



Department of
Environment and Conservation (NSW)

Your reference :
Our reference : 282151A7:WOF13617:PW
Contact : Paul Wearne, (02) 4224 4100

Technology and Environment Department
BlueScope Steel
(Attention: Alan O'Brien)
PO Box 1854
WOLLONGONG NSW 2500

Dear Sir

**BLUESCOPE STEEL COGENERATION PLANT
PROPOSED SALT WATER COOLING**

We are writing further to the meetings on 11 November 2005 and 13 December 2005 between the Department of Environment and Conservation NSW (DEC) and BlueScope Steel Pty Ltd (BSL) regarding the consideration of the use of once through salt water cooling for the Cogeneration Plant. This includes consideration of the following reports:

- BSL SCP Presentation, dated 11 November 2005;
- *Review of the likely ecological effects of increased temperatures in Allan's Creek and Port Kembla Harbour* dated April 2005 prepared by Jan Carey, School of Botany, University of Melbourne; and
- *Numerical Modelling of Cooling Water Field – Progress Report 3* dated 8 July 2005 and prepared by Cardno Lawson Treloar Pty Ltd.

The purpose of this letter is to confirm the outcomes of these discussions and to provide comments on our review of the information provided to date.

As discussed with you, recent amendments to the Protection of the Environment Operations Act 1997 now requires the environmental values of water to be considered when assessing an activity that is likely to cause water pollution. This also includes the practical measures that could be taken to restore or maintain those environmental values. The NSW government has confirmed Water Quality Objectives as the basis for setting these environmental values.

To assist in understanding the framework for assessing the impacts of the proposed cooling water discharges against the environmental values for Port Kembla Harbour, we have provided an outline of the assessment methodology at Attachment A.

We have also undertaken a review of the above reports and have provided our comments on them in Attachment B for your consideration. These comments will assist in the development of some of the information required to satisfy the processes in Attachment A. Any proposed techniques for the assessment of water impacts, for example, modeling should be developed in consultation with the DEC.

Providing rigorous environmental assessments does not identify any unacceptable impacts from the proposal, the DEC supports in principle the proposed continuation of once through salt water cooling for the Cogeneration Plant based on the overall environmental benefits it will achieve.

This in principle support of the proposal is based on the project objective of saving approximately ten million litres/day of dam water by utilising tertiary treated sewage effluent from Wollongong Sewage Treatment Plant (STP) in its place in industrial processes within BSL.

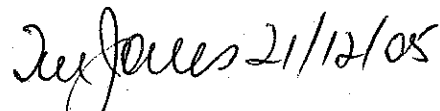
The priority outcomes for DEC in considering the proposal for continued and amended use of once through salt water cooling are to:

- Demonstrate transparent decision making with full consideration of all impacts;
- Minimise adverse local impacts with thorough consideration of all options to ameliorate thermal loads and associated impacts;
- Ensure long-term progress towards desired environmental condition of the Port Kembla Harbour through the development of an overall strategy which may include all BSL thermal (and other) discharges; and
- Ensure BSL commits to a program of works at the premises where the 10 ML/d dam water savings will be complimented by the use of recycled tertiary treated effluent from Wollongong STP.

We look forward to continuing to work through the proposal and would be able to meet at a suitably convenient time if required.

If you have any questions please contact Paul Wearne on 4224 4100.

Yours sincerely



TREVOR JONES
Manager Illawarra
Environment Protection and Regulation Division
Department of Environment and Conservation

Att: Attachment A
Attachment B

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ATTACHMENT A

Assessment Methodology for Assessing Cogeneration Plant Cooling Water Impacts on Port Kembla Harbour

The framework for assessing the impacts of cooling water discharges is provided by the NSW Government's interim Water Quality Objectives (<http://www.epa.nsw.gov.au/ieo>) and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ (2000) or <http://www.deh.gov.au/water/quality/nwqms/index.html#quality>).


Water Quality Objectives – Port Kembla Harbour

The NSW Government and community have specified interim Water Quality Objectives (WQOs) for the Illawarra catchment area (see <http://www.epa.nsw.gov.au/ieo/Lakellawarra/index.htm>). These are:

 Aquatic ecosystems

 Visual amenity

Relevant River Flow Objectives for the Harbour include:

 Minimise effects of weirs and other structures

 Maintain or rehabilitate estuarine processes and habitats

 Maintain wetland and floodplain inundation

 Manage groundwater for ecosystems

We also understand that the Port Kembla Harbour Environment Group which comprises members of the public, government agencies and key port uses has also been undertaking an exercise to assess the environmental values of the harbour. BSL may also wish to consider these values in the environmental assessment of the proposal.

Protection of the Environment Operations Amendment Act 2005

The Protection of the Environment Operations Amendment Act 2005 ('Amendment Act') was passed by Parliament on 24 November 2005. The amendments made to the Protection of the Environment Operations Act 1997 ('POEO Act') include Section 45 matters to be taken into consideration in licensing functions.

The Classified Waters Scheme (created through Clean Waters Regulation 1972 and retained through savings provisions in the Act) has been repealed and replaced by a range of factors ARAs need to consider when issuing licences or prevention notices under the Act in relation to an activity or work that causes, is likely to cause, or has caused water pollution (section 45(f1)). These factors are the "environmental values of water" affected by the activity; the practical measures that could be taken to restore or maintain those environmental values; and (if ARA is not the EPA) any guidelines issued by the EPA to the authority (section 96(3A)).

"Environmental values of water" means the appropriate WQOs which relate to the specified criteria in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000.

Applying the ANZECC & ARMCANZ (2000) Guidelines

ANZECC & ARMCANZ (2000) provides instructions for translating the desired environmental values into water quality management criteria. The proposal must consider the risks of each pollutant in the effluent and how it affects each Environmental Value.

To apply this framework to the protection of Aquatic Ecosystems refer to Volume 1, Chapter 3 Section 3.1.1; Box 3.1.3 & Figure 3.1.1 in ANZECC & ARMCANZ (2000).

Guidelines for protection of aquatic ecosystems

The following steps should be followed when applying the guidelines for the protection of aquatic ecosystems; steps 1–3 are the first parts of the broad framework presented in figure 3.1.1.

1. Define the primary management aims (Section 3.1.1.1)

In addition to the Environmental values, more detailed management goals should be developed for specific issues and/or threats to the environmental values (eg. toxic effects, effects due to changes in temperature, increased nuisance growths due to increased water temperature, etc.), the desired levels of protection for aquatic ecosystems, and the key attributes of the resource that must be protected (eg key species, habitats, recruitment).

2. Determine appropriate guideline trigger values for selected indicators (Section 3.1.1.2).

Determine indicators that are relevant to the environmental issues/concerns and management goals.

3. Assess test site data and, where possible, refine trigger values to guidelines using (i) the general framework for biological indicators (figure 3.2.1), and (ii) the decision frameworks for other indicators. Frameworks for (ii) are described in Section 3.1.1.3 ('Risk-based application of the guidelines'). Decision frameworks to apply to specific indicators, and detailed guidance on applying these, may be found in the Guidelines figures and sections as follows:

- (a) physical and chemical stressors — figure 3.3.1, Section 3.3
- (b) toxicants — figure 3.4.2, Section 3.4
- (c) sediments — figure 3.5.1, Section 3.5.

4. Define water quality objectives (figure 2.1.1, Section 2.1.5).

5. Establish a monitoring and assessment program (figures 2.1.1 & 7.1, Chapter 7).

Classifying the ecosystem

Port Kembla Harbour is classified as a marine dominated estuary therefore the "Marine" water quality guidelines apply. In the absence of specifically estuarine toxicity data, users should adopt the lower of the marine or freshwater values and apply whatever salinity corrections are available. This is based on the consideration that estuary species can face potentially greater stresses from their changing environment and that estuaries provide nursery grounds and refuges for species for particular (sometimes sensitive) life stages of organisms from marine and freshwater environments." For non-toxicants, specific estuary criteria are provided for a number of indicators in ANZECC & ARMCANZ (2000).

Level of ecosystem protection

The level of aquatic ecosystem condition for Port Kembla Harbour is "highly disturbed". The Guidelines state that the emphasis should be on improvement of disturbed ecosystems, not just maintenance of a degraded condition. In this regard the desired targeted level of protection in the longer term would be equivalent to a "slightly to moderately disturbed" ecosystem.

This is because an overriding principle is for the continual improvement in water quality. In addition it should not be reasoned that water quality can be degraded to the levels given in ANZECC & ARMCANZ (2000) Guidelines.

Water Quality Guidelines for Temperature

Refer to Section 8.2.1.5 "Temperature" in ANZECC & ARMCANZ (2000), then the guidelines for "Unnatural change in temperature" are detailed in ANZECC & ARMCANZ (2000), Volume 2, Section 8.2.3.4, p. 8.2-66. In summary:

"Hot water discharges should not be permitted to increase the temperature of the aquatic ecosystem above the 80th percentile temperature value obtained from the seasonal distribution of temperature data from the reference system."

For highly disturbed systems, appropriate site specific studies should be undertaken. Where local but higher quality reference data are used, a less stringent cut-off than the 80th % ile may be used, however, the 80th %ile cut-off (based on a good quality reference site) should be the target for site improvement. Modified values for highly disturbed systems should not approach levels that may cause or indirectly lead to acute toxicity.

The following factors (from Section 8.2.1.5) should be considered when assessing whether a change to the thermal regime will result in adverse effects to an aquatic ecosystem:

- the lethal tolerance range (including length of exposure) of all stages of the lifecycle of endemic populations (feeding, breeding, reproduction, timing and success). It is important to remember that the same species may have different tolerances depending on where it grows, as it may have adapted to a change;
- the influence on the rate of primary production in the system. This is important because studies have demonstrated greater sensitivity of plant growth to temperature increases than to nutrient increases, which can lead to nuisance growths;
- influence on the rate of secondary production of key species within the system. Thermal changes can lead to increased production of undesirable species and decreases in the production of desirable species e.g. bacteria out competing algae for nutrients;
- tolerances of the various life stages of the species that occur within the affected area. Not all life stages of a given species are equally sensitive, and reproductive stages are often the most sensitive to thermal disruption;
- likely impact on species richness and natural community composition (geographic distribution, vertical distribution, impacts on whole habitats such as seagrass) in the affected area;
- influence on enzyme-dependent microbial processes such as photosynthesis, N₂ fixation, denitrification, respiration and methanogenesis.

Other issues/pollutants of concern

Any other water quality risks should be described using the ANZECC & ARMCANZ (2000) guidelines, for example:

- Toxic effects of chemicals in the cooling water (cleaning agents or biocides).
- Changes to flows or levels of pollutants in discharges from the proposal or separately planned environmental works in BSLs premises (relate to existing PRP conditions on the BSL Environment Protection License).
- Temperature effects on other parameters and toxicity of other parameters, see "Incorporating temperature" (Section 8.3.5.14, p. 8.3-54, ANZECC & ARMCANZ (2000), Volume 2).
- Physical impacts of the discharge on the waterbody.

Mitigation options

Mitigation options should be investigated to meet a reasonable level of performance (meet guidelines for highly modified systems now) and then apply current best practice mitigation options over time to achieve the desired WQOs and level of protection (slightly to moderately disturbed) for the Harbour.

Modelling issues

Predictive studies using modelling can produce limited results, particularly as spatial and temporal variability in estuaries is poorly understood and the limited data available on thermal responses of Australian species.

At least three fish, three invertebrates and three plants should be used in the assessment and the species chosen should not be tolerant of high water temperatures. Results from the species most sensitive to thermal pollution should be used in decision making.

Mixing zone guidance

Where the quality of the water being discharged does not immediately meet Water Quality Objectives a mixing zone needs to be defined and managed. Mixing zones may be appropriate where all options to avoid and reduce discharge to receiving waters, and options for improving effluent quality through additional treatment processes, have been exhausted.

Parameters fundamental for the mixing modelling include: details of the source conditions such as discharge volume, velocity, outlet configuration and discharge depth. Also, information on the Harbour condition such as bathymetry, ambient currents and substrate condition in the near-field mixing zone.

Optimising the mixing performance of a discharge at a given location can be achieved by optimising **near field** mixing performance which is influenced by factors such as:

- a) Discharge geometry (port size, number, shape, orientation with respect to ambient flow);
- b) Location of port(s) in water column (eg. distance apart, depth);
- c) Design of the outfall (e.g. single or multi-point diffuser, port velocity);
- d) Depth of water over the outfall;
- e) Density difference between effluent and receiving water which determines buoyancy;
- f) Speed and orientation of currents across the outfall; and
- g) Degree of stratification in the water column which may limit vertical mixing.

Further principles for mixing zones:

- The area or volume of a mixing zone should be limited to an area or volume as small as practicable. The zone needs to be specifically defined spatially and how it may change in different conditions.
- The mixing zone should have a simple configuration that is easy to locate in the body of water and avoids impingement on biologically important areas.
- Important water use and ecologically significant areas are avoided, eg. plume to not hug the shoreline or create barriers.
- Any impacts within the mixing zone should be reversible.

A mixing zone is where numeric water quality criteria can be exceeded, however mixing zones are not appropriate for discharges of substances that cause acute toxic impacts and/or bioaccumulate. The area within the mixing zone must not contain:

- (a) Material in concentrations that cause acute toxicity to aquatic life;
- (b) Substances that can bioaccumulate;

- (c) Material in concentrations that settle to form objectionable deposits;
- (d) Floating debris, oil scum and other matter in concentrations that form nuisances;
- (e) Substances in concentrations that produce objectionable colour, odour, taste or turbidity; and
- (f) Substances in concentrations which produce undesirable aquatic life or result in the dominance of nuisance species.

Where a mixing zone has been designated the operator is responsible for monitoring their effluent(s) for pollutants, and the receiving waters, including baseline monitoring.

A post-construction outfall monitoring program is required to verify the near-field mixing zone modelling predictions and to provide a validated predictive tool for future assessments.

Monitoring

After completion of the assessment studies outlined above a monitoring program will be required. This ongoing monitoring will be responsive to the risks identified through the assessment studies but is likely to include:

- discharge monitoring (volume, temperature, toxicity)
- periodic ambient condition monitoring (pelagic and benthic communities).

Verification of the predictive model used to simulate water temperature distributions in Pt Kembla Harbour will be required.

Reference

ANZECC & ARMCANZ, 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australian and New Zealand, Canberra, ACT, Volumes 1 and 2.

ATTACHMENT B

DEC COMMENTS ON REPORTS SUBMITTED TO DATE

The comments provided below will assist in the development of some of the information required to satisfy the process in Attachment A.

Review of the likely ecological effects of increased temperatures in Allens Creek and Port Kembla Harbour dated April 2005 prepared by Jan Carey, School of Botany, University of Melbourne

The assessment would benefit from a comparative assessment of the organisms found in Pt Kembla Harbour with those found in comparable more natural locations such as Wollongong Harbour. He and Morrison (2001) provide relevant information to make this comparison. In keeping with the ANZECC & ARMCANZ framework provided in Attachment A and the suggested environmental target values (slightly to moderately disturbed system) a process similar to that described above for assessment of effects of temperature should be employed. Simply, identify the species/guilds of organisms expected to be found in a slightly to moderately disturbed system but are not currently found. Identify what aspects of the current environment and the proposal may be excluding these species and suggest possible amelioration measures.

Numerical Modelling of Cooling Water Field – Progress Report 3 dated 8 July 2005 and prepared by Cardno Lawson Treloar Pty Ltd

Simulation of temperature disturbances is critical to this assessment. It is encouraging that an appropriate 3-D model has been selected for this task.

A stand-alone document is required to describe model assessments. This letter (CLT, 2005) makes reference to previous reports/letter. A brief summary of the modelling approach and set up must be included together with reference to more detailed information about the model itself.

Model results should always be discussed with reference to:

1. Project aims
2. Underlying assumptions of the model formulation
3. Model performance indicators and acceptance criteria
4. Adequacy of the data for calibration and verification (quality, quantity and capture of situations of interest eg high flows)

Uncertainty/error analysis. Two options may be numerically different, but within confidence limits they may be indistinguishable.

Without this additional information it is difficult to provide a full complete of modelling.

Model scenarios should describe a set of worst case conditions (from an environmental perspective) as well as typical conditions. Modelling investigations must, therefore, include simulation of average daily and maximum heat loads for all seasons including winter when temperature increases may be greatest due to cooler receiving waters (existing modelling focused on the period from 1st Jan to 28th Feb when the heat load is expected to be greatest).

Results of modelling scenarios should also be presented as differences between water temperatures with and without the thermal loading in order to illustrate the extent of the thermal disturbance above ANZECC (2000) trigger criteria. That is, the simulated 50th percentile temperatures must be compared with 80th percentile natural ambient temperatures. This analysis can be undertaken for a summer period (e.g. 1st Jan to 28th Feb) and an equivalent winter period when ambient water temperatures are at a minimum.

Factors which may bias the modelling assessments must be discussed including uncertainties and conditions not simulated by the model. For example, the possible effects of shipping may be relevant: number of shipping movements per day; location of shipping movements w.r.t. thermal plume; and, an assessment of whether this is likely to have a significant effect on water temperatures (due to vertical mixing). Likewise, changes in Harbour circulation due to cooling water movements should be discussed.

The adoption of 22.5°C as the boundary temperature condition must be substantiated.

It will be necessary to verify the model against observation of actual water temperatures across the modelling domain. Any existing verification data for the current discharge should be presented to validate the model which will be used for assessment of proposed discharges.

Location of discharge point and discharge port geometry must be considered to minimise potential impacts- see point (h) below.

Modelled dilution estimates will be required for risk assessments of any toxicants in the discharge (see (d) below).

Clarification is required on volumes of discharge streams and position of intakes and outfalls.

Issues to be addressed by BlueScope Steel:

A review of contemporary literature and information is required to assess potential effects of increased thermal loadings including:

- a. temperature tolerances and preferences of organisms likely to be found in Pt Kembla Harbour.
- b. effects of enhanced temperatures on uptake of contaminants (metals and PAHs) due to increased metabolism of Harbour biota.
- c. risk of introduced species based on assessment of temperature preferences of threatening exotic organisms (e.g. toxic dinoflagellates which may threaten the status of the port for international shipping)

Assessment including bioassays (toxicity testing) will be required to determine the toxicity of the discharge associated with the combined effects of biocides and elevated temperatures.

- d. Assessment of toxicity of discharge (due to introduced biocides and anti-scalants – *Clamtrol*) for a range of dilutions (including no dilution) which can be related to model simulations of the dispersion of cooling waters in Pt Kembla Harbour.

Modelling and observations will be required to assess potential effects of extraction of plankton organisms in cooling (intake) water through:

- e. calculation of an extraction index such as:

where $T_{\text{intake}} / T_{\text{residence}}$

T_{intake} = time required to extract a volume of cooling water equal to the volume of water in Pt Kembla Harbour

and

$T_{\text{residence}}$ = average residence time of Harbour water (can be estimates from existing models based on tidal flushing)

Existing data (tides, bathymetry, intake flows) plus existing models may be suitable for this assessment. This index must be calculated for existing intake plus proposed (worst case) intake rates to indicate the potential for significant reductions in the zooplankton biomass due to extraction of cooling water.

f. investigation of zooplankton status within the Harbour including:

- sampling at sites in the Inner and Outer Harbours as well as at control/reference sites such as within Wollongong Harbour.
- investigation of the vertical distribution of zooplankton close to the intake point (to investigate optimum intake depth to minimise extraction of zooplankton).

An appropriate sampling design should be submitted to DEC for review.

This approach is consistent with ANZECC/ARMCANZ (2000) guidelines which encourage assessments focused on biological endpoints. It complements previous assessments which have been restricted to fish and benthic organisms.

g. No information has been provided in the reports on the options to ameliorate thermal impacts including but not limited to:

- i. technological measures to reduce water temperatures at the point of discharge such as attemperation, air condensers, wet or dry cooling towers – attemperation (pre-dilution) must be considered in the context of (e) and (f) identified above.
- ii. re-location of discharge point and discharge port configurations to: maximise initial dilution; minimise contact with boundaries; avoid thermal barriers which may block passage of organisms through Allans Creek.
- iii. Development of a long-term strategy to reduce the thermal loads to Pt Kembla Harbour and ameliorate temperature effects. That is, quantitative targets for temperature extremes and for the combined thermal loading of all BlueScope operations.
- iv. Optimising dilution and mixing processes.
- v. Artificial mixing with cool water drawn from depth in inner harbour.
- vi. Returning the heated water at a point away from the ecologically vulnerable shore zone.
- vii. Discharging the heated water into shallow ponds or canals, allowing it to cool, and reusing it as cooling water. This method is useful where enough affordable land is available. Combine with shading.
- viii. Build a cooling/heating channel. A continuous exchange flow with a larger body of water to allow mixing to play an important role in reducing the temperature of a discharge in the cooling channel.
- ix. Biological monitoring program that will be able to detect ecosystem responses to increased thermal discharges or a program of reducing the thermal pollution over time.
- x. Other options from international literature.
- xi. Removing and phasing/timing heat generating operations across the whole site
- xii. Using heated water/energy for beneficial purposes

Monitoring:

No information has been provided in the reports on monitoring.