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ECNZ MARSDEN 'A' POWER STATION : ASSESSMENT OF ENVIRONMENTAL EFFECTS : OCTOBER 1992

(Short Answers in Conservation Science)

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Dear Ray

ECNZ; MARSDEN A POWER STATION: ASSESSMENT OF ENVIRONMENTAL EFFECTS: OCTOBER 1992.

As requested I have studied the above AEE and provide the following advice relating to your questions:

1. Are predicted levels of trace element emission within accepted world standards?

The predicted levels of trace element emission are indicated in the AEE Table 5.1 Analyses of Fuel Oils (page 23) and Table 5.2 Marsden Power Station Stack Emission Monitoring Data (pages 24 and 25).

These levels can be put into perspective by considering relevant legislative standards applying in USA, Germany and New South Wales.

An amendment to the US Clean Air Act in 1990, Title III provisions, designates 189 Hazardous Air Pollutants. Included in these are the following which are relevant to trace element emissions from Marsden A:

- Arsenic compounds
- Cadmium compounds
- Chromium compounds
- Cobalt compounds
- Lead compounds
- Manganese compounds
- Mercury compounds
- Nickel compounds.

The amendment applies to major sources of these Hazardous Air Pollutants. Major sources are defined as any source, new or existing, that emits 10 tons a year or more of any single listed pollutant or 25 tons a year of any combination of these. These sources will be required to meet maximum achievable control technology (MACT) requirements by specified dates. The details of MACT are yet to be promulgated but reductions of emissions by 90 to 95% are required for existing sources seeking extension of time for compliance.

From the information relating to oil storage and data on trace element content given on page 5 and in Table 5.1 of the Marsden A AEE, it can be calculated that 150 days operating at 240MW with 80% unit load factor would result in the emission of 10 tonnes nickel.

An indication of the emission rates for trace elements resulting from the use of current maximum achievable control technology (MACT) can be obtained by considering the following German BImSchV 1989 emission standards. In the absence of New Zealand standards those for New South Wales are included to illustrate relative stringency.

Trace Element	German Standard	NSW Standard
	(mg/m3, based on dry gas @0C, 11 % 02)	
Mercury	0.1 Ave hrly	3.0 Max
Cadmium	0.1 Ave hrly	3.0 Max
Total As, Co, Ni, Se, Te, Sb, Sb, Pb, Cr, Co, Sn, Cu, Mn, V	1.0 Ave hrly	
Total Pb, As, Sb, Cd, Hg		10.0

2. Are the AEE assessments valid, eg "S02 The only concern", timing of sampling (Winter) and limited geographical areas sampled.

The AEE does not adequately address the phytoxicity of sulphur dioxide or the synergystic effect of sulphur dioxide and nitrogen dioxide. Possible effects from acidic particulate or dry deposition should also be considered.

Ambient air quality standards for sulphur dioxide generally are based on public health considerations. Many experts however consider that sulphur dioxide at low concentrations has greater phytoxicity significance than human health effects. There is uncertainty as to the no effects level and a wide range of sensitivity amongst various plant species. Some agricultural crops are affected at levels of less than 100 micrograms per cubic meter and some forest trees often appear to be more susceptible though this may result from other environmental stress factors. The International Union of Forestry Research Organisations has recommended maximum sulphur dioxide levels of 100 micrograms per cubic meter for most forest areas and 50 micrograms in areas of sensitive species. For more information see reference 1.

Nitrogen dioxide alone can affect some plant species at ambient concentrations as low as 120 micrograms per cubic meter. The presence of other phytoxic pollutants such as sulphur dioxide produces a synergystic effect which can cause plant damage at concentrations much lower than for each pollutant by itself. See reference 2 for further details.

Acidic precipitation or acid rain is commonly associated with thermal power generation facilities overseas when higher sulphur fuels are used. The sulphur oxides and oxides of nitrogen emitted with the flue gases react in the atmosphere to produce the corresponding acids. The resulting acidification results in damage to plant and animal species and materials and this manifests at various distances downwind of the pollution source or sources. Generally it is regarded more as a regional rather than a localised pollution problem. Acidic precipitation occurs either in a wet or dry form.

Dry deposition of materials that contribute to the acid deposition phenomenon tends to be greatest near emission sources. The spatial scales associated with wet deposition tend to be greater than for the dry deposition, on the average. Dry deposition has been observed 10 kilometers or less from the polluting source and may therefore be of significance in the Marsden Point situation.

In the case of Marsden A sulphur trioxide in the flue gases will readily form sulphuric acid when combined with water vapour. This will then be available to adsorb onto particulates and to combine with atmospheric ammonia to form sulphates and bisulphates. Nitrogen dioxide will react to form nitric acid and nitrates but this may not occur as rapidly. Dry acidic deposition may result from the fallout of particulates and the associated acidic sulphates, bisulphates and nitrates. The actual location of this deposition will be dependent on many factors including particle size and meteorological conditions but it is a likely phenomenon with 15 kilometers of the power station.

Acidic precipitation has significance for adverse effects on terrestrial habitats because of its ability to mobilise natural soil minerals such as aluminium to the extent that these become toxic to plant and animal species.

Reference is made in the AEE pages 52 and 53 to the vegetation survey conducted by Dr G.T. Daly of Lincoln University to determine adverse effects from sulphur dioxide. Without his report it is unclear whether he gave consideration to the possibility of the synergystic effects of other pollutants or from dry acidic deposition as outlined above. It is also unclear as to what the prevalence is of species sensitive to these pollutants are in areas which may be affected by emissions from Marsden Point activities.

It is difficult to comment on the timing of the sampling activities described in the AEE. Obviously winter was appropriate as that was when Marsden A was operating. It may not however be the appropriate time for vegetation surveys as it may correspond to a period of relative dormancy for sensitive species.

No doubt the location of sampling was determined using the recommendations in the NZ Meteorological Service Report Jan 1991 referred to on page 43 of the AEE. Meteorological data would also be essential in determining appropriate timing. A review of this report may be useful. It is unlikely that data from monitoring at one location only would be conclusive.

3. Advise on monitoring needs (if any) for marine, freshwater and terrestrial (especially plants) habitats. Include timing, geographical considerations.

(a) General Comment

It is recognised that Marsden A is not the only significant source of air pollution in the Marsden Point area. The oil refinery and associated shipping are also sources of similar pollutants. Monitoring should be directed at evaluating the effects of all activities as it is the sensitivity of the receiving environment which is the issue.

(b) Marine

The significant buffering ability of sea water and its natural mineral content are such that adverse environmental effects resulting from air pollutants are considered unlikely. No general monitoring is therefore considered necessary.

(c) Power Station Fuels

It is recommended that ECNZ should monitor and maintain records of the trace element content of all fuels used. These records be made available to the Northland Regional Council.

(d) Dry Acidic Deposition

Techniques are available for the determination of dry acidic deposition. ECNZ should participate in an ongoing monitoring programme aimed at illustrating whether or not this phenomenon is occurring in sensitive areas down wind of Marsden Point. Locations for monitoring would be determined by consideration of particulate emission characteristics, meteorological and topographical data.

(e) Freshwater and Terrestrial Habitats

ECNZ should participate in an in-depth survey to determine the relative sensitivity of plant or animal species to all air emissions in locations down wind of Marsden Point. Ongoing monitoring of soils and freshwater to determine any mobilising effect on natural mineral species with toxicity potential, such as aluminium, is highly desirable.

(f) Location and Timing of Monitoring

Recommendations on the location and timing for monitoring programmes can only be made after detailed study of the meteorological and topographical characteristics of the Marsden Point area. Consideration should be given to the characteristics of the pollutants involved and the location of species sensitive to these. Many of the factors involved are discussed above and in the reports available to ECNZ.

REFERENCES

1. K.F. Wentzel, 1983, "IUFRO Studies on Maximal S02 Immisions to Protect Forests" in D. Reidel Dorecht, "Effects of Accumulation of Air Pollutants in Forest Ecosystems" pp 295 - 302 (Urlich, B. & Pankrath, J., eds).

2. T.W. Ashenden and I.A.D. Williams, 1980, "Growth Reductions in Lolium Muliflorum Lam. and Phleum Pratense L. as a Result of S02 and N02 Pollution", Env Poln 21, 131 - 139.

Norman Thom
16 November 1992