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Gunns Limited
Bell Bay Pulp Mill Project
TASMANIA

In the matter of the Bell Bay Pulp Mill Project: A project of State Significance Resource Planning and Development Commission inquiry

Proponent: Gunns Limited

EXPERT WITNESS STATEMENT DR ESA KARI VAKKILAINEN EXPERT OF GUNNS LIMITED

1 NAME AND ADDRESS

Dr Esa Kari Vakkilainen
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2 AREA OF EXPERTISE

My area of expertise is in the design and operation of pulp mill recovery systems including boilers for energy generation.

I hold a Master of Science (1982), Licentiate of Technology (1986) and Doctor of Philosophy (1993) from Lappeenranta University of Technology in Finland, and have undertaken graduate studies at the Institute of Paper Science and Technology, Atlanta, USA. While completing my postgraduate studies, I worked for four years as an assistant professor at Lappeenranta University, teaching and researching furnace heat transfer, optimization of combined cycle processes, district heating and the combustion of biofuels.

I then commenced working at the Ahlstrom boiler works in Varkaus in Finland, where I was involved in dimensioning the steam generator thermal design and also worked on my first kraft pulp mill recovery boiler project in 1989. I joined Jaakko Pöyry as a consultant in 2001.

I have worked on the design and upgrade of recovery systems in about 20 kraft pulp mill projects around the world since I started working for Jaakko Pöyry, and have been working on the conceptual design of the recovery systems for Gunns' Bell Bay pulp mill since January 2005.

I am presently an Associate Professor at Lappeenranta University and the Helsinki University of Technology, have lectured and spoken to technical conferences around the world on recovery boiler systems, and was the Technical Chairman of the 2004 International Chemical Recovery Conference in Charleston, South Carolina.

I have written over 100 conference and research papers which have been published in industry, scientific and engineering journals and publications, and I am also the author of a book entitled 'Kraft Recovery Boilers – Principles and Practice', published by Suomen Soodakattilayhdistys r.y[1] (the Finnish Recovery Boiler Association – the peak body for professionals working in this field) Valopaino Oy, Helsinki, Finland. The book was published in 2005.

My qualifications and experience are detailed in Attachment 1.

[1] Suomen Sookakattilayhdistys r.y. (www.soodakattilayhdistys.fi)

I am sufficiently expert to make this statement because of my 20 years research and academic experience on the design and operation of boilers and recovery systems, my international experience in advising pulp mill operators, and my role in undertaking the conceptual design of the recovery systems proposed for the Bell Bay pulp mill.

I am fluent in Finnish, English, Swedish, French, German and Portuguese and use these languages in my professional work, although my mother tongue is Finnish. In preparing this report I have been assisted by the legal advisers briefed by Gunns to ensure that this written report clearly and accurately expresses my opinions in English.

3 INTRODUCTION

Volumes 6 and 7 of the Draft Integrated Impact Statement ("Draft IIS") set out the conceptual design of Gunns' proposed pulp mill. I wrote the sections of that report which deal with the recovery and gas destruction systems and the power boiler. I adopt Volumes 6 and 7, which should be read in conjunction with this witness statement.

Although not personally responsible for all of the detail contained in those volumes, I adopt their content for the purposes of this witness statement.

I have had the opportunity to review the witness statement of Kari Tuominen and I adopt the remarks made by him in section 3 of that statement concerning the involvement of Pöyry in the design development of the Bell Bay project.

In addition to those remarks I add that I was responsible for recovery system design and I was the author of sections 3.4 (the recovery aspects only), 3.5, and 3.8.4-3.8.10 of Volume 6 of the draft IIS, and two of the specialist papers in Annex XV of Volume 7 (on NOx concentrations and fuels for the power boiler).

4 SCOPE

In this witness statement I have been instructed to:

- Present an overview explaining the operation of the recovery systems proposed for the Bell Bay pulp mill, which comprises the evaporation plant, the recovery and power boilers, lime kiln, recausticizing plant, and the malodorous gas destruction systems; and
- Respond to issues raised in public submissions and in the Beca Amec report to the Resource Planning and Development Commission ("RPDC") that are within my area of expertise. In doing so, I have:
  - Provided a detailed explanation of, and justification for, the proposed malodorous gas destruction systems;
  - Explained why the in-stack NOx emissions from the main stack exceed the emission levels recommended in the RPDC's *Development of new environmental emission limit guidelines for any new bleached eucalypt kraft pulp mill in Tasmania* (2004);

- Provided a detailed explanation of the gaseous emissions calculations;
- Outlined the solid waste streams from the recovery system, and in particular the extent of dioxins and furans in that waste stream; and
- Clarified the capacity of the evaporator plant to handle spills.

5 OVERVIEW OF PULP MILL OPERATIONS

I have prepared a power point presentation which will form the basis of my oral evidence. Attachment 2 to this statement is a complete set of the slides that comprise that presentation.

The presentation addresses the following two issues:

- Presentation of Process Areas – Recovery : It is intended that Pöyry will provide an oral presentation of the process areas within the mill. While I am familiar with the overall design concept and operation of the proposed pulp mill, I will concentrate my discussion upon the recovery processes, leaving others in the team with more specialised knowledge to comment upon detailed aspects of the pulp mill such as the woodhandling, cooking and bleaching operations and the water and effluent treatment; and
- Malodorous gas recovery system : the Bell Bay pulp mill design concept includes collection, destruction and recovery of malodorous gases generated at the mill. My presentation includes the description of the basic design. I also address some questions raised in submissions about the malodorous gas system, which I also deal with later in this statement.

5.1 Overview of Recovery Systems

In summary, the recovery system has the following key elements:

- The evaporation system is designed to evaporate weak black liquor from the washing operations. The secondary condensate from the evaporation system is re-used in the pulping process, and the strong black liquor is combusted in the recovery boiler.
- The recovery boiler is where organic material, including organic content of the strong black liquor from the evaporation system, is combusted. A key by-product of this process is steam, which is used to drive turbogenerators to make electricity. Sodium sulphide and sodium carbonate are also recovered from the combustion process as molten ash (or smelt), which is then diverted to the causticizing plant.
- The causticizing plant is where the sodium carbonate in the green liquor is converted to sodium hydroxide by applying lime which produces white liquor for cooking. Non-process wastes, such as dregs and grits, are by-products of this process which are disposed of to landfill. The lime mud by-product is transferred to the lime kiln for treatment and recovery.
- The lime kiln is where lime mud is heated to generate lime.

– The turbo-generator produces electricity from steam generated by the recovery boiler and power boiler.

– The power boiler burns available biomass, such as sawmill residues, fines from the wood chip mills, residues from the forest, and primary sludge (see my paper on this issue in Annex XV, Volume 7 of the Draft IIS). The steam generated by this process is used to drive the turbo-generator.

A detailed discussion of these systems is described in my presentation at Attachment 2 and in sections 3.8.4 – 3.8.10 of Volume 6 of the Draft IIS.

5.2 Malodorous Gas Recovery Systems

My presentation at Attachment 2 also describes the malodorous gas destruction system. There are two types of malodorous gases generated by the pulp mill which will be captured and destroyed by the malodorous gas recovery system:

– Concentrated non-condensable gases (**CNCGs**) mainly from the cooking plant and the evaporation plant (specifically, the foul condensate stripper, evaporator surface condenser, foul condensate tank and firing liquor tank).

– Dilute non-condensable gases (**DNCGs**) mainly from the fibre line, the evaporation plant, sumps and various tanks.

If these malodorous gases are not captured and destroyed, they can escape from the pulp mill and adversely affect the amenity of nearby areas. This was a major problem for many pulp mills designed before about 1990. In about 1990 government agencies in some countries made it mandatory for all pulp mills to be retrofitted or designed to include technology that would capture and destroy CNGCs.

I have designed a gas recovery and combustion system to capture and destroy the NCGs with the following features:

– Recovery boiler; and
– Dedicated NCG boiler.

Both the recovery boiler and the dedicated NCG boiler are continuously on line and responsible for destroying all CNCGs and all DNCGs produced throughout the mill. They have a design capacity that allows for 150 % of normal operating conditions.

In normal operation, this system will ensure that at any one time there will be two places where both CNCGs and DNCGs are destroyed. This provides a built in redundancy in normal operation.

I have designed a system with further built-in redundancies as follows:

– An additional NCG boiler which duplicates the capacity of the first NCG boiler. This duplicate boiler would ordinarily remain inactive but can be brought on line in the event that either the recovery boiler or the dedicated NCG boiler is not operational, therefore ensuring that, other than in extreme cases where two out of the three boilers are not operational, there will be full capacity for the destruction of the gases;

- In the extreme event that two of the three NCG boilers are off line, the system is designed to be able to divert DNCGs to be destroyed in either the lime kiln or the power boiler, although this is not appropriate for ordinary operations. The remaining boiler on line will then be able to be dedicated solely to the destruction of CNCGs, which can be achieved efficiently in one boiler; and
- In the unlikely event that all three boilers are off line, the CNCGs will be treated in the scrubber and vented through the main stack, with the effect of reducing the presence of sulphur compounds by approximately 70 %.

Detailed descriptions of these systems are contained at section 6.3.11 of Volume 1 and section 3.8.10 of Volume 7 of the Draft IIS, as well as my presentation at Attachment 2.

6 RESPONSE TO SUBMISSIONS AND RPDC REPORTS

I have reviewed the submissions made in this case that is related to my area of expertise and have identified those submissions that raise issues that require further substantive explanation or clarification beyond what is included in Volume 6 and 7 of the Draft IIS. I deal with those matters in this section of my statement.

In addition to submissions raising substantive matters, many submission raising incidental issues or drafting queries were referred to me for comment, often arising from the text of Volumes 1 to 4 of the Draft IIS. I have considered these matters and provided my comments and understand that these matters will be dealt with by others.

6.1 Malodorous Gas Destruction System

Design principles

A number of submissions have raised questions on the recovery and malodorous gas destruction systems.

In designing the recovery and malodorous gas destruction systems, I was expressly asked by Gunns to minimise atmospheric emissions, and ensure the malodorous gas destruction system was robust and had sufficient redundancies so that malodorous gas emissions from the pulp mill could be prevented in the event of an upset or equipment failure.

In designing the pulp mill, Pöyry considered the minimum emissions achievable with use of AMT technology, and especially the choice of number of independent destruction units.

As a team, Pöyry concluded that the use of a system with triple redundancy for both CNCG and DNCG, which exceeds the AMT, would be the best approach in this case, and made this recommendation to Gunns.

As a team, Pöyry concluded that the use of a system where DNCGs and CNCGs are continuously burned during start-up, shutdown and plant upsets, would be the best approach in this case, and made this recommendation to Gunns. In typical AMT mills, NCGs are emitted from stack during shutdown.

Because a number of submissions have been made concerning the recovery and malodorous gas destruction systems, I include in this statement some additional material that was not included in the Draft IIS to further substantiate the recommendation made by Pöyry.

Using flare to destroy CNCG

The Beca Amec review of the Draft IIS has suggested that there could be a fourth or additional level of redundancy by including a flame burning stage that could burn the CNCGs in the event of a total failure of all three burners.

This technology could be included as an additional level of redundancy, but it is necessary to have regard to the consequences of including this added protection.

Flame burning of the gases will only be required in the event that all other gas destruction burners are not operational. Given the high level of redundancy built into the system I have designed, the probability of this occurring is extremely low, and the environmental impact is likely to be minor.

If a flame burner is included it must be understood that at full function its maximum destruction efficiency will be about 95%. To put that figure in perspective, the proposed NCG burner operates at a destruction efficiency of 99%. The flame burner must be at a temperature of 900 degrees celcius to achieve full destruction capacity.

If the flame burner is not kept burning at all times it will take approximately 5 minutes for the flame burner to achieve maximum destruction efficiency. Even if the flame burner is burning, it will ordinarily take about 2 minutes to achieve maximum destruction efficiency. In either case there will be the release of some NCGs. Reliability of flame burners has often been lower than desired, resulting in the release of NCG while the problems are sorted out.

To keep the flame burning continuously natural gas must be burned.

It is my opinion that in the circumstances the gas destruction system that I have designed is more than adequate and that a flame burner will not add significantly to the protections built in to the design but will increase the demand for natural gas.

AMT malodorous gas destruction is described in EU IPPC BAT document p. 108 as follows:

> *Besides the chosen gas treatment system the final TRS emissions are determined by the number of units that are connected to the gas collection system and the availability of the treatment system including back-up systems. Released fugitive TRS emissions consist mainly of non collected diluted malodorous gases. The availability depends on the gas treatment system, the number and type of back-up systems and the monitoring and control of the system. High availability of the gas treatment system can be achieved for instance by*
>
> – *use of a dedicated incinerator with SO_2 scrubber as the major unit and by use of the lime kiln or an alkaline scrubber as one back-up and a flare as a second back-up.*
> – *incineration of the strong and weak gases in the recovery boiler and use of the lime kiln as one back-up and a flare as a second back-up.*

The amount of units and options for malodorous gas treatment in Bell Bay pulp mill clearly exceeds this. In addition, 100 % of CNCGs and 100% of DNCGs can be destroyed during shutdown at the Bell Bay pulp mill.

Evaporator area as a source of TRS

The Beca Amec review of the DIIS has suggested that the Bell Bay design has omitted the collection of fugitive emissions from evaporator area. I disagree with that statement. In page 121 of Pöyry report 16B0104-E0035, Volume 6 of the draft IIS, the second paragraph states:

"*The evaporator plant will be provided with BAT-level CNCG and DNCG malodorous gas handling and elimination systems as well as washing liquor and spill containment and recovery systems*."

The concept design for the DNCG collection from the evaporator area at the Bell Bay mill is similar to other pulp mills that have been built recently, including the Stendal pulp mill in Germany which is referred to by Beca Amec.

There is nothing special about the evaporator area of modern mills that would make it a significant source of fugitive emissions when compared with other parts of the mill, where the same liquors and streams are pumped throughout the various other processes. In fact the European Commission Reference Document on Best Available Techniques in the Pulp and Paper Industry p. 27 does not mention evaporator as a major source of DNCG

"*Weak gases are emitted from chip pre-steaming, screening, pulp washing, the smelt dissolver and tank ventilations etc*."

Contrary to Beca Amec's assertions:

– The pump seals do not typically leak smelly gases as sealing water is used;
– Sump in evaporator area is collected to the DNCG destruction system;
– In the Bell Bay proposal, air from the methanol room is collected to the DNCG destruction system;
– The DNCG system in use at the Stendahl mill is best to my knowledge fairly typical without claimed distributed vacuum system to collect air around glands and seals
– The evaporator in the Stendahl mill does not have complete enclosure of the basement of the liquor evaporation system by a 6 metre high wall (evaporator building has walls if that is what was meant); and
– I have failed to find references from professional literature to the fact that there is substantial NCG escape from modern evaporation (termed fugitive emissions by Beca Amec).

Even assuming that fugitive emissions were to occur, it would be a localised event, most apparent close to the source of the emission.

There is therefore no justification for including the whole of the evaporator area within the DNCG collection system.

Burning DNCG and auxiliary fuels in lime kiln

In normal operation, all of the DNCGs from recausticizing will be burnt in the recovery boiler. It is possible to destroy DNCG from the lime kiln by burning them along with the secondary air.

The lime kiln fuel is natural gas. This fuel can be supplemented by other fuels depending on their availability. For example, if necessary, methanol and turpentine can be burnt in the lime kiln as fuel. Also, hydrogen is produced by some of the chemical plant options being considered by Gunns. This hydrogen can successfully be burnt in the lime kiln.

6.2 NO_x Issues

Sources of NO_x Emissions at the Bell Bay Pulp Mill

There are two sources of NO_x emissions at the Bell Bay Pulp Mill:

- Recovery boiler, lime kiln and the NCG boilers. A number of submissions have queried why the in-stack concentrations of NO_x from these sources exceed the level recommended by the RPDC in the *Development of new environmental emission limit guidelines for any new bleached eucalypt kraft pulp Mill in Tasmania* (2004); and
- The power boiler.

In-Stack NO_x Emissions

In designing the pulp mill, Pöyry considered the minimum emissions achievable with use of AMT technology and especially the choice of auxiliary fuel (fuel oil versus natural gas).

As a team, Pöyry concluded that the use of natural gas and AMT would be the best approach in this case, and made this recommendation to Gunns. However this choice means that, if most environmentally friendly operating practices are adopted, the emission limits specified in the *Development of new environmental emission limit guidelines for any new bleached eucalypt kraft pulp mill in Tasmania* (2004) cannot be met.

The main factors behind the inability to meet NOx emission limits are described in Volume 7, Annex XV of the Draft IIS, 16B0104-E0014 "NOx issue".

Because a number of submissions have been made concerning the NOx issue, I include in this statement some additional material that was not included in the Draft IIS to further substantiate the recommendation made by Pöyry.

The *Development of new environmental emission limit guidelines for any new bleached eucalypt kraft pulp mill in Tasmania* (2004) set an in-stack NO_x emission for a bleached kraft eucalypt mill (excluding the power boiler) at 1.3 kg NO_2/ADt.

I prepared a paper on this topic which is contained in Annex XV of Volume 7 of the Draft IIS.

In that paper I propose a limit of 1.6-1.7 kg NO_2/ADt.

The emission guideline for NOx was based upon the Swedish practice of firing the lime kiln with oil. It is widely acknowledged that oil-fired lime kilns will produce lower levels of NOx, but this does not mean that natural gas-fired lime kilns are inappropriate. Beca Amec has agreed that natural gas fired lime kiln is an appropriate technology for use in a mill. It has also conceded that slightly higher NOx emission levels should be allowed for lime kilns that adopt a natural gas firing system.

Leaving aside the broader environmental advantages of using natural gas over oil (vehicle movements, handling etc), it is more appropriate to take a holistic approach to determine the limit of NOx.

In this case, natural gas has been chosen as the fuel for a number of reasons, including the proximity of the site to a natural gas resource.

As an alternative to using oil instead of natural gas as the recovery boiler fuel, in-stack NO_x concentrations could be reduced by making substantial modifications to the operation of the recovery boiler by:

- Reducing the furnace temperature, which would result in an increase of SO_2 emissions; and/or
- Reducing the air ratio in the recovery furnace, which would result in an increase of poorly combusted emissions of CO, VOC and PAH.

Although it is technically possible to reduce the NOx to the emission guideline limit (whether originally published in the emission guidelines or altered to account for the natural gas fired lime kiln) in this way, to do so will result in an increase in other environmental impacts.

As Beca Amec have pointed out, examples of this method can be found in Sweden. In Sweden however there are no emission limits for CO, VOC and PAH and little concern has been expressed by regulatory regimes about these pollutants.

In my opinion, it is much better to derive emission limits in a holistic way, based upon the consequences of trying to achieve those limits balanced against the actual potential impact. In this case, it is unhelpful to focus on achieving the recommended in-stack NO_x concentrations if that will, as a result, cause higher emissions of carbon monoxide, SO_2 and TRS from the pulp mill.

Use of SNCR to reduce Power Boiler NOx

Some submitters have queried why SNCR technology has not been proposed to reduce NOx.

BAT is achievable by primary measures without SNCR technology.

SNCR technology to reduce NOx from Power Boilers is used in California and Sweden. It is not common elsewhere. The method involves the removal of NOx by injecting ammonia or urea, which reacts with the NO.

One significant problem with this method is that not all of the ammonia or urea will react with the NO, resulting in the release of ammonia to the environment. A 2-15 ppm ammonia slip is common.

In addition, the cost of NOx reduction by SNCR is higher than by other methods that could be used in (eg electricity production).

6.3 Gaseous Emissions Calculations

A number of submissions have raised questions about the variability of emissions to atmosphere.

In designing the pulp mill, Pöyry considered the typical emissions to atmosphere that are achievable with use of AMT technology.

As a team, Pöyry concluded that using AMT equipment would be the best approach in this case, and made this recommendation to Gunns.

At Appendix 3 I have provided a detailed explanation of how the gas emission rates were calculated.

6.4 Solid Waste Streams

A number of submissions have raised issues about the quality and quantity of solid waste streams.

In designing the pulp mill, Pöyry considered the typical waste steams that are disposed of with the use of AMT technology.

As a team, Pöyry concluded that building a solid waste landfill would be the best approach in this case, and made this recommendation to Gunns.

Annex VII in Volume 7 of the draft IIS describes the type and quantities of solid waste estimated to be produced by the proposed pulp mill. Of particular relevance to my evidence is the data for ash from the power boiler, green liquor dregs, slaker sand and dust from the lime kiln ESP.

Attachment 4 to this statement contains my review of the solid waste streams data and also estimates the concentrations of dioxins and furans in the solid waste streams.

It is important to note that many solid stream fractions that have been counted as going to landfill could be either re-used or disposed of by means other than landfill. Typically, lime kiln ESP ash, which is pure lime, can be sold as a fertilizer or used in forests as a fertilizer. While these other options may be available to Gunns, the conservative approach is to assume that all these solid waste streams will be disposed of to landfill.

6.5 Excess Capacity for Handling Spills

Some submitters have queried the excess capacity of the plant for handling spills. The following table shows the excess margin.

Extra evaporation capacity		Eucalyptus	Pine
Annual production	ADt/a	1 100 000	
Daily average	ADt/a	3143	2043
Evaporation - Department Design Capacity[2]	t H_2O/h	1200	1200
Balance value (with reserve, spills and water ingress)	t H_2O/h	1155[3]	988[4]
-spills	t H_2O/h	67	43
-reserve 10 %	t H_2O/h	120	120
-total	t H_2O/h	187	163
Evaporation (without reserve and spills)	t H_2O/h	968	825
Extra capacity for handling spills	%	19 %	31 %

6.6 Dioxins and Furans

Some submissions have queried the levels of dioxins and furans in various waste streams from the Bell Bay pulp mill.

Hannu Jäppinen will deal with the question of dioxins and furans in effluent.

I deal here with those submissions concerning dioxins and furans in air emissions, solid waste disposed to landfill, and their respective amounts in the leachate,

Dioxins and furans to the air

Dioxins and furans in the Bell Bay pulp mill air emission streams are predicted using Canadian practice. These values are based on a compilation of measurements in the US made by NACASI and measurements in Canada made by Paprican[5].

These predicted levels are contained in Attachment 3. It should be noted that the levels are much below the emission limits specified in the *Development of new environmental emission limit guidelines for any new bleached eucalypt kraft pulp mill in Tasmania* (Volume 2).

Dioxins and furans in solid waste streams and leachate

Dioxin and furan levels in pulp mill solid waste streams have not generally been considered problematic. Dioxins and furans in the Bell Bay pulp mill solid waste streams and leachate are predicted using Canadian (Paprican) data. These values are based on a compilation of measurements in the US made by NACASI and measurements in Canada made by Paprican[6].

These predicted levels are contained in Attachment 4.

[2] DIIS, Volume 6, table 3-2 at Page 26
[3] DIIS, Volume 7, Annex I Pulp mill main dimensioning, Annex ID, Page 2-2
[4] DIIS, Volume 7, Annex I Pulp mill main dimensioning, Annex IC, Page 2-2
[5] Uloth, Vic and van Heek, Ron, 2002, Dioxin and furan emission factors for combustion operations in pulp mills. NPRI Guidance document, http://www.ec.gc.ca/pdb/npri/2002guidance/dioxin2002/dioxin_combustion_e.cfm
[6] Uloth, Vic and van Heek, Ron, 2002, Dioxin and furan emission factors for combustion operations in pulp mills. NPRI Guidance document, http://www.ec.gc.ca/pdb/npri/2002guidance/dioxin2002/dioxin_combustion_e.cfm

The use of UNEP Guidelines

Some submissions have queried the levels of dioxins and furans from the Bell Bay pulp mill using estimations based on 2003 UNEP Guidelines. It is important to note that caution must be used before placing reliance upon the "National dioxin program in Australia", which suggests that pulp and paper production emission to land is 100-1000 times greater than emissions to air and water[7].

The data in that document does not present the true picture as it relies upon the UNEP Guidelines 2003 to estimate land emissions. The more recent UNEP Guidelines of 2005[8] has markedly decreased its estimation of emissions to land.

UNEP 2003 had used a value of 1000 µg TEQ/t Ash, whereas UNEP 2005 uses 50 µg TEQ/t Ash to estimate emission residue for power boilers. UNEP 2005 acknowledges the fact that recovery boilers do not generate disposable ash. It should also be noted that the UNEP guidelines use a conservative approach, i.e. they use estimates from the high end of the available data.

Canadian (Paprican) estimates are more in line for pulp mills which, like Bell Bay, do not burn chlorine contaminated wood and do not dispose of sludges to landfill.

With Paprican values the emission to:

- Air is about 10 % of UNEP 2005 values; and
- Land is about 1 % of UNEP 2005 values.

General Comment

A precautionary or conservative approach has been taken here. The use of AMT technology further minimises the air emissions of dioxins and furans. In practice it is expected that the actual emissions of POPs will be lower than the levels predicted. This comes about as a result of more efficient combustion and better mixing of flue gases in the recovery boiler and power boiler furnaces.

7 DECLARATION

I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have, to my knowledge, been withheld from the Commission.

…………………………………..
Dr Esa Kari Vakkilainen

[7] National dioxins program, dioxins in Australia: a summary of the findings of studies conducted from 2001 to 2004, table in page 3

[8] United Nations Environment Programme, Standardized toolkit for identification and quantification of dioxin and furan releases. 2005, Prepared by UNEP Chemicals Geneva, Switzerland, 2nd edition February 2005, 250 p.