

SECTION 12 RECOMMENDATIONS

It is our recommendation that any authorisation for PPC to burn the secondary materials listed in this document should be granted subject to the following conditions:

12.1 COMPLIANCE WITH POLICIES

PPC comply with its own Secondary Materials Policy, as well as the ACMP Policy on Secondary Materials.

12.2 CAUTIONARY APPROACH

PPC may only proceed with one waste stream category at a time from trial burn to full-scale production. Only once stable operation is attained for cement production for the first waste stream, will PPC consider application of a second waste stream category (which will be one of the other 5 waste streams included in this application). This second waste stream will commence with a trial burn, following the same monitoring, measurement and auditing procedures as required. Only once authorisation is granted for the second waste stream, in addition to the first, will full-scale implementation of both streams commence. This process shall be repeated for each additional waste stream. Thus PPC shall implement a cautionary, step-by-step process of gradually adding a waste stream through the “trial burn-approval-stabilising of kiln” process before commencing the same process with another waste stream. Under no circumstances will a new waste stream be introduced without stable kiln operation (whether or not waste streams are currently being burnt), a proper trial burn and reporting to the authorities and independent audit.

12.3 TRIAL BURNS

- a) Trial burns are to be conducted prior to full-scale implementation of any new secondary material category per kiln and per waste stream.
- b) The emissions from the trial burn shall be reported, and full-scale production will only commence once the emissions profile and the other conditions in this section are met.
- c) For the purposes of the trial burn, PPC may perform preparation of the waste streams in order to facilitate the safe feeding and metering of such to the kiln. Such preparation will be limited to physical preparation in such a manner as to avoid the generation of noxious or offensive gases and any chemical alteration of the waste streams.
- d) Given the minor quantity of wastes to be burnt in the trial burn, a dedicated storage area shall be constructed adjacent to the kiln facility according to guidelines set out by DEAT.
- e) The waste streams shall be present on-site for no longer than 90 days, and residual waste not consumed in the trial burn shall be removed from site and disposed of to a suitably permitted facility within 7 days of completion of the trial burn.
- f) The feeding of the waste streams to the kiln during the trial burn shall occur by means of formal and controlled feeding equipment to the kiln only. Temporary or informal conveying systems to these feed systems shall be employed only for the trial burn.
- g) Full baseline and emissions monitoring, and independent auditing shall be performed and reported on to the authorities. Only once written approval of these results has been received from the authorities, may full-scale production commence.
- h) If dioxin emissions measured during the trial burn warrant it, then PPC shall install suitable mitigation measures. A repeat of the trial burn employing such measures shall be performed before full-scale implementation may proceed.
- i) Specific limits for compounds and elements tolerated in waste materials should be determined and published as the “Acceptance Criteria” for each kiln. This shall be

submitted as part of the Trial Burn report to the authorities within 90 days of the trial burn occurring, and shall specifically be approved by the authorities prior to full-scale implementation for that waste stream commencing.

- j) In order to ensure that the waste streams to be burnt in the trial burn are representative, as far as practicable, of the normal operational scenario, PPC will ensure the following:

Table 5: Waste Streams to be sourced for Trial Burn

Waste Stream	Source of Waste Stream
Waste tyres	As the chemical composition of tyres does not deteriorate significantly with time, there are no specific requirements relating to the age of the sample.
Sewage Sludge Pellets	Fresh (i.e. 1 month old) pellets shall be prepared off-site by an independent contractor/municipality from a normal sample of sewage over several days. The preparation process shall be inspected by the independent auditor for the presence of any other contaminants or pre-treatment.
Pulp and Paper Waste:	Industrially produced paper waste will be sourced or paper waste generated at Dwaalboom, and prepared to the requirement of the kiln concerned.
Plastic waste:	Unrecyclable plastic waste will be sourced from municipalities after being sorted. The material will be shredded and analysed to ensure that the waste is suitable for the kiln process.
Hydrocarbon sludges and liquids:	Fresh arisings from an industrial source will be used.

- k) It is important that the coal and feed material quality remains constant during the entire trial burn so as to avoid introducing any variables into the process. PPC will therefore ensure the consistency of such feed in advance (such as moisture content of feed, etc.) by monitoring weather and preparation conditions.
- l) During the trial burning exercise, the waste shall be fed at a constant rate, most closely resembling that of anticipated operating conditions or until a feed rate is established which complies with the predicted emissions rate.
- m) No further burning of waste streams applied for in this application may occur until:
- Written confirmation has been received from the authorities to proceed with full-scale operations, and
 - Formal storage and feed systems have been constructed and tested on site.

12.4 FULL-SCALE PRODUCTION

Secondary Materials combustion will cease if PPC is unable to meet the emissions inventory (measured as dry and at 10% O₂) as stipulated in Table 12-2.

Table 12-1: Secondary Materials emission limits

MAXIMUM ALLOWABLE EMISSION LIMITS	
POLLUTANT	LIMIT
Total dust	As per current APPA permits
CO	As per current emissions
HCl	10 mg/Nm ³
HF	1 mg/Nm ³
NO _x	As per current emissions
SO ₂	50 mg/Nm ³
TOC	10 mg/Nm ³
Cd +Tl (sum of elements)	0.05 mg/Nm ³
Hg	0.05 mg/Nm ³
Sb, As, Pb, Cr, Co, Cu, Mn,Ni + V (sum of elements)	0.5 mg/Nm ³
Dioxins toxic equivalence	0.1 ng/Nm ³

- a) Though the Infotox Report recommends that current emissions for Mercury, Lead and Cadmium must be adhered to for future emissions, after commencement of the Secondary Materials Co-Processing Programme, it is the recommendation of the Scoping Report that EU Limits be adhered to for these parameters. This is based on the fact that the current emissions of these metals are not available, and that coal used in the cement kilns already contains various quantities of metals. Although the Community Health Risk Assessment only considers inhalation, the EU Limits have been adopted on the assumption that they consider all health impacts including inhalation and ingestion of these metals.
- b) An automatic cut-off device must at all times be installed in the feed line of secondary materials to enable immediate discontinuation of feed during upset conditions. Feed should only be possible again once the kiln operation is stable again under normal loads. This device should be linked to a continuous carbon monoxide monitor.
- c) In general, a “failsafe” design philosophy on control instrumentation should be adopted for SM utilization. Feed of secondary materials shall be cut off when instability exists or kiln stoppages occur. Secondary fuels are only utilized if the kiln is operating above 70% of kiln rated production. (This limit is only an indication, and is different from kiln to kiln and will have to be established for each kiln independently). This excludes the current practice of using waste oil for kiln start-up purposes. In most cases, waste fuels should not be used during start-up and shut-down of kilns, except where kiln temperatures are achieved to produce clinker that meets quality standards. Waste fuels should not be used during failure of the air pollution control devices (i.e. ESP at the stack of the kiln). This does not apply to CO purging.
- d) When using hazardous waste such as hydrocarbons as a secondary material, dual flow measurement should be considered, to prevent undetected incorrect feed rates.
- e) For quality assurance reasons, a limit for Cl content in total feed (fuel and raw material) would be 310 mg total input (fuel and raw materials) per kg clinker produced. The majority of this chlorine (i.e. > 90%) should only be used on the fuel input for preheater/calciner kilns, such as the two kilns at Dwaalboom, to ensure low PCDD/F emissions. This limit will,

- however, be reviewed subject to emissions monitoring results during trial burns and commissioning.
- f) When using secondary raw materials which contain volatilisable organics, these must be fed to the kiln on the fuel path (and not on the raw material path). PPC must establish the maximum organic carbon content for all secondary materials to be considered as secondary raw materials.
 - g) In cases where the concentration of Cr VI exceeds the normal range found in cements made without secondary materials, leaching tests should be conducted.
 - h) PPC shall employ the approaches detailed in Table 12-3 to feeding the various waste streams into the kiln:

Table 12-2: Feed systems for Secondary Materials

Waste Stream	Method of Feed to Kiln
Waste tyres:	
	Back end of preheater of calciner kiln. Mid kiln injection of tyres to long dry kin.
Sewage Sludge Pellets:	
	Feed through main burner. In calciner of preheater kilns, the sewage sludge can be fed to secondary firing point.
Pulp and Paper Waste:	
Dry	Feed to the calciner or back end.
Plastic waste:	
Dry	Small granules fired through the main burner. Larger pellets to the back end or the calciner.
Hydrocarbon sludges and liquids:	
Received in drums	Drums are decanted into a feed system that can feed the material to the back end, calciner or the main burner depending on the characteristics of the liquid or sludge.
Received in tankers	Unloaded into a liquid feeding system for use at the main burner or back end of the kiln.

12.5 MONITORING AND MEASUREMENT

- a) A full baseline assessment shall be conducted prior to the introduction of the waste streams in the trial burn, using normal fuels (i.e. coal) and feed material.
- b) No burning of secondary materials will occur post trial-burn until Opsis monitors are installed and calibrated. The Opsis monitor will measure the following parameters: NO, NO₂, SO₂, HCl, HF, CO and benzene. The Codel monitors currently installed at each stack will continue to monitor the particulates concentrations on-line.
- c) Any measurement of emissions will have to be reported at a specified oxygen level (typically 10%) and dry (i.e. no water vapour). PPC will need to ensure that this is communicated to any external specialists performing such measurement, and that their Opsis on-line emission monitors will be able to accommodate such. The conversion formulae back to 10% O₂ will need to be approved by CAPCO.
- d) All monitoring shall include isokinetic sampling and analysis at SANAS or equivalent accredited laboratories according to ISO, EPA or ASTM methods for the following parameters:

- i. CO, CO₂,
- ii. NO_x, SO₂,
- iii. HCl, HF,
- iv. All metals (as per standard ICP analysis) and Mercury and Thallium,
- v. Total Chromatographable Organics or TCO (which includes all VOC's and SVOC (semi-volatile organics)),
- vi. Dioxins and furans, PCB's, PAH (polycyclic aromatic hydrocarbons). This is compulsory for the baseline and trial burn monitoring, but for further monitoring, please refer to the next point (e).
- vii. Total Particulate Matter (TPM, or cement kiln dust).

With the exception of dioxins, TCO, PCB's and PAH's (see next point), the monitoring frequency for the above, post-trial burn, will be one month after full production secondary materials co-processing **per waste stream**, and annually thereafter. If a new waste stream is added to the secondary material programme, then the monitoring schedule resets itself, and monitoring should be performed one month after full production recommences with the new waste stream, etc.

- e) TCO, PCB's and PAH measurements, given their cost, will be performed only when required, i.e. if these compounds are present in the secondary materials being fed to the kiln. Dioxin measurements will only be performed if the secondary materials contain chlorides **or** carbon in any quantities above detection limits, **and** are being introduced into the back-end (i.e. the raw material feed side) of the kiln. When dioxin measurements are required on this basis, the following dioxin monitoring schedule be adhered to for each waste stream introduced to the kiln:
 - i. Before (i.e. baseline) and during the trial burn, as well as
 - ii. After one month of running full scale secondary materials consumption, and
 - iii. Annually thereafter.
- f) All the above scenarios will be performed with the raw mill running and the raw mill down (in the case of in-line mill system) for the first year of sampling. The emissions monitoring exercise conducted for the baseline assessment shall be repeated for the trial burn in exactly the same fashion as for the baseline monitoring.

12.6 EXTERNAL AUDITS AND REPORTING

- a) PPC shall employ an independent environmental auditor to audit the operations against the conditions of the Record of Decision and legal requirements, on the following frequency:
 - During the trial burn (please refer to Section 4);
 - Commencement of full-scale production;
 - 6 months after commencement of full-scale production;
 - One year after commencement of full-scale production, and
 - Annually thereafter.
- b) The scope of the audit shall cover all operations and supporting paperwork of the sourcing, sampling and analysis, acceptance, transportation, storage and preparation on site, operation, monitoring, reporting, staff training, emergency preparedness and response procedures and processes.
- c) The acceptance of a new waste stream (i.e. from a new waste source, or a new waste category or type within the 5 listed in terms of this application) shall be reported to the

authorities (Provincial Environmental Department) with full details regarding its source, quantity and composition 14 days prior to the planned combustion thereof.

- d) All external analysis results shall be provided directly from the emissions sampling contractor to the independent auditor, along with original laboratory results. The auditor shall then compile a report on the trial burn, and provide this to the authorities within 30 days of the date of the trial burn.

12.7 OTHER AUTHORISATIONS REQUIRED AFTER TRIAL BURNS BUT BEFORE FULL-SCALE PRODUCTION

- a) All new applications of secondary materials not included in the list of waste materials included in this application shall be subject to a separate EIA application.
- b) All relevant legal requirements must be met and specifically assessment in terms of the OSH Act concerning "Major Hazard Installation Regulations" must be submitted to the Department of Labour prior to commencing with full-scale production.
- c) PPC will need to register their waste storage facilities as a Waste Disposal Site in terms of the Environment Conservation Act, 1989 (Act 73 of 1989), section 20, and ensure compliance with DWAF's Minimum Requirements for temporary storage of hazardous waste.
- d) PPC must apply for and comply with the requirements of Scheduled Process No. 39 of the Atmospheric Pollution Prevention Act of 1965 as applicable to Class 1 incinerators, subject to guidance from DEAT in terms of the APPA review process current at the time of writing.

12.8 SAMPLING AND ACCEPTANCE, TRANSPORTATION, HANDLING AND STORAGE OF WASTE STREAMS

- a) PPC shall comply with a stringent sampling and analysis protocol for all waste samples prior to acceptance, as described in Section 4.1. Specialized analytical facilities and resources for such will be required at PPC Jupiter, and PPC shall demonstrate compliance of such to SANS 17025 and SANAS accreditation of such centralised facilities. A satellite laboratory will be available at Dwaalboom for fingerprint confirmation. Thus an "accept-refuse" model for secondary materials based on known information concerning limits and restraints as well as principles as set out in PPC's policy should be developed
- b) Due cognizance should be given to possible incompatibility of secondary materials during handling and transport in accordance with SANS 10232-1, Annexure F. Liquid streams shall be stored separately to solid wastes. Flammable liquids (i.e. hydrocarbon sludges) shall be stored separately to substances with a high oxidizing potential. Waste streams with toxic components (such as metals, PCB's) shall be stored separately from other toxic waste streams.
- c) Where hazardous wastes are to be used as secondary materials, assessment of all their safety & health hazards will be required and MSDS information will be compulsory.
- d) Procedures governing the transportation of hazardous waste will be compiled in accordance with the relevant SANS codes under the National Road Traffic Act (i.e. SANS 10232-1 to 3). These procedures, as well as the Sampling and Acceptance Procedure detailed in section 12, shall be included in all audits recommended by this report.
- e) The appointment of the waste transport contractor shall be subject to the contractor complying with the following:
 - Compliance with all requirements of the National Road Traffic Act and associated SANS codes for Transportation of Dangerous Goods.
 - All Emergency Response equipment as stipulated in the Transport Emergency Card (as prescribed by SANS 10232-4) shall be carried on the vehicle.

- All drivers carry a Professional Driver's Permit and are trained in HAZMAT response.
 - All documentation relevant to the load is accurate and complete.
 - The contractor has contracted adequate emergency response facilities along the route from the Generator to the PPC plant.
 - All placarding and emergency information relevant to the load is displayed by the transport contractor.
- f) Establish suitable and safe transfer systems from transportation to the storage area to avoid SHEQ risks from spillage such as fugitive emissions or vapour displacement. Suitable vapour filtration and capture equipment should be in place to minimize impact to the reception point and surrounding areas from unloading activities.
- g) PPC shall assure that storage facilities fit their purpose. Appropriate storage for liquids should meet relevant safety and design codes for storage pressures and temperatures.
- h) Solid materials handling systems should have adequate dust control systems.
- i) Storage design should be appropriate to maintain the quality of the materials: for solids, prevent build-up of old materials; for liquids, mix or agitate to prevent settlement, etc.
- j) PPC shall design transfer and storage areas to manage and contain accidental spills into rainwater or firewater, which may be contaminated by the materials. This requires appropriate design for isolation, containment and treatment. Appropriate storage for liquids should have adequate secondary containment.
- k) There should be written procedures and instructions in place for the unloading, handling, and storage of the solid and liquid fuels and raw materials used on site.
- l) Designated routes for vehicles carrying specified fuels and raw materials should be clearly identified within the site.
- m) Appropriate signs indicating the nature of materials should be in place at storage, stockpiling, and tank locations. Storage halls should be fitted with water sprinkler systems and be vented to control accumulation of solvent vapours (which could be sent to the kiln).
- n) Tanks containing hydrocarbons should be fitted with an explosion safety device. Additional devices may be considered such as atmosphere control (e.g. N₂ inertisation) and temperature control (e.g. shell cooling), etc. depending on the results of the HAZOP study.
- o) Equipment should be grounded and appropriate anti-static devices and adequate electrical devices selected (e.g. motors, instruments, etc.).
- p) All dry material should be stored in protected warehouses and liquid material in engineered and bunded storage facilities. In particular, transfer of wastes from the transporter should occur within an enclosed or bunded area.
- q) Emergency Response Plans will be developed for any accidents and incidents, and spill kits should be maintained on-site.
- r) The storage areas of hazardous waste should be as close to the points of application to the kiln as possible, but far enough away to prevent being heated by the radiant heat from the kiln and to allow truck delivery access.
- s) Pumps and piping systems for liquid and sludge transfers should be able to tolerate varying viscosities and solid particles (or filters should be installed to remove such). Adequate maintenance of these pumping systems needs to be performed to prevent pipe bursts.
- t) Transfer of dry materials (especially paper, sewage pellets and plastic) should be enclosed to prevent wind-blown litter.
- u) Only pre-sorted or waste that does not require separation will be accepted.
- v) The general principles of storage and handling are detailed in Table 12.4.

Table 12-3: Storage guidelines for specific waste streams

Waste Stream	Storage Facility	Environmental Risk
Waste tyres:		
	<u>Whole Tyres</u> Stock pile on a walled concrete slab with storm water control <u>Tyre chips</u> Stockpile in open, walled bunkers on a concrete slab. Ensure proper storm water runoff.	Fire risk, and for whole tyres, rodents and mosquitoes.
Sewage Sludge Pellets:		
	Store in a dry ventilated place under roof on concrete floor. Ensure fugitive dust control. Keep away from water	Fire risk, soil and surface water contamination Self heating when in contact with water
Pulp and Paper Waste:		
Dry	Store in a dry ventilated place under roof on concrete floor. Ensure fugitive dust control. Keep away from water.	Dust (occupational), Litter, Surface Water
Wet	Will not use due to high moisture content.	Surface Water and Soil contamination
Plastic waste:		
Dry	Stockpile in open bunkers on a concrete bed. Ensure proper storm water runoff.	Dust (occupational), Litter, Surface Water
Wet	Will not use due to high moisture content.	Surface Water and Soil contamination
Hydrocarbon sludges and liquids:		
Received in drums	Store in a dry ventilated place under roof on concrete floor.	Fire, explosions, air emissions (VOC's), contaminated soil and surface water
Received in tankers	Well designed tank installation with bunds, fire protection and water management system.	

12.9 HAZOP STUDIES

- a) The HAZOP studies should be concluded prior to trial burns commencing. These studies would apply for all possible facility/material combinations envisaged and rolled down to plant level for further detailed investigation.
- b) Specific sources of secondary materials should be used as a second level HAZOP study, once the generic study has been completed.

12.10 STAFF TRAINING AND AWARENESS

Appropriate training and certification in hazardous operations for new workers and sub-contractors should be given before commencement of co-processing.

12.11 OCCUPATIONAL HEALTH AND SAFETY

- a) Air monitoring: A measurement programme must be established to determine the airborne concentration of any hazardous chemical in the workplace. This programme should include an air quality survey which is to be performed by an approved independent inspection authority in order to determine whether occupational exposure limits (OEL) are exceeded. The prescribed OEL's of substances is part of this Act under Regulations for Hazardous Chemical Substances, 1995.
- b) Medical surveillance: Where employees may be exposed to potentially hazardous chemical substances, a comprehensive medical surveillance programme must be established.
- c) Respiratory zone: Where OEL's may be exceeded in the workplace, a clearly demarcated zone should exist where the use of suitable respiratory equipment is compulsory.
- d) Record keeping: Apart from the records of the previously mentioned required programmes, i.e. training, air quality surveys and medical surveillance, a complete record of all material safety data sheets (MSDS) should be kept.
- e) Adequate personal protective equipment should be made available to employees and contractors, and to individuals visiting the installation. Its use should be required. This includes but is not limited to: helmet, glasses, gloves, hearing protection, safety shoes, respiratory protection, and other protective equipment specified in the Safety Data Sheets.
- f) Storage areas should be kept clear of uncontrolled combustible materials. Clear safety warnings, no smoking, fire, evacuation route, and any procedures signs should be posted.
- g) An emergency shower and eye washing station should be clearly marked and located near the storage of liquid alternative fuels.
- h) A fire protection system must be available at all times and should meet all standards and specifications from local authorities (e.g. local fire department).
- i) Adequate alarms should be provided to alert all personnel about emergency situations. Communications equipment (e.g. telephone) should be maintained at the site so that the site control room and the local fire department can be contacted immediately in case of a fire.
- j) Adequate systems and procedures should be in place to minimize the risk of unauthorized access to hazardous materials used on-site.
- k) Carefully consider plant layout to ensure access for day-to-day operations, emergency escape routes, and maintainability of the plant and equipment.
- l) Modifications to installations and equipment shall be documented.
- m) Automated handling equipment should be used wherever possible.

- n) Special procedures, instructions, and training should be in place for such routine operations as:
- Working at height, including proper tie-off practices and use of safety harnesses;
 - Confined space entry where air quality, explosive mixtures, dust, or other hazards may be present;
 - Electrical lock-out, to prevent accidental reactivation of electrical equipment undergoing maintenance, and
 - “Hot works” (i.e. welding, cutting, etc.) in areas that may contain flammable materials.

12.12 EMERGENCY RESPONSE PLAN

A plan shall be developed prior to the trial burns which:

- Identifies potential spill or contamination areas;
- Defines clean-up procedures;
- Identifies areas of high risk on site or in the local community;
- Provides written instructions in the event of an emergency;
- Documents equipment required in the event of an emergency;
- Assigns responsibilities to employees and local officials;
- Details emergency response training requirements, and
- Describes reporting and communication requirements both within the company and with interested external stakeholders.
- The emergency response plan shall be reviewed with relevant external emergency services.
- Emergency drills shall be arranged with the local community emergency response services to ensure a coordinated response under emergency conditions.