BENCHMARKING FOR BEST PRACTICE ENVIRONMENTAL MANAGEMENT

By Professor Bryan R Jenkins and Philip T Hine

ABSTRACT

Benchmarking of environmental performance to demonstrate the achievement of best practice environmental management is a component of a new form of licensing of industrial discharges in Western Australia. The paper describes the approaches to benchmarking for the critical environmental issues for an alumina refinery and wastewater treatment plant. It also describes the lessons learnt from the benchmarking process on appropriate methods, the benefits and difficulties in the benchmarking process, and changes that would assist benchmarking for best practice environmental management.

1 Introduction

The WA Department of Environmental Protection (DEP) has developed a category of licensing termed "Best Practice Environmental Licence" (DEP, 1998). This form of licence is intended to apply to those premises where good performance is demonstrated, where best practice environmental management is utilised, and where there is an ongoing programme of continual improvement in environmental performance. This approach to licensing is designed to provide industry with greater flexibility in achieving agreed environmental performance objectives through a process of "audited self management" (Jenkins, 1996).

This audited self management approach is offered as an alternative to normal regulatory licences, which involve prescriptive technical specification of environmental requirements and close inspection of facilities to ensure compliance. The key principles of audited self management are:

- establishment of objectives for environmental performance which are benchmarked to best practice and agreed with the department;
- an environmental management system, with third party or government accreditation, which ensures continual improvement in environmental performance;
- auditing of performance with third party involvement and verification; and
- public reporting of environmental performance and pollution incidents.

The Best Practice Environmental Licence provides recognition to an industry which is committed to environmental performance that is beyond compliance. This recognition together with reduced licence fees is providing an incentive for industry to achieve higher environmental standards than can be achieved by normal regulatory licences. It is also being achieved with less regulatory control by government and with greater transparency in reporting to the community.

This paper discusses the benchmarking approaches that have been used to determine the suitability of licensees for best practice environmental licences.

The first step in the benchmarking process is for significant environmental issues to be identified on the basis of environmental impact, the receiving environment, legal and other requirements, and the views of interested parties. From the list of significant issues, a group of critical issues are identified and agreed with the department. To be granted a Best Practice Licence, a licensee must be performing at a best practice level for these critical issues. Benchmarking is to be used to identify best practice for the critical issues. Best practice does not necessarily equate to best available technology. Best practice encompasses a performance range where the top performer is "best in class".

There have now been two Best Practice Environmental Licences issued. One is for the alumina refinery at Kwinana on the shores of Cockburn Sound operated by Alcoa World Alumina Australia. The second is for the Woodman Point wastewater treatment plant operated by the Water Corporation.

This paper describes the approaches to benchmarking that were used to demonstrate best practice management of the critical issues for these two facilities. A variety of benchmarking approaches was required. While existing international benchmarks were sought, it was found necessary to undertake original research to establish best practice benchmarks. The definition of 'critical issues' involved consideration of monitored emission levels in relation to regulatory standards, emissions contributing to regional contaminant levels approaching ambient standards, professional judgement on significant impacts related to the type of facility being licensed, and concerns expressed by the community about environmental issues. The paper also discusses some of the lessons learnt from undertaking these benchmarking exercises.

2 Benchmarking Strategies for Kwinana Alumina Refinery

For the Kwinana Alumina Refinery, there were three critical factors identified for which benchmarking was undertaken to determine the plant's suitability for a Best Practice Environmental Licence. One of the critical factors was dust. Historically, there had been exceedances of the dust standard and dust was the main concern of nearby land users. A second factor was sulphur dioxide emissions. The Kwinana Industrial Area is covered by an Environmental Protection Policy, which sets ambient air quality standards for sulphur dioxide (Government of Western Australia, 1992). Control of these emissions is therefore a high priority for protecting the receiving environment. The third factor was groundwater contamination. The aquifer underlying the refinery site discharged into Cockburn Sound. Recent studies had shown that groundwater was a prime source of contamination for the Sound (DEP, 1996).

2.1 Performance Benchmarking for Dust Management

The Kwinana Alumina Refinery creates 10,000 tonnes of residue every day as a by-product of its alumina production. The material is deposited in a Residue Area covering 200ha and solar dried. The Residue Area is 5 km inland from the refinery and is surrounded by market gardens. Dust generation from the Residue Area has the potential to adversely affect neighbouring properties, particularly between November and March when conditions are dry and hot, and strong south westerly winds prevail. The performance objective that was set was for the ambient dust concentration at the boundary of the residue disposal area not to exceed 260 ug/m^3. Ambient data levels were also to be compared with an internal standard of 90 ug/m^3.

Three types of performance benchmarking were considered in evaluating the management of dust from the Kwinana Alumina Refinery residue area:

- comparison with similar facilities in similar circumstances,
- comparison with ambient dust concentration standards, and
- historical comparison of Kwinana Alumina Refinery dust levels (PPK, 1998).

Comparison with similar facilities

The preferred comparisons are with similar operations in similar land use settings and climatic conditions. Consideration was given not only to alumina refineries but also to other mining and mineral processing industries. Not all facilities that were approached agreed to participate. In addition, dust monitoring data needed to be available in a form which enables meaningful comparisons. The Department of Environmental Protection licence requirement was in terms of Total Suspended Particulates (TSP) averaged over 24 hours. This is an appropriate indicator for nuisance dust, however some facilities measured PM10 (particles below 10 microns) which is common where health effects are a concern. Data from 14 facilities was obtained including four alumina refineries. Of these, six were located in similar climatic conditions. In terms of annual averages of 24-hour TSP results, the Kwinana Refinery dust levels were consistent with the better performers (figure 1).

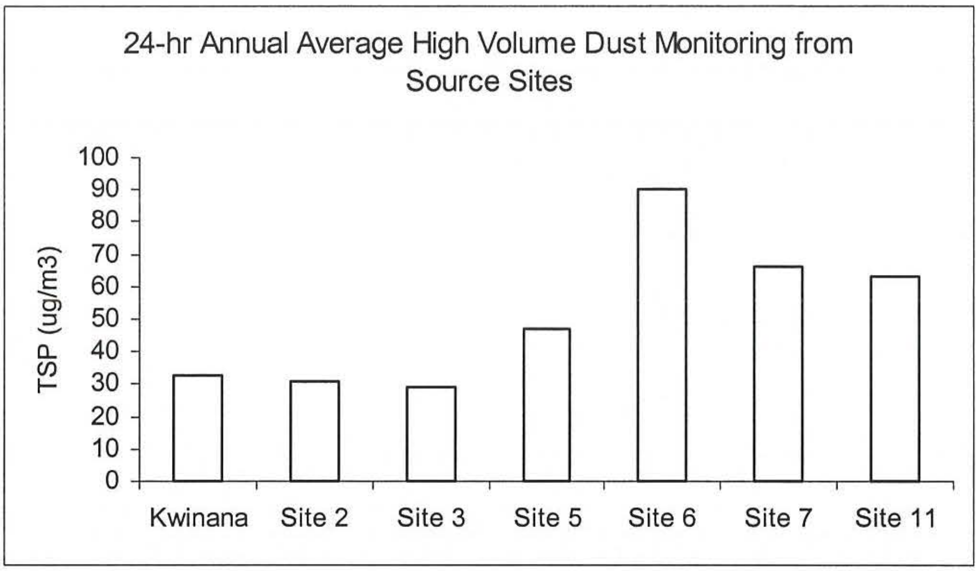


Figure 1 (Source: PPK, 1998)

Comparison with dust standards

The Western Australian standard is for 24-hour average values not to exceed 260 ug/m^3 and for the annual average not to exceed 90 ug/m^3. The 90 ug/m^3 value is also an internal target for a maximum 24-hour value. It is not only required that the dust levels are at best practice in comparison with other facilities, it is also required that there is compliance with the relevant standards. As can be seen from figure 1 the annual average of 33 ug/m^3 is about one third of the standard. Figure 2 shows the percentage exceedance of two benchmarks for 24-hour dust measurements – the standard of 260 ug/m^3 and the Alcoa internal standard of 90 ug/m^3. There were no exceedances of the 24-hour standard at Kwinana (the maximum recorded was 187 ug/m^3). The Kwinana site had the lowest number of exceedances (1%) of the internal standard of 90 ug/m^3.

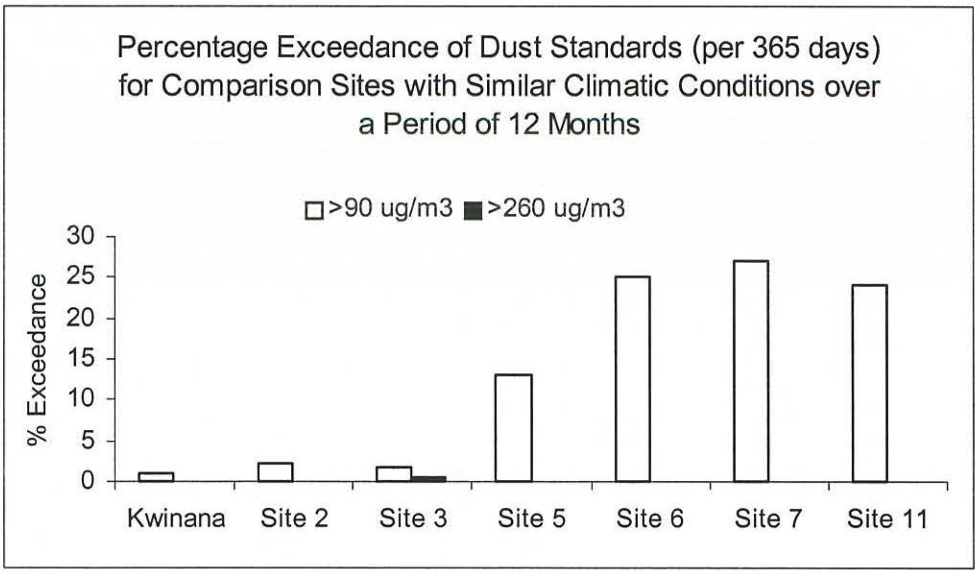


Figure 2 (Source: Kwinana Alumina Refinery, 1998b)

Historical comparison of performance

A key component of "best practice" is ongoing improvement in the management of critical issues. At Kwinana many of the improvements were initiated from knowledge gained from benchmarking studies. The successful experience of BHP at Port Hedland led to a study of the drying and dusting processes on the residue drying beds and of sprinkler wetting. The study found that a rough moist surface was best for reducing dusting. This could be achieved by turning over the residue. A new process was developed for laying down a thinner layer of residue (0.5 m instead of 1 m) which allowed vehicles to get on to the surface almost immediately to turn it over. The mud dried faster and the dusting was reduced. It was also found that efficiencies in the sprinkler system could be achieved by greater process control eg by ensuring the ideal pressure was maintained for optimum sprinkler operation. Sprinkler head configuration was examined and resulted in improvements that provided greater wetting over a greater area even in windy conditions as well as reducing maintenance requirements. Other improvements included reducing construction activities in the windier summer months, training in dust control and assignment of a person full time to management of dust control during high-risk months. Figure 3 shows the improvements in dust control over recent years.

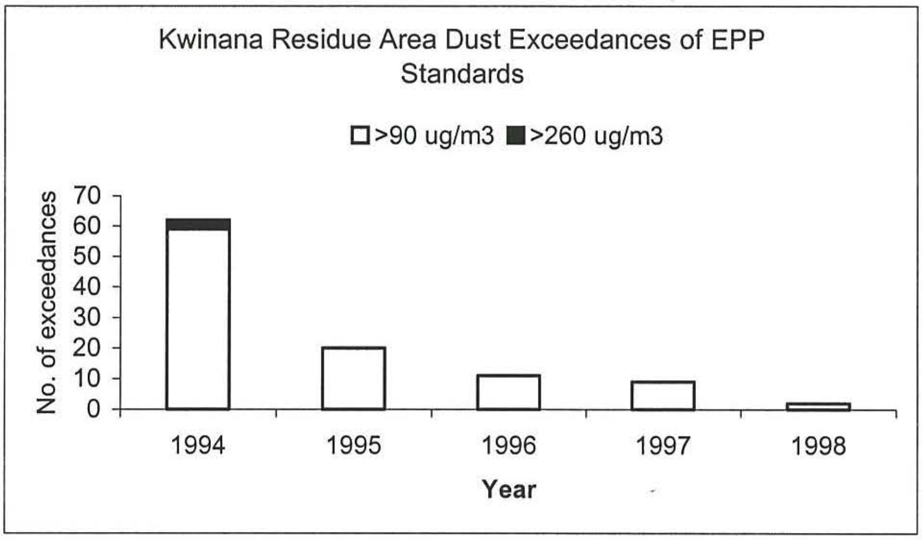


Figure 3 (Source: Kwinana Alumina Refinery, 1998b)

Conclusion

Under the three approaches of benchmarking against other facilities, relevant standards and historical performance, the Kwinana Alumina Refinery meets best practice criteria. Some of the other conclusions from this benchmarking exercise are that benchmarking leads to transfer of knowledge of improved environmental practices, that there is a need to search widely to find comparable partners with comparable data, and, that achievement of improvements can take several years and requires attention to the underlying processes.

2.2 Waste Minimisation for Sulphur Dioxide Emissions

The Kwinana Refinery operates eight steam boilers, six calciners and two rotary kilns. Sulphur dioxide emissions have been minimal since the refinery moved from the use of heavy fuel oil with a sulphur content of 3.5% to natural gas as the normal operating fuel. An inventory of low sulphur distillate (0.5 – 0.6% sulphur) is maintained for use in the event of a gas outage and for test burning requirements. Gas outages have occurred on average about once per year and last for about 24 hours. Approximately 12 test burns per year are conducted typically lasting from 40 minutes to one hour. The performance requirement for the BPEL is to ensure that discharges of sulphur dioxide are managed to achieve the objectives of the regional air quality policy.

Emission Levels

The shift in fuel has had a dramatic effect on sulphur dioxide emissions from the plant. As shown in figure 4 the emissions have declined from more than 20,000 tonnes per annum to effectively zero during normal operations. This represents best practice by waste minimisation rather than by comparative benchmarking.

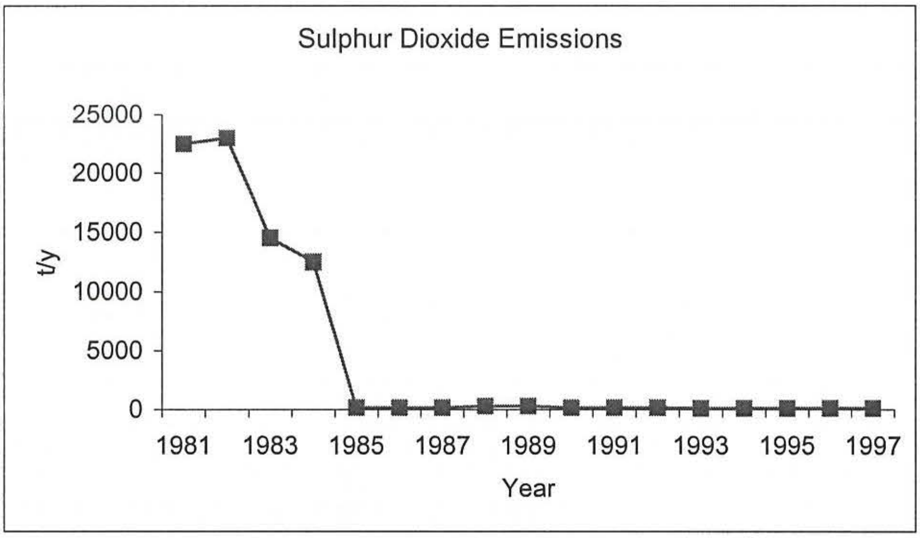


Figure 4 (Source: Kwinana Alumina Refinery, 1998a)

Contribution to Regional Air Quality

The main air quality concern in the Kwinana region is with sulphur dioxide. The Kwinana Alumina Refinery has the lowest emissions of the eight plants that emit sulphur dioxide. It emits 0.6% of the SO2 released by the largest single emitter. Furthermore the region now meets the air quality standard for SO2. The improvement over time for the Kwinana region is shown in figure 5.

Conclusion

The Kwinana Alumina Refinery meets best practice in relation to sulphur dioxide emissions. However the test in this case is not by traditional performance benchmarking. Rather the test for best practice is the achievement of waste minimisation and the achievement of acceptable air quality in the region.

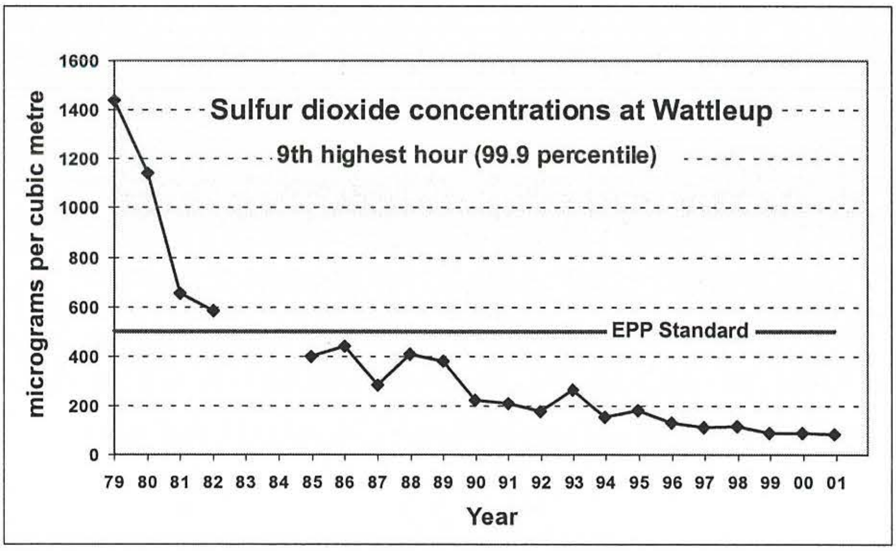


Figure 5 (Source: Department of Environmental Protection monitoring records)

2.3 Technology Benchmarking for Groundwater Remediation

In the mid-1970s, Alcoa had identified contamination of the groundwater by caustic soda and sodium carbonate solutions from alumina refining process, both beneath the refinery and the residue ponds. There was potential to affect other downstream users of the aquifer and the potential to discharge into Cockburn

Sound. A remediation programme was implemented including groundwater recovery, leachate extraction, leakage minimisation, prevention of new sources, and, monitoring and data assessment. The performance requirement for the BPEL was that there is a net decrease in contamination load as determined from electrical conductivity measurements.

For this issue, there are no easily identified benchmarking partners with comparable circumstances. A different approach to assessing whether best practice had been achieved was needed. This comprised:

- the technology used in the components of the remediation strategy;
- the outcome achieved in controlling contamination; and
- the professional judgement of independent specialists.

Technology Used

The approach by Alcoa has been to tackle the remediation of groundwater on a number of fronts. One component has been the capture of the contaminated groundwater plumes by recovery bores. A second component has been installing low yielding bores to extract leachate from the pores of the residue. A third component has been to locate leaks in the clay liners at the base of the old residue areas and repair them by injecting chemical grout. Another series of actions were directed at preventing new contamination. This included a change to dry stacking of residue instead of wet slurry deposition, the installation of underdrains to recover leachate and the use of composite liners (compacted clay overlain by PVC sheeting). Over the years, monitoring and remedial activities have been modified as more was learnt about groundwater conditions and as new technologies became available.

Outcome Achieved

Groundwater quality is routinely measured at 315 monitoring bores and 39 production bores. In addition approximately 30 private bores are sampled every two years. This provides the basis for assessing whether the desired outcome of remediation is being achieved. Figure 6 shows the change in contaminant levels (as measured by electrical conductivity) between 1993/4 and 1997. Decreases of more than 1,000 uS/cm have been achieved on the downstream margins of the residue pond.

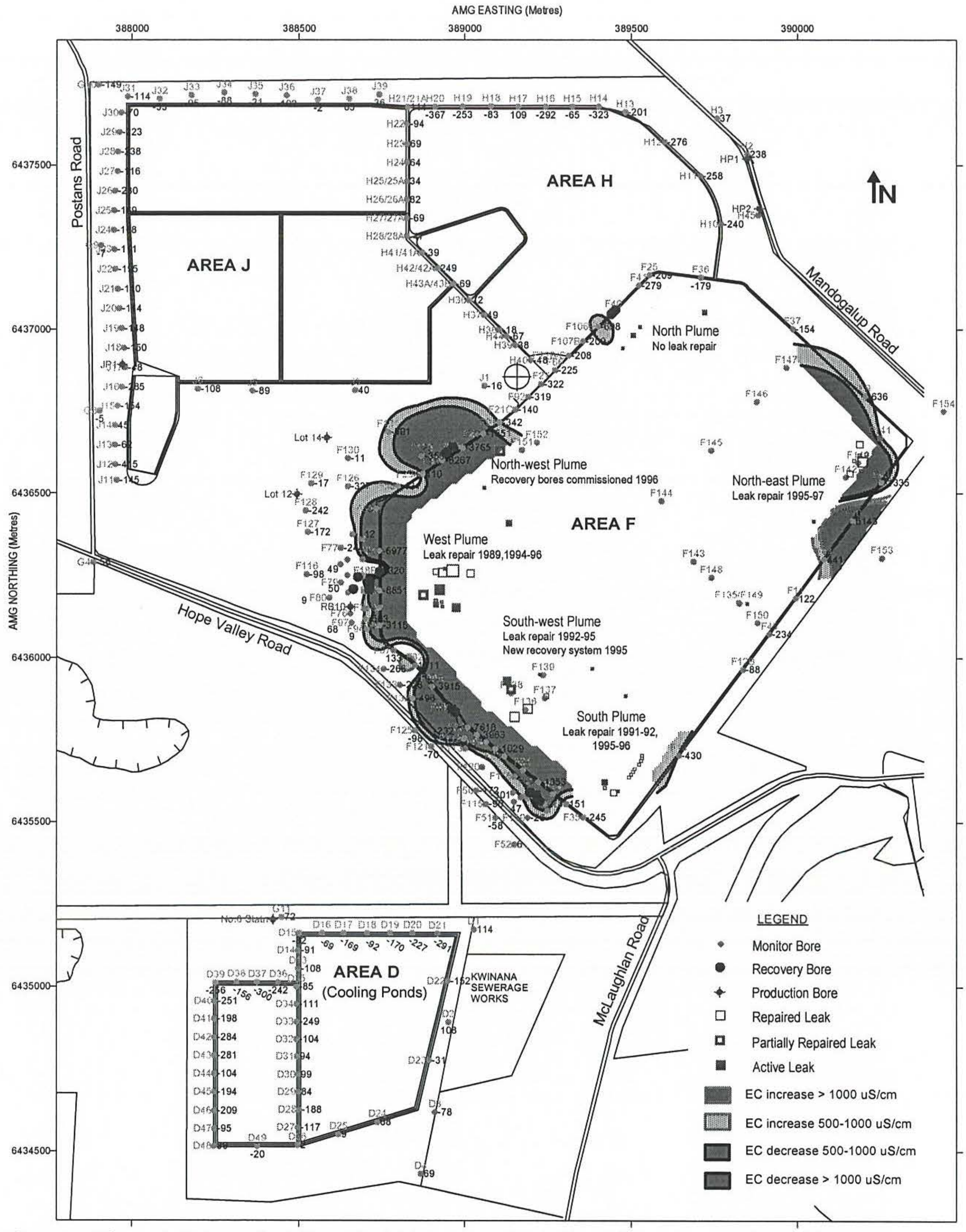


Figure 6 Change in EC over the full aquifer thickness from 1993-94 to 1997 at the operating residue areas (Source: Haselgrove, 1998)

Professional Judgement

As part of the best practice assessment, a review was undertaken by an external consultant who had extensive international experience in groundwater remediation (Miller, 1998). Based on the capability of the team involved; the investigations, research and remedial activities undertaken; the wide variety of activities being used; and, the success in managing the contamination compared to other industrial organisations, the consultant recommended that best practice criteria had been met.

Conclusion

While traditional performance benchmarking was not feasible for this issue, it was possible to devise a benchmarking strategy for assessing whether best practice had been achieved. This involved a combination of technology benchmarking of the components of the remediation strategy, the monitoring of the remediation outcome and professional judgement of how it compares with practice elsewhere. This example also highlights the importance gaining a sound understanding of the problem being managed and the value of addressing the issue on a number of fronts.

3. Benchmarking Strategies for Woodman Point

The Woodman Point Wastewater Treatment Plant serves the urban areas of Perth from Fremantle to Munster in the south and east to Hazelmere, Kalamunda and Armadale. Domestic wastewater comprises the majority of influent to the plant, with a small proportion (8.2%) of the volume from industrial sources. The outfall discharges 4km offshore from Cape Peron into Sepia Depression with a water depth of 20m. The plant treats wastewater to a primary level and has a capacity of 125ML/d. The Water Corporation is currently upgrading the plant to advanced secondary level with a capacity of 160ML/d. The current flow of 100ML/d results in approximately 9,600 wet tonnes of biosolids. The critical factors considered for benchmarking of best practice were considered to be the impact of the outfall discharge and the management of biosolids.

3.1 Performance Benchmarking for Outfall Discharge

For performance benchmarking there is a need to ensure comparable circumstances for benchmarking partners. In addition to general selection criteria of similar scale, similar waste treated, availability of data and willingness to participate, specific consideration was also given to similar climate (preferably Mediterranean), the siting of the outfall (preferably an offshore outfall with low to moderate wave energy and shore-parallel currents) and the nutrient status of the receiving environment (preferably nutrient-poor and nitrogen-limited). It was possible to involve 11 benchmarking partners in this exercise including plants from Western Australia, the eastern states of Australia, South Africa and the west coast of the United States. The performance requirement for the BPEL is that microbiological quality meets primary contact criteria at the boundary of the nominated exclusion zone.

The following indicators were considered for benchmarking purposes:
- microbiological characteristics and their epidemiological implications;
- concentrations of contaminants (metals and pesticides) in sediments and biota; and
- nutrient effects on phytoplankton and benthic invertebrates.

Microbiological Characteristics

All benchmarking partners monitored indicator bacteria concentrations at adjacent recreational beaches. There were variations in the standards used in different jurisdictions however the differences were not considered significant. Compliance at recreational beaches in the vicinity of outfalls with relevant guidelines was generally very good for all benchmarking partners. However, performance comparisons were deemed inappropriate as instances of non-compliance were invariably linked to activities other than effluent discharge. For the Woodman Point outfall, coliform concentrations were undetectable 2 km from the nearest beach, and monitoring showed 100% compliance with shellfish harvesting guidelines.

Contaminant Concentrations

Data was available for both impact sites (ie near the outfall) and reference sites (ie. well removed from outfall effects) for metal concentrations in sediments. The metals data can be interpreted both in terms of any increase relative to the reference site and in terms of the potential for adverse environmental effects. Although there is a wide natural variation in reference sites, the increase due to the presence of an outfall was minimal with the possible exception of benchmark partner 12 with respect to cadmium (figure 7). For the assessment of potential environmental impacts, the recent Australian Water Quality Guidelines (ANZECC/ARMCANZ, 2000) were used. The guidelines for metals in sediments contain "ISQG-Lows" which denote a very low risk of adverse effects based on the international database of Long et al. (1995). All results were below these criteria except benchmarking partner 9, however these higher values were due to background levels not the result of the outfall discharge (refer figure 7). There was insufficient data on pesticides or metals in biota to make meaningful comparisons.

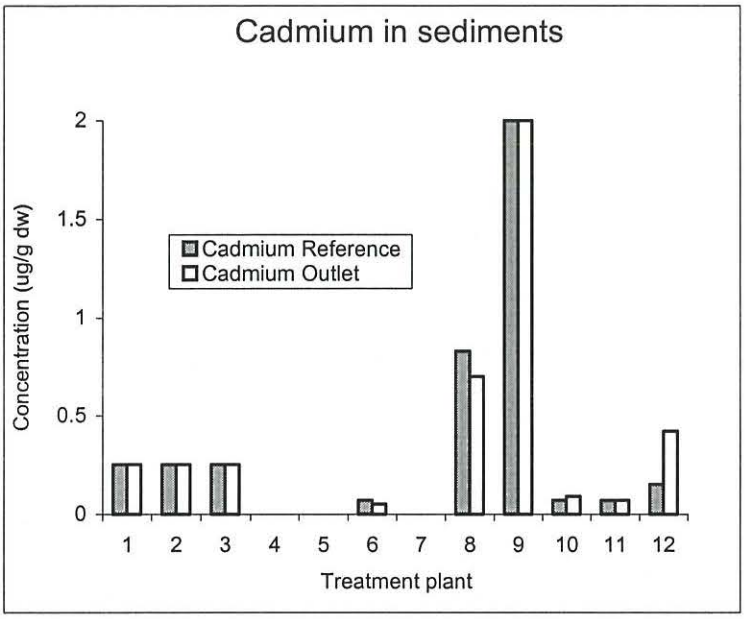
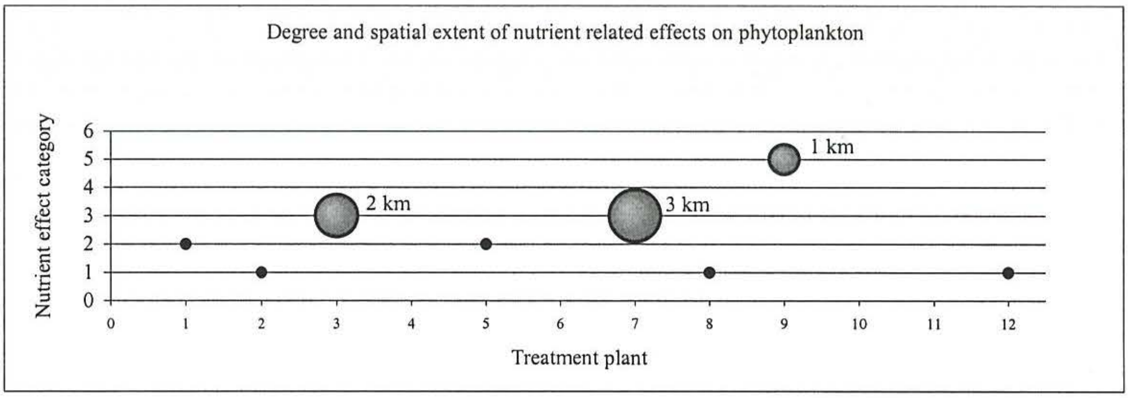


Figure 7 (Source: DA Lord & Associates, 2001)

Nutrient Effects

Direct quantitative comparison of nutrient effects was not feasible because of the different environments around the outfalls. Therefore a qualitative scale was developed for comparisons of benchmarking partners from 1 (no measurable effect) to 6 (severe measurable effect). The results of this comparison for phytoplankton and infauna effects are shown in figure 8. The nutrient-related effects caused by the Woodman Point outfall (Treatment Plant 1) are within the range of natural variation and ranked among the lesser degree of effects noted among benchmarking partners.



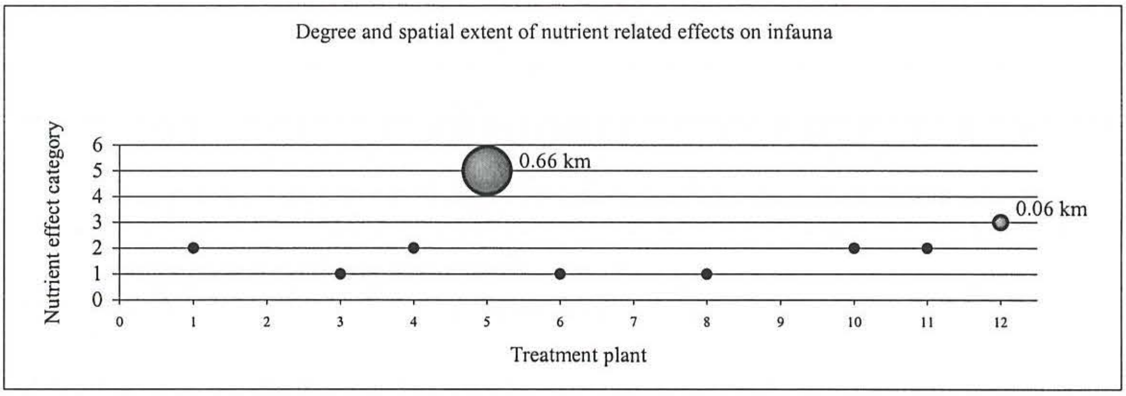


Figure 8 (Source: DA Lord & Associates, 2001)

Conclusion

The Woodman Point discharge meets the relevant environmental requirements and is ranked amongst the superior performers in terms of benchmarking against best practice. The current upgrade to advanced secondary treatment will further improve environmental performance. In this benchmarking exercise, there were some difficulties in obtaining data from benchmarking partners when relying on written responses. A sufficient number of partners was obtained only by visiting the partners' offices. Data limitations reduced the range of indicators that could be considered. In addition the absence of control data for the effects of other sources meant microbiological comparisons were difficult while the existence of reference data for metals in sediments was essential in making meaningful comparisons.

3.2 Biosolids Management

Benchmarking for biosolids management is most appropriately expressed in terms of the environmental outcome achieved - best practice being defined in terms of making the best productive use of the biosolids created in the wastewater treatment process. Land application as a nutrient source and soil improver for agriculture is currently considered best practice. For the analysis of achieving best practice in biosolids management the main test that was used was the extent of adoption of management practices set out in good practice guides by government authorities and industry associations for land application of biosolids. A related consideration was the compliance of the biosolids with standards for productive use of the biosolids. The licence performance requirement is to ensure that 100% of biosolids are reused for land application in accordance with the biosolids guidelines.

Management Practices

The Californian Water Environment Association (CWEA, 1998), the NSW Environmental Protection Authority (NSW EPA 1997) and ARMCANZ (1995) have produced manuals and guidelines for good practice in the management of biosolids. The adoption of the recommended practices was evaluated for the benchmarking partners. A summary of this evaluation is displayed in Table 1. This comparison puts the Woodman Point as one of the top performers among the benchmarking partners.

Compliance with Biosolids Standards

The biosolids need to be of a quality that is suitable for direct land application. The anaerobic digestion of the biosolids for more than 15 days meets the requirements for Pathogen Grade 2. The dewatered biosolids contaminant concentration levels are well within the limits for Contaminant Grade B based on the WTC 1995 Guidelines for Sewage Systems – Biosolids Management.

Conclusions

The benchmarking exercise confirms that the plant is operating at best practice. The comparison with standards means that the quality of the biosolids produced at the Woodman Point plant is suitable for land-based applications. In a more general sense there was concern that only 7 of the 31 potential benchmarking partners responded to the questionnaire. Also, some of the initial responses did not seem to fit the question being asked. It was evident that some questions needed clarification because they could be misinterpreted. This necessitated follow up with the respondent.

	Benchmarking partners							
Management practices	1	2	3	4	5	6	7	8
Disposal and reuse	•	•	•	•	•			
Biosolids management procedures	•	•		•	•			
Long-term management plan	•							•
Monitoring of heavy metals	•	•	•	•	•	•	•	•
Monitoring of nutrients	•	•			•			
Monitoring of pesticides	•	•	•			•		
Monitoring of pathogens	•			•				
Temporary storage	•	•	•					
Transport procedures	•			•	•			
Assessment of land for application	•	•	•					
Monitoring of land	•	•			•			
Research and development		•	•					

Note: Plant 1 is the Woodman Point Wastewater Treatment Plant.

Table 1 Evaluation of Biosolids Management Practices (Source: Water Corporation, 2001)

4.Lessons Learnt

Benchmarking of environmental performance is a relatively new field and the experienced gained in evaluating the suitability of facilities for Best Practice Environmental Licences provides some useful insights into the benchmarking process. These insights are discussed under the following headings: -

- methods of defining best practice;
- benefits of benchmarking;
- difficulties in the benchmarking process; and
- changes that would assist benchmarking.

4.1 Methods of defining best practice

The traditional approach to benchmarking is to compare different companies with respect to specific performance criteria. An example of this traditional approach is the comparison of dust levels from residue facilities (section 2.1 above). Data on annual averages or frequency of exceedance of a nominated level provided suitable indicators for comparing environmental performance of the benchmarking partners. Comparisons of performance against indicators were also possible for benchmarking some of the effluent characteristics of wastewater treatment plants. However, this approach to benchmarking was not always possible and other methods were adopted. In addition, it was found useful to adopt more than one benchmarking method for each critical issue.

Table 2 summarises the benchmarking methods used for the BPEL evaluations. The different methods are described below:

- Performance indicator: - In this method an appropriate indicator is needed which can measure relative environmental performance and for which comparable monitoring data is collected by the benchmarking partners. This was possible for dust from residue areas and for metals in sediments at wastewater treatment plant outfalls. However, it was not possible for groundwater contamination, as a suitable indicator and benchmarking partners in similar circumstances were not available. It was not possible for microbiological characteristics of wastewater effluents even though there was a suitable indicator and monitoring data was available because the data on impacts did not control for other sources and therefore was not comparable.
- Comparison with standard: - Rather than a comparison with the performance of other benchmarking partners, there is a comparison with a standard. This was the second approach used for dust levels where an internal target of 90 ug/m^3 was set. The target was 35% of the licence requirement. Comparison with guidelines was used for effluent microbiological characteristics with respect to

shellfish harvesting in the absence of benchmarking partners needing to monitor for this requirement. Compliance with land application guidelines was a secondary benchmark in relation to biosolids. However it was more of a "necessary" rather than a "sufficient" condition of achieving best practice.

- Technology used: - Although it is not a requirement of achieving best practice, if best available technology is used, then best practice has been achieved by the licensee. For the evaluation of the management of groundwater contamination it was easier to consider the technology used in each of components of the remediation strategy as benchmaking partners with comparable problems were not available.
- Management guidelines: - Where there are best practice or good practice guidelines then these can be used for benchmarking purposes. This was the approach adopted for biosolids management, as there were several guidelines available. Furthermore, the variable nature of biosolids makes performance benchmarking problematic as the circumstances facing possible benchmarking partners will also vary.
- Outcome achievement: - There are certain critical issues for which best practice is more appropriately defined in terms of achieving an environmental outcome rather than comparative performance with respect to an indicator. This was the case for groundwater contamination where remediation was the desired outcome. It was also the case for biosolids management where achieving a standard of biosolids that enabled land application was achieving best practice.
- Contribution to regional impact: - Where the discharges from a facility have the potential for regional impacts, either in combination with other discharges (eg sulphur dioxide emissions in the Kwinana industrial area) or because of the sensitivity of the receiving environment (eg. nutrient impacts on marine ecological systems), then reducing the contribution to regional impacts to a minimum represents the achievement of best practice. Reducing the refinery's emissions of sulphur dioxide to an insignificant amount qualifies as best practice. The "no measurable effect" on the qualitative scale of nutrient impact also represents best practice.
- Waste minimisation: - Similar to "best available technology", implementing waste minimisation is also an alternative way of defining best practice. For sulphur dioxide emissions from the alumina refinery, waste minimisation was achieved by changing the fuel rather than the technology but the implication was the same.
- Professional judgement: - For some critical issues it may not be possible to provide an objective assessment of whether management of a critical issue is best practice. Professional judgement is a subjective assessment of whether best practice has been achieved. The audit of the remediation of groundwater contamination by an internationally recognised consultant is an example of benchmarking against the consultant's experience.

	Critical issue				
Benchmarking method	Dust levels	SO_2 emissions	Groundwater contamination	Effluent levels	Biosolids management
Performance indicator	•			•	
Comparison with standard	•			•	•
Technology used			•		
Management guidelines					•
Outcome achievement			•		•
Contribution to regional impact		•		•	
Waste minimisation		•			
Professional judgement			•		

Table 2 Benchmarking Methods Used

4.2 Benefits of benchmarking

The introduction of benchmarking as a means of evaluating the achievement of best practice in order to qualify for a BPEL has generated a number of benefits. One of the key benefits is that, as a component of BPEL, it has helped shift the focus from just achieving regulatory compliance to achieving a higher standard of environmental performance. A number of licensees now have as a goal the gaining of a BPEL and are changing management practices to improve environmental performance.

A second benefit has been a clearer definition of critical environmental issues and performance objectives for managing those issues. This combined with monitoring performance against those objectives has led to a greater management effort in addressing the critical issues. A related benefit has been the need to understand the underlying processes associated with a critical issue in order to improve its management. This was particularly evident in the management of dust from residue areas (see section 2.1 above) and the remediation of groundwater contamination (see section 2.3 above).

Another benefit has been the transfer of knowledge of improved practices that can occur during the benchmarking process. Some of the principles and practices in dust management adopted by BHP at Port Hedland were applied to dust management at the Kwinana Alumina Refinery. Consultants also played a part in transferring knowledge and auditing performance, both of which helped facilitate the achievement of best practice.

A further benefit, which is now beginning to emerge, is the recognition that maintenance of best practice requires continuous improvement. Benchmarking is not a one-off exercise but needs to be repeated as industry standards of performance improve.

A final, more general benefit is that this process is reducing the environmental impacts of industrial operations.

4.3 Difficulties in benchmarking studies

Although there was a successful conclusion to the benchmarking studies, there were a number of difficulties encountered during the studies. One of the more difficult issues was securing suitable benchmarking partners who were willing to participate in the benchmarking process. Without partners that provide meaningful data, it is not possible to undertake benchmarking in the traditional sense. The experience also highlighted the limitations of desk studies and questionnaires seeking written responses. Site visits provided a higher level of response and more comprehensive data. However, it should also be noted that those industries, which did participate, would appear to be among the better performers. Thus if there was any selection bias it was to the positive side of best practice.

A second difficulty was the availability of comparable monitoring data. In different jurisdictions in Australia and particularly in different countries the parameters measured can vary. Furthermore, the measurement locations can vary. Without similar data meaningful comparisons for benchmarking purposes cannot be made.

A more subtle but related issue in relation to monitoring data is the availability for each benchmarking partner of reference sites to allow for variations in background levels and control sites to identify the contributions from other sources. The availability of information on background levels from reference sites for metals in sediments meant that variations in natural background could be accounted for in benchmarking comparisons. Whereas the absence of control sites to measure the contribution from other sources for microbiological monitoring meant that it was not possible to meaningfully compare the effect of wastewater outfalls on nearby beaches.

Monitoring regimes adopted by industry usually reflect the regulatory standards of government for the jurisdiction in which they operate. Where there are differences in regulatory standards between jurisdictions this can lead to differences in monitoring by industry. There were differences in microbiological standards across the different countries involved in the benchmarking of wastewater treatment plant outfalls. However, they were sufficiently similar so that comparisons could be made. Dust criteria varied and these differences influenced the parameter measured (in some cases total particulates and in other cases particles less than 10 micron). Comparisons could only be made by assuming conversion factors between the two types of measurements.

An operational difficulty is the time required to complete benchmarking studies. This was particularly the case for traditional benchmarking involving comparisons of partners against performance indicators. The process of identifying critical issues, identifying benchmarking partners, gaining the partners agreement to participate, obtaining sufficient data to undertake meaningful comparisons and then evaluating the results, can take a long time, especially when some of the tasks are outside the control of the organisation undertaking the benchmarking study.

4.4 Changes that would assist benchmarking

There are a number of changes that could be made to assist best practice benchmarking and reduce the difficulties noted above. One significant change would be an increased willingness by industry to participate as partners in benchmarking studies. There is value to being a benchmarking partner in gaining information on improved approaches to environmental management. An alternative way of increasing the availability of environmental performance information is to make it publicly available. The growing trend for corporate environmental reporting and triple bottom line accounting is consistent with making environmental performance more available for benchmarking purposes.

Regulatory authorities could assist by increasing the consistency of regulatory requirements. This is needed at both the international and national level. A related change is achieving greater consistency in monitoring practices and performance indicators. A recent example of such changes is the National Environment Protection Measure for Air Quality (NEPC, 1998). This committed all Australian jurisdictions to the same air quality standards and to consistent monitoring and reporting of air quality measurements.

Where there are multiple sources of possible adverse environmental effects or where background concentrations are highly variable then there is a need for control measurements to distinguish the contributions from different sources or reference measurements to determine any impacts above background. This would not only improve benchmarking studies but also improve the management of environmental systems. It was only after putting in place an integrated system of emission and ambient monitoring of sulphur dioxide and the ability to predict individual contributions through computer modelling that systematic management of air quality was achieved in the Kwinana airshed.

A task to which both government and industry can contribute is the documentation of best practice guidelines. Their existence was invaluable in the benchmarking of biosolids management and more significantly they facilitate the adoption of better environmental management practices.

Another improvement would be the better documentation of benchmarking methodologies for environmental performance. The recent approaches in Western Australia were a learning experience. The preparation of this paper is a small contribution to improving benchmarking methodologies.

References

ANZECC/ARMCANZ. 2000. The Australian and New Zealand Guidelines for Fresh and Marine Water Quality. ANZECC and ARMCANZ, Canberra.

California Water Environment Association. 1998. Manual of Good Practice for Agricultural Land Application of Biosolids. CWEA, California, USA.

D A Lord & Associates. 2001. Impacts on the Marine Environment – Benchmarking Study Report Woodman Point Wastewater Treatment Plant. Prepared for Water Corporation, Perth. (Commercial-in-confidence)

Department of Environmental Protection. 1996. Southern Metropolitan Coastal Waters Study. DEP WA.

Department of Environmental Protection. 1998. Best Practice Environmental Licences. DEP, Perth.

Government of Western Australia. 1992. Environmental Protection (Kwinana) (Atmospheric Wastes) Policy.

Haselgrove K. 1998. Groundwater Management at the Kwinana Alumina Refinery. Hydrosearch Pty Ltd Booragoon WA.

Jenkins B R. 1996. Best Practice Environmental Regulation – the Western Australian Approach. Conference on Environmental Management Beyond 2000, Griffith University Brisbane 5-6 December 1996.

Kwinana Alumina Refinery 1998a. Sulphur Dioxide Benchmarking – Best Practice Licence Submission. Kwinana Alumina Refinery, Kwinana WA.

Kwinana Alumina Refinery. 1998b. Alcoa Kwinana Residue – Dust Management and Performance. Kwinana Alumina Refinery, Kwinana WA.

Long ER, MacDonald DD, Smith SL, and Calder FD. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management V19 pp81-97.

Miller, DW. 1998. Discussion Paper in Support of Best Practice Licence Kwinana Refinery Alcoa of Australia Ltd. David W Miller Associates Osterville MA USA.

National Environment Protection Council. 1998. Ambient Air Quality - National Environment Protection Measure. NEPC Adelaide.

New South Wales Environmental Protection Authority. 1997. Environmental Guidelines – Use and Disposal of Biosolids Products. NSW EPA, Sydney.

PPK. 1998. Dust Benchmarking – Best Practice Environmental Licence Submission Kwinana Alumina Refinery. Prepared for Alcoa of Australia Ltd.

Water Corporation. 2001. Biosolids Management – Benchmarking Report Woodman Point Wastewater Treatment Plant. Water Corporation, Perth. (Commercial-in confidence)

Water Technology Committee. 1995. Guidelines for Sewage Systems – Biosolids Management. ARMCANZ Water Technology Committee 1/95.

Acknowledgments

The authors are grateful to Steve Genoni of Alcoa and Ivan Unckovich of the Water Corporation for reviewing a draft of this paper.