clay liners by a mechanism known as diffusion. One US study noted that diffusion will move organic chemicals like benzene through nearly a metre of clay landfill liner in approximately 5 years and will continue to move such organic contaminants through the clay for many years in a steady flow.[11]

Chemicals move through soil in two ways - advection and diffusion. Clay liners have been designed with only advection in mind. Advection is the movement of fluids through soil as normally understood with pressure forcing liquids through the 'gaps' between soil particles much in the same way as rainwater penetrates through the soil profile. Clay of good quality is considered to be 'tight' in this regard impeding the normal transport of liquids through its profile.

Diffusion is different in that the mechanism of movement is driven by molecular activity. Dr Peter Montague of the Environmental Research Foundation explains it this way,

All molecules are in constant motion; this motion is what we call "heat." Hotter molecules are moving more rapidly than cooler molecules. Due to the motion of heat, molecules tend to move from a more concentrated chemical solution to a less concentrated chemical solution. As a consequence of this, the concentrated chemicals inside a landfill tend to move through the bottom clay liner even if there is no pressure pushing them downward. The random motion of the molecules causes the chemicals inside the landfill to move steadily through the clay liner.[12]

Studies have also found that the movement of BTEX through clay liners into groundwater continues *even if the leachate collection systems are working perfectly*.

Why HDPE liners leak.

Gunns may argue that the HDPE liner will prevent any leachate from coming into contact with the clay liner which only acts as an emergency backup if the HDPE liner is split during installation or as the first loads of fill are laid (usually spread with plant equipped with caterpillar tracks that can split liners). Even if this situation does not arise there is widespread industry knowledge that the best HDPE liners leak through pinholes in the plastic welded seams.

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[11] Richard L. Johnson, John A. Cherry, and James F. Pankanow. "Diffusive Contaminant Transport in Natural Clay: A Field Example and Implications for Clay Lined Waste Disposal Sites." ENVIRONMENTAL SCIENCE AND TECHNOLOGY, Vol. 23 (March, 1989), pgs.340-349.

[12] Montague, P., *Clay landfill liners leak in ways that surprise landfill designers*. Rachel's Environment and Health Weekly No. 125. Environmental Research Foundation. April 18, 1989.

Over time leachate from wastes deposited in the landfill will leak through the HDPE liner and geofabric membrane at rates of up to 200 litres per hectare per day[13]. The leachate will contain organochlorine compounds including dioxins and furans as well as a wide range of other persistent pollutants including heavy metals. The material in the landfill is also highly caustic and corrosive.

Common contaminants in putrescible and industrial wastes are organic solvents such as BTEX[14] which, even in dilute form, have been demonstrated to penetrate 100mm HDPE liners in less than two weeks.[15]

It appears that Gunns accept that the landfill will leak over time and that the material in the landfill represents a hazard in terms of groundwater contamination. They acknowledge that despite the double liner, leak rates will be 10- 30 litres a day at full development. This equates to a maximum of 10 000 litres a year of toxic leachate that will enter groundwater from the landfill on best case estimates from the landfill designers and liner suppliers.

Groundwater in the proposed location of the landfill (on a slope) varies between 16m below surface level at the top of the slope and 5m below surface level at the bottom of the slope according the hydrogeological tests in the dry season by Gunns[16]. This is contradicted in other areas of the report which place groundwater levels at 10m (upper slope) and <5m on the lower slopes[17]. The landfill is to be filled progressively from the upper slopes to the lower slopes as new cells are needed.

This is a critical issue as proximity to groundwater will determine the speed of groundwater contamination. The distance to groundwater levels claimed in the report are inadequate as seasonal fluctuations could be expected to see this level rise closer to the surface – particularly as the investigations occurred in the dry season. More long term monitoring is needed for confidence about groundwater levels and background concentrations of metals and suspended solids which have reported significant anomalies in the testing to date.

Gunns comment that if groundwater contamination occurs it will initially be from the upper level of the slope which provides a greater temporal and hydrogeological buffer to groundwater thereby giving time to rectify the situation. What they do not say is that recovering leachate contamination from groundwater is virtually impossible. In addition the flow of groundwater is directly toward the Tamar River. If the leaks occur in the lower section of the landfill their will be very little buffer to groundwater indeed. Scrutiny of the IIS has not revealed the depth of the constructed cells for the

[13] Rudolph Bonaparte and Beth A. Gross, "Field Behaviour of Double-Liner Systems," in Rudolph Bonaparte (editor), WASTE CONTAINMENT SYSTEMS: CONSTRUCTION, REGULATION, AND PERFO RMANCE [Geotechnical Special Publication No. 26] (New York: American Society of Civil Engineers, 1990), pgs. 52-83.

[14] Benzene, Toluene, Ethylbenzene and Xylene

[15] G. Fred Lee and Anne R. Jones, MUNICIPAL SOLID WASTE MANAGEMENT IN LINED, "DRY TOMB" LANDFILLS: A TECHNOLOGICALLY FLAWED APPROACH FOR PROTECTION OF GROUNDWATER QUALITY (El Macero, Calif.: G. Fred Lee & Associates, March, 1992).

[16] IIS 2006 Volume 16 Appendix 55 p32

[17] IIS 2006 Volume 16 Appendix 55 p24

dump and the drawings in the appendices are not to scale. As a result it is impossible to estimate the distance from the bottom of the landfill to groundwater.

In 2006 the Western Australian State government introduced a new *mandatory* buffer of 2 metres between the base of a lined landfill (i.e. the base of the liners) and the maximum groundwater levels. This followed an investigation of a modern, double lined Class 3 landfill (HDPE and clay lined with leachate extraction) sited in a very similar hydrogeological setting to the Gunn's landfill, which was found to leak BTEX, arsenic and other toxic leachate compounds after only 3 years of operation.

Gunns also admit that the waste they will be depositing in the cells from mill process will have a very high alkalinity due in part to the lime residues and caustic. The estimated leachate pH of 9.5 – 12 is highly alkaline. Concern is also expressed by the landfill designers that the wastes may generate significant heat if not hydrolysed prior to dumping and that this is likely to damage liners.

As noted by Gunns below the only barrier left between groundwater and the hazardous leachate is the weathered soils below the clay liner. The 'if' and 'buts' in the paragraph below provide very little reassurance.

'The landfill leachate quality has the potential to affect quality of the groundwater, especially the pH and conductivity, in the event of a significant breach in the landfill liner's integrity. However, the weathered soil between the landfill and the groundwater would attenuate the impact of any leachate lost from the landfill, and the effectiveness of this attenuation will depend on where the breach occurs. Attenuation will be much greater for a breach at the upper end of the landfill than for a breach at the lower end, although the concept design does not rely on this attenuation'[18].

Conclusion

The groundwater at the pulp mill site in Bell Bay will eventually be subject to contamination from fugitive losses at the mill site. The chlorine dioxide and caustic used in the process are highly corrosive and will over time lead to equipment failure and loss of process liquors. The question is not 'if' contamination will occur, but 'how much?' and 'how soon?'

Similarly, the contamination of groundwater at the landfill site is inevitable. The major concern is how long it will take for this contamination plume to reach the Tamar River. The plan to pipe toxic leachate back to the mill effluent treatment plant also increases the risk of spills in the remnant bushland between the mill and the waste dump.

The risk of a catastrophic spill from the effluent pipeline into the Tamar River should be carefully assessed as the claims in the IIS that the effluent will be non-toxic should be dismissed. A wide range of credible scientific evidence demonstrates that post treatment effluent remains toxic and can induced sub-lethal effects in aquatic biotic.

[18] IIS 2006 Vol 16 Appendix 55 p32

The pipeline will be buried (i.e. not visible) and the public is therefore totally reliant on the mill operators to make public an information about leaks or catastrophic failure of the effluent pipe and to initiate remedial action where possible.

Marine Pollution

Kraft pulp mills use massive amounts of water to assist in cleaning pulp to a production standard. It is predicted that this mill will use between 64 000-80 000 m^3 of water per day[19] or between 22-28 million m^3 per annum[20].The wastewater carries a large range of contaminants requiring pre-treatment before discharge off-site. The proposed disposal method of disposal is to pipe the pretreated contaminated wastewater to a point 3km off-shore where it will be dumped in the ocean.

After treatment the liquid waste still contains significant concentrations of toxic chemicals and other pollutants that can harm the marine environment. The dumping point for the effluent pipeline is near Tenth Island – an important breeding colony for Australian Fur Seals. This has particular implications for organochlorine pollutants which will be released at a rate of 41kg p/day according to the IIS. Mammals at the top of the food chain have been demonstrated to accumulate dioxins, furans and other organochlorines in fatty tissues. Gunns have claimed that biomagnification and bioaccumulation of dioxins and furans in marine mammals does not occur. This is completely at odds with global scientific opinion.

In modern ECF pulp mills organochlorine discharges have been significantly reduced by substitution of chlorine dioxide in the bleaching stages of production. This does not prevent the formation of elemental chlorine within the system and so discharges of organochlorines can be expected to continue and therefore expected to accumulate in the fish, mammals and other marine biota near the discharge point. There is growing evidence to confirm that these chemicals are causing sub-lethal effects in marine biota including reproductive abnormalities and liver enlargement.

It has also been recognized that, along with organochlorines, *resin acids* contribute mostly to the inherent toxicity of effluent from ECF pulp mills[21]. As Environment Waikato (New Zealand) point out,

Resin acids are natural plant compounds derived from the wood feedstock. Resin is a hydrocarbon secretion produced by plants…Resin is composed mainly of volatile terpenes, and non-volatile solids which include compounds known as resins acids.[22]

The resin acids are significant in that they survive effluent treatment and the resins, their degradation and transformation products are of toxicological significance in the food chain where effluent is dumped.

In the past environmental assessment of the resins in the receiving waters and sediments of mills has been hampered by a lack of assessment criteria. More recently

[19] Jaakko Poyry ,Pre-engineering Report for IIS Vol 6 Table 3-27
[20] Assuming 350 days operation per year as suggested in the IIS.
[21] Environment Waikato Technical Report 2005/58 (2006) Review of Science Relating to Discharges from the Kinleith Pulp and Paper Mill. Feb 2006. p18
[22]Environment Waikato p 18.

the Ontario Guidelines[23] have been developed which are suitable for assessing resin acids such as dehydroabietic acid and total resin acids.[24] The toxicity of resin acid is of significant concern and Stuthridge[25] notes that resin acids may cause sub-lethal effects in fish at 5-20 ug/l.

The Ontario guidelines for **total resin acid is 25ug/l** and for **dehydroabietic acid is 8ug/l.** (see Appendix 3 for details).

In a recent assessment of a New Zealand ECF pulp mill it was found that resin discharges *increased dramatically* after conversion to the chlorine dioxide process. At the point of discharge from the outfall the effluent contained 109 times the Ontario guideline for total resin acids of 25ug/l reporting a whopping 2725 ug/l. For dehydroabietic acid the effluent at point of discharge measured 28.8 ug/l or 3.6 times the Ontario Guideline.[26]

Bullhead Catfish downstream of the effluent outfall reported a 37 fold increase in resin acids in bile samples compared to bullhead catfish upstream of the effluent outfall. They also had enlarged livers.[27] The pulp mill studied used a combination of softwoods and eucalypt.

In direct contradiction to the New Zealand case study the RPCD claim that chlorinated phenols which are commonly among resin acids (such as *2-chlorosyringaldehyde*) do not need to be monitored! The RPCD rationale for omitting these contaminants from the monitoring review is as follows[28];

Measurement of chlorinated phenols including 2-chlorosyringaldehyde is not necessary for non-chlorine based bleaching processes. Research conducted for the National Pulp Mills Research Program has shown that chloroguaiacols and chlorocatechols are not present in significant quantities in effluents from bleaching eucalypts by modern sequences. The major chlorinated phenol detected in laboratory effluents from chlorine dioxide bleaching of eucalypts is 2-chlorosyringaldehyde. Secondary treatment reduces the concentration of this compound in treated effluent and it is not likely to be detectable in receiving waters or the environment.

However, a commercial in confidence report prepared by Ensis (CSIRO and SCION) for the Tasmanian Pulp Mill Task Force (Department of Economic Development) in February this year noted that Gunns will use predominantly hardwood (eucalypt) but also some softwood (pine) in the pulp mill.

Ensis note that softwoods generate significantly more resins in effluent but that

In our considered judgement, there is very little difference in the environmental impact of treated effluent from a modern bleached kraft pulp mill using pine or

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[23] Provincial Water Quality Objectives of the Ministry of Environment and Energy, Ontario Canada 1994 (reprinted 1999) Table 2.
[24] Environment Waikato p18
[25] Carter Holt Harvey Ltd 1998 Evidence in relation to water resource consent applications for the Kinleith complex. Cites evidence by Trevor Stuthridge, Research Scientist with expertise in characteristics of trace organic contaminants in Pulp and Paper wastewaters.
[26] Environment Waikato p26
[27] Tremblay L, van der Heuval M and West D, 2005. Methods for determining the effects of pollution on fishes. Ministry for the Environment sustainable management Fund Project 5115 Final report .p 49
[28] RPDC *Recommended environmental emission limit guidelines for any new bleached eucalypt kraft pulp mill in Tasmania.Vol 2 p32-33*

eucalypt wood, provided processing conditions are similar and best available technology (BAT) in effluent treatment is employed.[29]

Ensis suggest that the effluent treatment proposed removes the resins and quote a laboratory experiment conducted in 1997 in which 'Virtually 100 % resin acid removals were achieved'[30] and go on to report that 'removal of resin acids during secondary treatment at mills in the USA generally was above 85 %'. [31]

As noted in the Environment Waikato report resin acids survive the effluent treatment process and are having impacts upon fish populations. The Environment Waikato report was not taken into account as part of the Ensis literature review.

In summary, toxic resin acids are present in the effluent at point of discharge at levels of toxicological significance which accumulate in fish after they have been through the effluent treatment system and should therefore be reinstated to the modelling and monitoring regime for any ECF pulp mill effluent.

Another major concern noted in the report was the presence of sterols in both softwood and eucalypt based effluent that is suspected of inducing reproductive effects (endocrine disruption) in fish. As Ensis note

The sterols in unbleached kraft pulps from E. globulus wood were degraded by chlorine dioxide during ECF bleaching and the transformation products were in the bleaching filtrate (Freire et al 2005). The possible biological activity of these products has not been investigated.

In short there is insufficient information to determine why and how sterols in effluent from ECF pulp mills are impacting the reproductive capacity of fish. Yet there is no requirement for the Gunns pulp mill to monitor or model concentrations of these sterols in their outfall.

Modeling requirements not met in the IIS

The IIS is required by the Scope Guidelines to address the impacts of the effluent pollutants in the marine environment by modeling the predicted impacts at the discharge zone and then conducting further dispersion modeling. Tasmanian government agencies have already indicated to Gunn's that the modeling in the IIS is inadequate to predict contaminant concentrations due to a lack of fine resolution. Further modeling is claimed to be underway but is not available to the public.

The Scope Guidelines require that deposition modeling be conducted for total suspended solids. Gunn's have failed to conduct such modeling relying instead upon a claim that this fraction of the effluent will be buoyant 'rising quickly to the surface' to be dispersed by wind, wave and current actions. Modeling of TSS may have proven difficult for Gunn's as they appear confused as to the actual amounts of TSS they will dump per day. Volume 1 1.4.5 (p63) claims that 1.3 tonnes per day of total suspended solids (TSS) will be dumped at the end of the outfall yet at Vol 3 Table 11-9 p.21 it is claimed the true quantity is 2.1 tonnes per day or 766 tonnes per annum..

Inadequate Baseline Monitoring to Predict Impacts.

[29] Ensis 2006 *Literature Review – toxicity of pulp mill effluents*. Client Report 1631.
[30] Slade et al 1997
[31] LaFleuer and Barton 1997

The contaminated effluent must meet Water Quality Objectives at the discharge zone at the end of the pipeline. Water Quality objectives usually required to be met in Australia are defined in the ANZECC Guidelines (2000). However, in the case of this proposal the IIS states,

"the temporal period of water quality monitoring for this study was considered insufficient to determine water quality objectives as suggested in the ANZECC Guidelines (2000). As such consultation with DTAE…interim water quality objectives for the ocean outfall." (Vol 3 p17)

It is not acceptable that baseline condition monitoring, a critical dataset for determining pollution impacts and modelling conditions, remains substantially incomplete. As such no claim can be made that the current modelling is conservative – on this basis alone it is significantly flawed.

Table 2 Interim Water Quality Objectives negotiated between Gunns and Tasmanian Government

Parameter	Interim WQO mg/l
TSS	32.0
BOD5	3.3
COD_CR	2360
AOX	0.046
TDS	41,000
Colour	7.0 PCU
Chlorate	2.0

The effluent pipeline is designed to permit direct deposition of wastewater to the marine environment through an ocean outfall mounted diffuser about three kilometers off-shore. According to the IIS, wastewater from the mill will contain a range of contaminants as listed in Table 3 below. However the values used in the modeling of contaminant concentrations at the dumping zone are significantly reduced a can be seen in Table 4 below.

The reduction in values used in the model directly contradicts the claim by Gunn's that the modeling for pollution loads at the discharge point of the pipeline are conservative. Gunn's admit they have *not* used maximum measured background levels in modeling.[32]

Aquenal PTY LTD have directly measured higher AOX levels in background than used in the model (up to 0 .026 mg/l instead of 0.0176) indicating that if a combination of higher background values for AOX and maximum AOX in effluent were used – then WQO for organochlorines will not be met.

Gunn's have also used lower background values for AOX and BOD than the maximum values measured by Aquenal Pty Ltd as part of the data gathering exercise for inputs into this model. The result is that the model is not conservative in its

[32] IIS 2006 Vol 3 p 429

estimates of contaminant loading of effluent and is not conservative in its assumptions about background loading levels of the marine environment into which the effluent will be dumped.

The IIS concludes that AOX will exceed the Water Quality Objectives (for 5% of the time) if highest measured background levels of AOX are used. An assumed level of background BOD has been set at 2.5mgl. If actual levels of BOD are measured at 3mg/l then the WQO will be exceeded 100% of the time (i.e. effluent discharges will likely exceed WQO limits for BOD and AOX.). The maximum levels of BOD measured by Aquenal Pty Ltd were 3mg\l[33] not the 2.5mg/l listed in the model inputs of Table 11.11.[34]

Table 3. Effluent characteristics (IIS, Vol 2)

Effluent Characteristics[35]	mg/l
TDS	3000-3500
BOD	5-15
COD	300-400
TSS	20-40
Chloride	500-700
Sulphate	200-400
Sodium	700-900

Table 4. Claimed Effluent Characteristics for Modeling Water Quality Objectives at Point of Discharge. (IIS Vol 3)

Effluent Characteristics[36]	Concentration (mg/l)	Daily discharge
TDS	2190	153 tonnes per day
BOD	11	.75 tonnes per day
COD	330	23 tonnes per day
TSS	30	2.1 tonnes per day
AOX	5.90	41kg per day (146 tonne pa)
Colour	220	25.5 tonnes per day
Chlorate.	1.8	125 tonnes per day

Organochlorine (AOX) pollution - Implications for Fur Seals

[33] IIS 2006 Vol 3 p421
[34] IIS 2006 Vol 3 p429
[35] IIS 2006. Vol 2 p495-496
[36] IIS 2006. Vol 3 Table 11-9, p.423

Among many other pollutants in the effluent over forty kilograms per day of organochlorines will be dumped into the ocean at the end of the outfall pipe. Many organochlorines are persistent in the environment and highly toxic – particularly dioxins and furans. ECF pulp mills have been demonstrated to release quantities of organochlorines that have a significant negative effect on aquatic life forms.

Concerns have been raised by the public about the impacts of organochlorine wastes upon marine life and specifically fish which will be eaten by Australian Fur Seals in an adjacent breeding colony.

Dioxins and furans are highly toxic in very small amounts. Even at extremely low levels, dioxins are very persistent, semivolatile and mobile, travelling great distances in air and water. They are fat-soluble, bioaccumulating in humans, wildlife and fish, and are transferred from mother to fetus, in-utero and through breastmilk.[37] Not only do humans transfer dioxin to their offspring in this way – so do mammals such as seals.[38]

Increasingly organochlorine contamination of marine mammals through food web accumulation is being blamed for illness, death and deformities as in the case of Russia's Baikal Seal *(Phoca sibiric).* As noted by the international Seal Conservation Society;

'*There is a serious problem of pollution in Lake Baikal, research showing that organochlorines and other chemical pollutants build up through the food web in the Lake and accumulate in the seals as top-level predators. These pollutants can cause disease, reproductive problems and lowered immunity in the seals. Identified sources of this pollution include the agricultural use of pesticides, including DDT, and the emissions and discharges of PCBs and dioxins from industrial activities in the towns around the Lake. Particularly heavy pollution has been found in the vicinity of the Baikalsk and Selenginsk Pulp and Paper Plants and the power plant at Sludianka.*[39]'

The Baikalsk Pulp and Paper Mill relies on the older elemental chlorine method for bleaching and while treating its waste water before release, it is still reported to dump hundreds of kilograms of organochlorines into Lake Baikal every year. The Gunn's mill is claimed to be a state of the art ECF (Elemental Chlorine Free) plant which releases dioxin and other organchlorines at much lower levels than the elemental chlorine plants.

However it is interesting to note that the Russian pulp mill is required to treat its waste waters to a high degree. Indeed, 'the waste waters of the plant go through four stages of treatment: complete biological, chemical, mechanical and additional biological treatment.'[40] Issues of chlorine pollution aside it is concerning to note that independent studies of the plants effluent puts the concentration of sulphates (after

[37] NTN Lloyd-Smith (2006) Pulp Mill Brief. Dioxins.

[38] Beckmen et al., Science Total Environment. 1999 Jul 1;231(2-3):183-200.Factors affecting organochlorine contaminant concentrations in milk and blood of northern fur seal (Callorhinus ursinus) dams and pups from St. George Island, Alaska.

[39] http://www.pinnipeds.org/species/baikal.htm

[40] S.A.Gurulev, The face of Baikal – Water http://www.bww.irk.ru/baikalwater/pollution.html

treatment) between 300-324 mg/l and chlorides at 73.9mg/l.[41] This compares rather favorably to Gunn's predicted release of sulphate at 200-400mg/l and chloride at 500-700mg/l. It is disappointing that a so-called 'state of the art' pulp mill in Australia cannot (or will not) at least meet the same effluent cleanup levels of an ageing soviet pulp mill.

Further evidence of organochlorine toxicity to fish was demonstrated in a 1997 Canadian study which showed genetic damage to juvenile salmon from the diluted effluent from an ECF mill.[42] One 1994 Australian study cited in the National Dioxin Program reported results for the analysis of carp samples from Lake Coleman which received effluents from a treated pulp and paper mill with concentration in the 4 carp samples between 0.48 – 4 pg I-TE g^{-1} wwt.[43]

Contrary to the extraordinary claims by Gunn's IIS that dioxin is *not* bioaccummulative, most reputable scientific organizations hold the opposite view.

ANZECC (2000) have stated that dioxin *is bioaccumulative* in marine mammals... The Australian Federal Department of Environment and Heritage agree that dioxin *is bioaccumulative* in marine mammals.[44]This view is also shared by the USEPA who list dioxin (2,3,7,8 TCDD) as 'Persistent, highly toxic and bioaccummulative'.[45] The growing list of authoritative institutions who further isolate Gunn's spurious claims on dioxin include the (US) Agency for Toxic Substances and Disease Registry[46].

In fact no literature can be found to support Gunn's extraordinary view that dioxin is *not bioaccummulative* – particularly in higher trophic order organisms with high body fat content.

While it has been claimed by Gunns in this IIS that a paper by Wan et al (2005) provides '*direct evidence for lack of biomagnification of dioxins through trophic levels of a food web*' even casual scrutiny of the paper refutes this claim. In fact the paper by Wan et al (2005) states initially that *'Many investigations have highlighted the bioaccumulation of dioxins in animals'* and then goes on to explain the difficulties in explaining the movement of dioxins through the food web.

The footnote for Gunn's emphatic claim explains that Wan et al studied a variety of different trophic level species including … 'three invertebrate species, six fish species, and one marine mammal.' However closer scrutiny of the paper by Wan et al reveals that the study actually included 'three invertebrate species, six fish species,

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[41] E.N.Tarasova et al (1992) POLYCHLORINATED BIPHENYLS AND MERCURY IN SEDIMENTS AND AQUATIC BIOTA, NEARSHORE JUVENILE FISH COMMUNITIES AND FOOD WEB STRUCTURE IN THE LOWER SELENGA RIVER, RUSSIA

[42] Easton, et al. "Genetic Toxicity of Pulp Mill Effluent on Juvenile Chinook Salmon (Onchorhynchus Tshawytscha) Using Flow Cytometry." Water, Science, & Technology. 35, 2-3 (1997).

[43] Ahokas J, Holdway D, Brennan S, Goudey R, and Bibrowska H 1994, 'MFO activity in carp (Cyprinus carpio) exposed to treated pulp and paper mill effluent in Lake Coleman, Victoria, Australia, in relation to AOX, EOX, and muscle PCDD/PCDF', Environmental Toxicology and Chemistry, vol. 13, pp. 41-50.)

[44] State of the Marine Environment Report for Australia: Pollution -Technical Annex 2 http://eriss.erin.gov.au/coasts/publications/somer/annex2/richardson.html

[45] Hazardous Waste Characteristics Scoping Study – USEPA Office of Solid Waste, Nov 15 1996.

[46] ATSDR. 1998. Toxicological Profile for Chlorinated Dibenzo p dioxins. Draft Report. Agency for Toxic Substances and Disease Registry, Division of Toxicology, Atlanta, Georgia. February.

and one marine bird.' It appears that Gunn's have 'accidentally' used data from analysis of a Herring Gull to draw their conclusion about the Australian Fur Seal.

Conclusion

It appears from the inconsistencies in the IIS that the water quality modeling is *not* conservative as it has not used maximum effluent contaminant levels as inputs to the model. Further, the maximum background values for some important parameters (such as AOX and BOD) have not been applied in the model which relies on lower background levels than those peak values measured by Aquenal Pty Ltd.

If the model is conservative (as claimed by the IIS) then the maximum values would have been applied in the model. When this is done it is clear that Water Quality Objectives cannot be met for BOD for 100% of the time and will be exceeded for AOX (organochlorines) *at least* 5% of time. It appears the IIS has rounded down the concentrations of pollutants in the effluent in order to allow the model to predict that Water Quality Objectives can be met (except for AOX). It is clear that the effluent from the mill will negatively impact water quality and if truly conservative modeling was conducted the impacts would be unacceptable.

The extraordinary claims by Gunn's that dioxin does not bioaccummulate in marine mammals is at odds with the global scientific community and brings into question the credibility of the IIS. It appears to be a distorted pseudo-scientific argument to deflect legitimate community concerns about the impacts of the dumping over a 100 tonnes a year of organochlorines (including dioxins) into the ocean near a seal breeding colony. It is an argument with no scientific credibility.

Air Pollution

All ECF pulp mills generate air pollution. They are often highly odorous and can have amenity impacts for many kilometers due to the sulphurous components in the stack gases. While the unpleasant odours may impact upon the lifestyle and amenity of adjacent population centres they are not always harmful to health. Other emissions from pulp mills can be harmful to health.

The IIS for the mill relies on a number of predictive techniques and methodologies to assure authorities and the public that the mill will not contribute to any air quality or public health problems as a result of its operations. These include process design considerations that are claimed to reduce emissions and meet regulatory limits, modeling of predicted impacts of the air pollution from the mill (i.e. where it will fall and in what concentration) and then a health risk assessment as to whether the concentrations modeled pose a health risk in addition to existing background levels.

It is beyond the scope of this report to critique all of these techniques in detail but a number of issues relating to the air pollution potential of the mill are raised below.

Dioxins and Furans

NTN has great concern about the toxic emissions that can arise from pulp mills that use chlorine in the bleaching system (in this case chlorine dioxide) and which then subject process liquors and residues to reduction steps via incineration. NTN is particularly concerned about dioxins and furans (polychlorinated dibenzodioxins and polychlorinated dibenzofurans or PCDD's and PCDF's) which are formed as a byproduct of incineration when both chlorine and carbon are present in the incinerator fuel.

The Gunns ECF mill has processes which are known to produce dioxins and furans (which are highly toxic at minute levels) from burning of lignin/black liquor and the incineration of sludges for chemical recovery as well as other process sources.

The main processes which are sources of concern for PCDD and PCDF production as well as other airborne pollutants are the;

- power boiler,
- recovery boiler,
- lime kiln and
- concentrated non-condensable gas incinerator(s)
- bleach plant
- chemical plant
- waste water treatment plant, (comprising liquid surface area sources at clarifiers and aeration basins)

The RPDC note that for the purposes of emission estimations of dioxins and furans UNEP regards ECF and TCF plants as essentially equivalent, however in 2003, the UNEP Expert Group on Best Available Techniques and Best Environmental Practices in their Draft Guidelines on Pulping Processes clearly stated that in "TCF bleaching the formation of dioxins and furans is zero." Examination of the available literature indicates that for ECF plants this not the case.

In a highly sensitive comparison of the dioxin content of samples of ECF and TCF pulp produced by the same mill showed that while a measurable amount of dioxin (in the form of tetrachlorinated furan) was formed in the ECF bleaching process, there was no evidence of dioxin formation in the TCF process[47]. Similarly, in 1995 another study compared ECF and TCF pulp and identified 2,3,7,8-TCDF in chlorine dioxide bleached pulp.[48] Chlorinated dioxins and furans have also been detected in air sampling from a Finnish ECF mill[49], and have been reported in sludge from another ECF mill in North Carolina[50].

[47] Barry Commoner, Mark Cohen, Paul Woods Bartlett, Alan Dickar, Holger Eisl, Catherine Hill, Joyce Rosenthal (June 1996) DIOXIN FALLOUT IN THE GREAT LAKES, Where It Comes From; How to Prevent It; At What Cost, Center For The Biology Of Natural Systems, Queens College, Cuny, Flushing, New York. Available at <http://www.qc.edu/CBNS/dxnsum.html> Cited in NTN 2006 Pulp Mill brief http://www.oztoxics.org

[48] Rappe, C. and Wagman, N., (1995) Trace Analysis of PCDDs and PCDFs in unbleached and bleached pulp samples. Organohalogen Compounds 23: 377-382 Cited in NTN 2006 Pulp Mill brief http://www.oztoxics.org

[49] Rodenberg, C., Kontstas, H., Jappinen, P., Tornaeus, J., Hesso, A., & Vainio, H (1994) Airborned chlorinated dioxins and furans in pulp and paper mill. Chemosphere 29 (9-11): 1971-1978 Cited in NTN 2006 Pulp Mill brief http://www.oztoxics.org

[50] Gleadow, P., Vice, K., Johnson, A., Sorenson, D., & Hastings, C., (1996) Mill application of closed cycle technology. Proceedings 1996 Non Chlorine Bleaching Conference, Orlando Fl. March 1996 Cited in NTN 2006 Pulp Mill brief http://www.oztoxics.org

In regards to air emissions, side reactions during chlorine dioxide bleaching lead to the formation of chloroform, chlorinated phenolics and other chlorinated organics, as well as phenol and methanol. Chloroform, dichloroacetic acid methyl ester and other volatile organochlorine compounds have been found in the vent gases of mills using 100% chlorine dioxide substitution.

These compounds have also been found to volatilise from the treatment ponds of these mills, but were almost non-existent when investigated in a TCF mill[51]. Moreover, the presence of organochlorines in both filtrates of ECF bleach liquors and in sludges from treatment plants means that they cannot be incinerated without the emission of products of incomplete combustion including the dioxins and furans (PCDDs and PCDFs).[52]

The precursors for the chlorinated organic chemicals are not present in TCF bleach plants and therefore dioxin formation is highly unlikely.

It is noted that the pulp mill stacks will be monitored for dioxins and furans quarterly in the first year of operation and twice yearly thereafter. The monitoring method will be the European Standard (CEN or Comité Européen de Normalisation) method EN 1948:1997 with sampling period of 4 hours minimum and 8 hours maximum[53].

Concerns were raised over this form of testing by Belgian scientists when investigating dioxin emissions from municipal waste incinerators. It was found that a sampling methodology that assessed PCDD and PCDF emissions over back to back two week periods (as compared to the 4-8 hour period of the EN 1948:1997 method) reported PCDD and PCDF emissions 30-50 fold higher than in the same stacks using the 4-8 hour samples[54]. The sampling results correlated with a previously unexplained elevation of PCDD and PCDF in soils surrounding the incinerators. Unless the 'continuous' (2 week back to back) method of sampling is introduced, significant under-reporting of PCDD and PCDF emissions can be expected.

As the RPDC have set a PCDD/PCDF limit 0.1ng I-TEQ /Nm^3 (monthly average) for the Recovery boiler, Power Boiler and lime kiln, the total dioxin air emission limit for the mill site is 3 times that which would be expected for an operation such as a municipal waste or medical waste incinerator. Again this would need to be quantified by the continuous dioxin sampling methodology. One or more additional incinerators may be constructed at the mill site to combust non-condensable gases. These have been given no emission limit for dioxin.

Acid Gas and Particulate Pollution

The RPCD has set emission limits for a range of industrial pollutants that are to be expected from ECF pulp mills.

These include the acid gases sulphur dioxide, sulphuric acid mist and hydrogen chloride as well as NO_x, PCDD/PCDF and residual sulphur (for odor).

[51] Juuti, S. et al. "Volatile Organochlorine Compounds Formed in the Bleaching of Pulp." Chemosphere. 33,3 (1996).
[52] Paul A. Johnston, Ruth L. Stringer, David Santillo, Angela D. Stephenson, Irina. Ph. Labounskaia, Hannah M.A. McCartney, (1996) TOWARDS ZERO-EFFLUENT PULP AND PAPER PRODUCTION: The Pivotal Role of Totally Chlorine Free Bleaching November 1996. Technical Report 7/96
[53] RPDC, Summary of the Review. Table 13, note p. page 47
[54] De Fre. R and Wevers M., (1998) Underestimation in dioxin emission inventories. Organohalogen Compounds, Vol 36 (1998)

Gunns have already indicated that they will not be able to meet the NO_x emission limits for the power boiler and have asked that the RPDC revise them upwards[55].

Most Tasmanians are aware and concerned about the poor air quality in the Tamar Valley Air Shed and the issue of heavy particulate pollution in the Launceston area. Particulate pollution has been the subject of intense study in recent years and has been found to have significant impacts on respiratory health. The most commonly assessed particulate is PM 10 (particulate < 10 microns in diameter) and more recently PM 2.5 (particulate < 2.5 microns in diameter). It is PM 2.5 that has been found to have significant health implications. Due to the small size of the particles, they have the ability to penetrate the lungs, cause respiratory disease and carry adsorbed toxins into the human body.

Ambient PM2.5 has not yet been studied in detail in Australia but can be assumed to occur as a fraction of all PM 10 that is reported. The IIS estimates that 88% of all PM10 is actually PM 2.5[56].

The National Environmental Protection Council (NEPC) has developed National Environmental Protection Measures which include a Measure for Air Quality. In the Air Quality Measure limits are set for ambient (background) air on the basis of health risk assessment. These are not stack limits for individual industrial facilities.

The Air Quality NEPM states an ambient limit for PM 10 of $50ug/m^3$. However the Tasmanian Air Quality EPP sets a Design Ground Concentration Limit of $150ug/m^3$ for PM 10 explaining that'

The NEPM criteria are not relevant to assessing the impact of individual sources of emissions to the atmosphere, except to the extent that the emissions from the point source would prejudice compliance with the air quality goals for that air shed under the NEPM.[57]

In other words two official views exist as to what ambient concentrations of particulate should be – a federal and state view. This has great significance for the TVAS as the modeling conducted for the IIS indicates that some areas *already exceed* the NEPM ambient limits for particulate between 7 to 49 times per year.[58] *The pulp mill has only been required to keep its particulate emissions within the* $150ug/m^3$ *limit at ground level beyond its boundaries.*

In other words there is a significant particulate pollution problem in the TVAS with major contributions from wood heaters and existing industry. Introducing a major new source of particulate to the local air shed cannot be seen to be in the interests of public health and should not be justified through reductionist risk assessments.

Georgetown will exceed acceptable levels.

[55] IIS Vol 6 Appendix 7 p.15
[56] IIS Vol 9 App 16 p21
[57] IIS Vol 9 App 16 p14
[58] IIS Vol 9 App 16 p 5 data from DPIWE's AQMS at Ti Tree Bend

One location identified through the air pollutant modeling in the IIS of concern was Georgetown (south) which reported short term peak levels of PM 10 and PM 2.5 at well over 100% of the criterion limit. NO_2 was at 40% of the criterion and SO_2 at 20% of the criterion.

Gunns are however confident that the mill will make little difference to pollution levels and in regard to Georgetown note

'… the mill contribution to these peak levels is zero (i.e. the exposure at these locations to NO_2 SO_2 and PM10 is (and will continue to be) due to existing industries in Bell Bay).[59]

Such a statement tests the credibility of the IIS yet again as Gunns attempt to make the argument that all of the other industries in Bell Bay cause impacts of PM10, PM 2.5, SO_2 and NO_2 at Georgetown but that the pulp mill contribution will be zero.

This claim strains credibility to the limit (and beyond) when it is clear that the mill eject over 100, 000kg of particulate into the local air shed every year and will share the prevailing winds with other industries that are causing air quality problems.

Conclusion

The Gunns pulp mill will release dioxins and furans into the Tamar Valley airshed along with acid gases and fine particulate. The addition of such significant quantities of respiratory irritants and airborne toxics to an already overloaded air shed can only result in increased incidence of public health impacts.

The DGLC's for particulate set by the RPDC are too high and should be substituted for NEPM values. The odors from the pulp mill will cause amenity impacts on adjacent population centres and are highly unlikely to be prevented by any of the mitigation measures described in the IIS.

Georgetown will continue to experience poor air quality which is likely to be exacerbated by the development of the pulp mill.

Appendix 1

[59] IIS Vol 9 App 16 p 42

Annual Chemical Consumption in tonnes per annum [60]

Many of these chemicals will be used for the production of bleaching agents. The chemical manufacturing facilities planned are listed in Appendix 2.

salt (merchant chemical plant)	50 000 tpa
salt (base case: IDP chemical plant)	35 000 tpa
sulphuric acid (base case: IDP chemical plant)	300 tpa
sulphuric acid (merchant chemical plant)	23 238 tpa
hydrochloric acid (base case: IDP chemical plant)	200 tpa
caustic soda (base case)	5 075 tpa
caustic soda (merchant option)*	18 700 tpa
sulphate	14 151 tpa
peroxide (base case: IDP chemical plant)	2 200 tpa
peroxide (base case: with final P stage)	11 093 tpa
sand	3 000 tpa
limestone	24 750 tpa
burnt lime	6 875 tpa
magnesium sulphate	250 tpa
urea	1 551 tpa
aluminium sulphate	1 100 tpa
baling wire	1 334 tpa
defoamer	550 tpa
talc	550 tpa
sulphamic acid	20 tpa
phosphoric acid	165 tpa
sodium carbonate	388 tpa
flocculation aids	132 tpa
filtering aids	204 tpa
boiler water & steam chemicals	20 tpa

Appendix 2

[60] IIS Vol 6 Table 3-28 p40. Note: More will potentially be produced on site for merchant purposes

Chemicals Used in the Bleaching Process and planned on-site Chemical Manufacturing Plants[61].

The chemicals used in the bleaching process at the pulp mill will be:

- Oxygen
- Sodium hydroxide
- Chlorine dioxide
- Hydrochloric acid
- Sulphuric acid (under some operating scenarios)
- Hydrogen peroxide
- Sodium bisulphite

The following on-site production facilities are planned:

- Alkali plant including brine preparation
- Oxygen plant
- Integrated chlorine dioxide plant consisting of
  - Hydrochloric acid synthesis
  - Sodium chlorate electrolysis
  - Chlorine dioxide plant

Appendix 3

Ontario Guidelines (Water Quality Objectives) for Total Resin Acids and Dehydroabietic Acid in Receiving Waters.

[61] IIS Volume 6 p58

Resin Acids (Dehydroabietic Acid and Total Resin Acids)
dehydroabietic acid (DHA) - CAS No. 1740-19-8

Total Resin Acids - includes: abietic acid CAS No. 514-10-3; sandaracopimaric acid CAS No. NA; isopimaric acid CAS No. 5835-26-7; levopimaric acid CAS No. 79-54-9; neoabietic acid CAS No. 471-77-2; palustric acid CAS No. 1945-53-5; pimaric acid CAS No. 127-27-5;

Interim PWQOs[5]: Interim PWQOs for Dehydroabietic Acid (DHA) and Total Resin Acids are pH dependent as shown below:

	Interim PWQO	
Receiving water pH	**DHA (µg/L)**	**Total Resin Acids (µg/L)**
5*	1	1
5.5*	2	3
6*	2	4
6.5	4	9
7	8	25
7.5	12	45
8	13	52
8.5	14	60
9*	14	62

*** - pH is outside the range of the PWQO for pH**