

CASE STUDY: DUST CONTROL IN REFUSE TRANSFER STATIONS

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ABSTRACT

EnviroWaste has identified a significant airborne hazard and embarked on a comprehensive programme to demonstrate a committed, collaborative and innovative approach to improve the work environment within its transfer stations and recycling facilities. Epidemiological research has shown significant effects on worker health in transfer station and recycling facilities from high concentrations of total airborne dust, bacteria including faecal coliforms, and fungal spores. Onsite sampling at EnviroWaste transfer stations has confirmed that employees are exposed to significant levels of these contaminants. A number of pro-active steps were taken to manage this hazard, including the installation of a fogging system.

1. INTRODUCTION

1.1 EnviroWaste Services Limited

EnviroWaste Services Limited is the second largest integrated waste collection company in New Zealand. EnviroWaste operates throughout New Zealand with a presence in every major centre and 41 sites. Staff currently number at 425 with approximately 15% working in transfer stations and recycling centres. The majority of the staff is male with an average age of 41.04 years.

Operations at EnviroWaste include refuse collection, processing and disposal, landfill development and management, recycling, liquid and hazardous waste collection and treatment, environmental monitoring and management of contaminated land. Two of EnviroWaste's four Auckland transfer stations are run as joint venture sites.

1.2 Background

In this document the term "transfer station" refers to both transfer stations and recycling operations.

Most major towns and cities in New Zealand have transfer stations where waste is disposed of by domestic or commercial customers prior to being transported to landfill. Work within the transfer station requires waste sorting and recycling, often manually.

Due to the high concentrations of total airborne dust, bacteria, faecal coliform bacteria and fungal spores, workers at transfer stations and landfills may experience an increased risk of pulmonary disorders and gastrointestinal problems (University of Florida, 2000; Poulsen et al., 1995a; Poulsen et al., 1995b). Although no long-term studies have been carried out to assess the risk of work-related health problems

specifically for the waste and recycling worker, a relationship has been established in other industries (including pig and poultry farms, animal feed mills and cotton mills) between health problems and airborne dust containing micro-organisms (Poulsen et al, 1995a).

Until early 2006 EnviroWaste's Customer Service Operators (CSOs) had been working in the transfer stations with no respiratory protection and unquantified exposure levels. Machines at the transfer stations have enclosed air-conditioned cabs which could minimise the operators' exposure to the dust; however most machine operators habitually worked with their cab doors open. High dust levels have placed added strain on the machine air conditioning units and in some cases they were unable to cope.

EnviroWaste identified an excessive quantity of dust in the transfer stations potentially affecting employees, environmental compliance and plant. Initial steps to assess the size of the problem evolved into a project to address the dust and several associated issues.

Throughout this project actions taken have exceeded the minimum standard required by Workplace Exposure Standards WES) (1992) and have been driven by a desire to improve the work environment, achieve a high standard of practice and protect the health of the employees.

1.3 Factors Contributing to Increased Risk

Recent factors contributing to increased employee dust exposure in the transfer station environment are:

1.3.1 Shed Design

The design of the transfer stations has been altered from a simple roofed pit with open sides to a fully enclosed shed ensuring improved environmental containment. From the viewpoint of the Resource Management Act (1991) the design has been successful in limiting dust and odour dispersal; however it has increased the concentration of dust trapped within the transfer station. The subsequent flow-on effect to employee and customer is increased exposure to potentially harmful dust.

1.3.2 Resource Recovery

Diversion of refuse from landfill is achieved by recovering recyclables from the waste stream. There is, therefore, a need to have Customer Service Operators either manually or mechanically, picking through refuse or pulling out recyclable items. In addition, mechanical sorting of waste to extract recyclable commodities increases the level of dust disturbance.

1.3.3 Closure of Greenmount Landfill in Auckland

The recent closure of the Greenmount Landfill has meant that the closest landfill is the North Waikato Regional Landfill at Hampton Downs. The extra distance to the new landfill means transportation of waste is no longer cost effective for many operators who have instead opted to deposit their loads at one of EnviroWaste's network of transfer stations. This has resulted in the construction of new, fully enclosed transfer stations throughout Auckland to meet the increased demand..

1.3.4 Change in Waste Composition

With the closure of Greenmount Landfill a greater proportion of dusty and putrescible waste is now processed at transfer stations. For the transfer station staff, predicting which load will be dusty is impossible until it has been discharged.

1.3.5 Increased Costs

Dust dispersal from dusty loads was traditionally controlled by wetting them down; a tactic which is less frequently used as it adds weight to the load and increases weighbridge charges. This issue has become more important with recent increases in waste disposal costs.

1.3.6 Increased Volume

As Auckland has grown, more waste has been generated. This, combined with the closure of the Greenmount Landfill, has resulted in transfer stations receiving greater volumes of waste and new transfer stations being built. This increased number of transfer stations means that more employees are being exposed to potential dust hazards.

1.3.7 Work Organisation

To solve public and employee safety issues and facilitate the smooth operation of transfer stations it is necessary to have, in some cases, increased staffing levels, leading to more people being exposed to dust.

2. QUANTIFICATION AND MANAGEMENT OF THE HAZARD

Initial environmental health testing was performed in December 2005 by EnviroWaste and an independent occupational hygienist. The aim was to determine the significance of the dust hazard and to relate the results to any possible health effects. The results indicated that airborne dust in the transfer stations was a significant health hazard.

The immediate response once the significance of the hazard was established was to form a team involving transfer station operations, sales, refuse collections, environmental and health and safety personnel to manage the problem. The project was jointly lead by health and safety and transfer station operations, who reported to EnviroWaste senior management on progress and solutions. The EnviroWaste and joint venture Boards of Directors were updated via board papers. Employees were consulted and informed of progress at regular meetings. All parties were anxious to have this issue resolved promptly and supported the team toward this outcome.

The pressing concern was employee health; P2 disposable respirators were provided as an urgent stop-gap measure with staff trained in their correct fit, use and storage. Staff were required to wear this equipment at all times in the transfer station environment until additional measures reduced the dust level. However, while the impact of the hazard was minimised in relation to employee health, the team continued to search for ways to reduce the dust at source and control dust that was discharged at the transfer station. A number of comprehensive responses implemented by EnviroWaste has significantly reduced dust levels in the transfer station environment as detailed below:

- National and international solid waste companies were consulted about ways to reduce dust due to the potential impact on worker health. Interestingly, their emphasis was on environmental compliance only, indicating that EnviroWaste would be leading the industry in specifically addressing this particular hazard to employee and customer health in the context of New Zealand's waste handling industry.
- Consultation with engineering companies to investigate active dust extraction. The size of the transfer station sheds and the costs exceeding \$500,000 per site made this an unviable option.

- A fogging system was installed at the Patiki Road site as a trial in October 2006 which atomises water into a droplet size ranging from 2-30 microns (selectable). The aim of this system is to reduce airborne dust by accelerating deposition.
- New exhausts with catalytic converters have been fitted onto the machines. These systems reduce carbon black particles by 30%, carbon monoxide by 95%, hydrocarbons by 95% and noise by 15db.

Process and work organization changes to reduce the quantity of dust entering transfer stations included:

- All staff complete an incident form each time a customer discharges a dusty load. This alerts the site manager, who makes contact with the customer requesting them to place their dust into bags provided by EnviroWaste. A separate dust collection service was established in Auckland, which has since discontinued due to inefficiencies in running this kind of operation. In some cases where customers have failed to change dust disposal practices, hard-line approaches such as refusal to dispose at the site, or significant price increases to cover the interruption to transfer station operations and the cost of mitigating the effects of the dust are being considered.
- Sales representatives have been trained and instructed to be more vigilant when selling and assessing waste disposal options to potential customers so that waste, such as dust, can be collected separately or controlled.
- Involvement of transfer station customers in the solution, thereby raising industry awareness. Some of these customers are also competitors in the collection market which added a challenging dynamic to the solution.
- The machines have been engineered to be inoperable unless the cab doors are closed, with staff being advised of this modification and requirement.
- Working with the WasteMINZ safety Forum to look at industry initiatives to control the dust at source and still remain competitive in the market.

Since December 2005 ongoing testing has been performed to monitor progress and to determine the efficacy of the solutions. This has comprised: deposited dust tests; static and personal monitoring; heavy metal analysis; and microbial analysis.

2.1 Results of the Environmental Health Monitoring.

2.1 Deposited Dust

The December 2005 results for deposited dust testing showed that concentrations of dust at the four sites measured exceeded the New South Wales State Pollution Control Commission complaint guidelines and the United States Environmental Protection Agency residential area guideline by 20-150 times. New Zealand does not have guidelines for deposited dust; however deposited dust is used as an air quality indicator internationally to measure acceptable levels in the environment (Air Matters Ltd., 2005). Inspirable dust (particles smaller than 10µm) was considered to be problematic with toxic elements present although well within the WES.

Testing in December 2006 showed a significant reduction in deposited dust compared to December 2005, indicating that the steps taken in managing dusty loads were effective in all four transfer stations, despite increased volumes of waste.

2.2 Personal Monitoring

Personal monitoring was conducted in March 2006 on a CSO from each of the four Auckland sites by attaching a respirable dust cyclone and filter to an operator's collar and connecting the cyclone to a sampling pump over a period of one shift. The heavy metals were collected by attaching a mixed cellulose ester filter with a 0.8µm pore size to the collar of the worker and connecting that to a calibrated sampling pump. This was to determine the respirable and inspirable dust as well as respirable silica and heavy metals (Air Matters Ltd., 2006). Personal monitoring has continued throughout 2007-8 with inconclusive results due to poor compliance with the testing method by the workers, as well as highly variable results due to small sample size. Personal monitoring has been discontinued in the latest series of data collection.

2.3 Heavy Metals

Heavy metals were measurable with the overall concentrations being low and well beneath the recommended guidelines in the WES. However, some of the metals detected bio-accumulate in the body tissues, for example, arsenic, lead, manganese, chromium, nickel, and lead. It was considered that the contribution to the results from cigarette smoke was negligible, however these metals are present in cigarette smoke and potentially provide an additional source for bio-accumulation for the worker (Air Matters Ltd., 2006).

2.4 Patiki Road Fogging System

The overall trend (2005-8) shows increased deposition and a reduction in airborne inhalable dust since installation of the system, with between-sample variation most likely attributable to specific treatment regimes (ie the frequency, interval and duration of fogging in use at each sampling date). Ongoing testing throughout 2007 and 2008 indicated that the fogging system has a major effect on airborne dust reducing the average levels of inhalable airborne dust (particles >100µm) by 3-6 times.

The personal and stationary dust sampling results suggested an average reduction of 36% and 53% respectively in inspirable (>10µm) dust post-fogging; however the fogging system appears less successful at trapping particles less than 4 µm (Air Matters Ltd., 2006). Ongoing testing has been less conclusive due to poor compliance with the testing process by refuse station staff. However, the respirable dust levels remained well below the WES for all contaminants with the exact composition of the dust still unknown, unpredictable and variable.

Total average faecal coliform abundance showed a decrease with the addition of chlorine dioxide (ClO₂) to the fog, however *E. coli* appear to have exhibited less of a response than other faecal coliform taxa. What appears to be complete elimination of non-*E. coli* coliforms in the November 2006 (fogging without ClO₂) sample is almost certainly an anomaly, as these coliforms are present in all subsequent samples (with ClO₂).

Abundances of viable spores of potentially pathogenic fungal species, including *Aspergillus fumigatus* and *A. niger*, appear to have been reduced by the addition of chlorine dioxide to the fogging system, but remain above safe guideline levels proposed by Biodet Ltd (the microbiology lab who quantified the fungal samples). Higher abundances of viable spores were recorded in the loadout area, compared to the shed floor (customer tipping area).

Visitors to the site commented on the noticeable reduction in airborne dust and there have been other benefits such as a reduction in air temperature in the sheds and reduced odour.

3. SUMMARY

A number of factors have led to the increased risk of airborne dust in transfer stations. EnviroWaste has undertaken a rigorous programme of environmental and personal health monitoring as well as looking at wider initiatives to minimise the impact of airborne dust on their employees. Although the fogging system is being installed in other EnviroWaste transfer stations, the most effective results in reducing airborne dust were demonstrated by active load management. EnviroWaste has demonstrated commitment to addressing this problem as well as leading the waste industry in identifying and managing this health hazard despite testing indicating that dust levels were below the Workplace Exposure Standard.

Referee

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