Attachment 1

1. Application

1.1 Applicant

New Zealand Galvanising Limited
PO Box 38956
Wellington Mail Centre

1.2 Consent Applied for

DA000110 [20293]: Discretionary Activity

To discharge contaminants to air from the operation of a hot-dip galvanising process and associated activities.

1.3 Location

New Zealand Galvanising Limited (NZGL) has applied to discharge contaminants to air from their site at 129 Hutt Park Road, Gracefield, Lower Hutt, at or about map reference NZMS 260:R27;703.947.

2. Background

NZGL has applied for renewal of their discharge to air permit, WGN950003 to discharge contaminants to air from the operation of a hot-dip galvanising process and associated activities.

The applicant does not propose to change any part of the current operation or processes carried out on site. However, as a result of negotiations over the recommended consent conditions, the applicant will investigate a preferred emission control equipment option, and implement this within four years of commencement of the permit.

2.1 History

NZGL operates a hot-dip galvanising process for a wide variety of engineering work, ranging from small objects to large steel walkways. The applicant has operated the hot-dip galvanising process from the present site since 1991. Prior to this, the plant was operated by William Cable Limited from 1981 to 1990 when that company ceased trading. William Cable Limited operated a similar plant nearby from pre-1940s to 1981 when the plant was moved to the present site.

Prior to the implementation of the Resource Management Act (RMA) 1991, hot-dip galvanising was specified in Part A 5(e) of the Second Schedule to the Clean Air Act 1972. The Clean Air Licence No. HD/14/0030/89, issued by the Department of Health on 9 November 1989 to William Cable Limited (the former owner), became a

discharge to air permit (WGN920416) issued by the Wellington Regional Council (WRC) pursuant to the Resource Management Act 1991. This expired on 31 March 1995. A new permit was then issued by WRC containing operating conditions that took into account concerns from neighbouring submitters. The current permit, WGN950003 expired in August 2000. A draft application was submitted for a renewal of the discharge to air permit on behalf of NZGL on 1 February 2000.

The *Technical Report and Assessment of Effects on the Environment (1995)*, was re-submitted with the renewal application. The applicant stated that the activities carried out by NZGL, and the potential effects on the environment from these activities remained essentially the same as in 1995.

Outstanding issues from the 1995 application included:

- Consultation with people who may have been affected by NZGL's activities;
- A review of air emission control methods; and
- A review of the efficacy of current methods of minimising the emission of fume from the site and how operating factors can reduce such emissions to a level, which should, given consistent application, not cause significant adverse effects within the industrial location.

These outstanding issues were addressed in additional information submitted to the WRC in July 2000, when the application was officially received.

2.2 Location and Zoning

The applicant's premises are situated in a large industrial area, which is zoned **Special Business** pursuant to the Proposed District Plan – City of Lower Hutt. The legal description of the land is Lot 1 DP 25464, being part of the land under the certificate of title number F4/655.

Surrounding neighbours include light to heavy industrial and commercial activities, and support services. Immediate neighbours include industrial engineering factories, industrial and commercial building materials' suppliers, freight carriers, wholesale and retail food suppliers, automotive repairers and automotive parts retailing, an industrial gas supplier, and research laboratories and facilities. The location is of moderate sensitivity, but is consistent with the operation of a well-maintained and operated galvanising process.

2.3 Topography and Meteorology of the Area

The area is generally flat with the Eastern Hutt hills as the only significant topographical feature near the applicant's site.

The nearest anemometer to Gracefield is located at Wellington Airport, approximately 10 kilometres south-west of the applicant's site. There is a local meteorological station at Gracefield that records surface wind frequency on a daily basis. The applicant provided information of wind roses illustrating average wind speed (knots) and frequency (%) for Wellington Airport for the period January 1960 to September 1988, and for Gracefield for the period 1970 to 1980. The Gracefield data confirmed qualitative information that the Gracefield area is influenced by the Eastern Hutt hills giving nearly three times the calm periods (less than one knot) experienced at the

Wellington Airport. The north-westerly component also increases from less than 5% to about 20% at the expense of the northerly. The influence of the Eastern Hutt hills decreases with increasing distance to the north-west of the site. More recent data was not submitted by the applicant.

All wind directions are unfavourable for the applicant insofar as any discharges will carry towards other development irrespective of wind direction. The area is also subject to temperature inversions during relatively cool, calm, and clear conditions, and the applicant recognises that during such periods atmospheric dispersion is limited. Katabatic (cold air) drainage down the Hutt Valley during such stable meteorological periods is common and under those circumstances contaminants trapped within the inversion layer are transported to the south of the site.

3. Proposal

3.1 NZGL Factory

NZGL operates in a rectangular building approximately 55 metres long and 17 metres wide with a standard pitched roof and a central roof ridge. The sidewalls are about 8 metres high and the roof ridge is about 11 metres high. The building is as high as, or higher than, any other buildings in the immediate vicinity.

NZGL operates generally from 7:30am to 4:30pm daily, five days each week. Occasionally hours are extended to about 7:00pm on weekday evenings, and Saturdays from 6:00am to 12:00pm, depending on workloads.

3.2 Description of NZGL Processes

All steelwork to be galvanised is received by truck through the large roller door at the southern end of the processing building. The applicant requires that all received work be substantially free of paint, plastic, or other materials. These materials may otherwise give rise to increased discharges of contaminants to air during galvanising operations.

The steelwork is stored and prepared for processing in the tying up and jigging area between the pre-fluxing and molten zinc galvanising baths. The steelwork is transported by remote-controlled, overhead rail cranes at all times. Large articles are directly suspended from the crane, whereas small articles are placed by hand into suitable steel mesh baskets or hung from racks, which are then directly suspended from the crane. The finished galvanised products are despatched by truck through the large roller doors at the northern end of the processing building.

Hot-dip galvanising, by the pre-fluxing method, involves the coating of clean, oxide-free iron or steel with a thin layer of zinc. For the zinc coating to take, the work requires the following stages:

(a) ***Degreasing Operations***

Degreasing removes oil and grease from the steelwork to prevent oil mist generation during galvanising, and to produce better quality products. The hot caustic soda degreasing bath contains about 60g NaOH per litre of water held

at about 75-80^{o}C by a gas-fired heater. The degreasing bath is heated by Maxon 608 Tubaflame gas-fired burners, with a maximum rate of heat release of about 0.17MW. Combustion gas is discharged into the workplace through a flue of about 0.15 metres diameter, which terminates at about 2.5-3.0 metres above floor level. Discharges to air are limited to **water vapour** (steam).

Degreasing is followed by a cold water rinse in a bath of identical size to the degreasing bath.

(b) ***Pickling***

Adhering mill scale, rust, and other oxides are removed by acid treatment. Two pickling baths are currently used – the first dip contains "weak" acid (less than 10% hydrochloric acid by weight), and the second dip contains "strong" acid (about 16-18% hydrochloric acid by weight). Both acid solutions are used cold (the most effective temperature is 18-21^{o}C, which is maintained by reaction between acid and water scale).

Concentrated hydrochloric acid is diluted with water to produce the "strong" acid, and is currently inhibited with Stannine LF, a substituted thiourea-based blend with a foaming surfactant. This inhibitor minimises efflorescence, reduces acid attack on steel without affecting scale removal, and acts as a wetting agent. It is also designed to produce a blanket of foam on the bath surface to suppress acid mist and pickling fumes. The resulting smoother work surface:

- gives a better finish to galvanised articles;
- reduces metal attack to give less iron accumulation in the pickle, and prolongs the pickling solution's life; and,
- forms less hydrogen which reduces efflorescence with less acid mist discharged.

Discharges to air are primarily **HCl gas** and a small quantity of **acid mist**.

All articles of galvanising work are rinsed in two cold water baths after the degreasing and pickling operations to remove residual contamination and processing liquors before immersion into the next processing bath. The only discharge to air from each of the rinsing baths is **water vapour**.

(c) ***Pre-fluxing***

Pre-fluxing improves the quality of galvanising work by improving zinc adhesion to the steel surface. The hot flux solution assists air drying of the work prior to zinc dipping. The pre-fluxing bath contains a solution of zinc ammonium chloride in water at a concentration of about 200-400g/litre, and a specific gravity of 1.112. The temperature is maintained at about 75-80^{o}C by a gas-fired heater. The pre-fluxing bath is heated by Maxon 608 Tubaflame gas-fired burners, with a maximum rate of heat release of about 0.17MW. Combustion gas is discharged into the workplace through a flue of about 0.15 metres diameter, which terminates at about 2.5-3.0 metres above floor level. Zinc ammonium chloride causes less fuming during galvanising than ammonium chloride, but has slower fluxing action. The only discharge to air from the pre-flux bath is **water vapour**.

NZGL operates the pre-fluxing process in a way that avoids flux being added to the galvanising bath. This practice substantially reduces the emission of fume, compared with the alternative flux blanket method. This minimises the emission of fume from the zinc bath, but requires that the work to be dipped is **thoroughly dry** following pre-fluxing, and that the speed of dipping into the molten zinc is slow and even.

Drying is achieved by dipping work into the hot flux solution, and allowing adequate drainage of retained flux solution after withdrawing the work from the flux tank. This step allows the warm steel to evaporate retained moisture. Suspending work above the galvanising bath allows convection and radiant heat to further dry the work. While this is reasonably practicable for uncomplicated work at a steady throughput, moisture is retained by complicated work (especially if finned, hollow, or partially hollow). Complicated work thus requires a substantial period to dry sufficiently so that steam generation during dipping is negligible.

The effect of complete drying of fluxed work is that it slows down production. To maximise the drying of work but still be economically viable, production of around 120 tonnes of steel per month is the realistic maximum for the site. Drying of work can be supplemented by heating systems, but the cost of heating can become high, especially during winter months.

Drying also avoids steam explosions in the galvanising bath, which cause molten zinc spatter, and can degrade work quality. This often results in the burning of zinc fume to generate excessive zinc oxide smoke.

Completed work is dried by hanging it in the workplace. There is no extra ventilation over the fluxing and galvanising baths. **Water vapour** is discharged to air during this process. However, even totally dry work can cause excessive **fume emission** if it has a high surface area, or during double dipping of work too large to be fully galvanised during one dip.

(d) ***Galvanising***

Zinc coating is carried out by immersion of pre-fluxed work in molten zinc held at 450-460^{o}C by a gas-fired burner. The zinc bath is heated by a Maxon 3-inch WR gas-fired burner, with a maximum rate of heat release of about 0.52MW. **Combustion gas** is discharged into the workplace through a rectangular flue measuring about 0.20 metres x 0.25 metres, which terminates at about 2.5-3.0 metres above floor level. The quality of coating depends not only on the composition of the iron or steel work, but on the quality of zinc, the presence of about 1% lead and minor quantities of aluminium (Toning Alloy), galvanising bath temperature, time of immersion, and rate of work withdrawal. Galvanising generates **ash**, and raking of this material generates **dust**.

Ash is the zinc oxide film that develops on the surface of the molten zinc during galvanising operations. Ash is frequently raked from the molten zinc surface to one end of the zinc bath during galvanising. The built up ash is then

periodically removed by shovel to a nearby drum, which is despatched off-site for recycling.

Dross, the zinc-iron alloy formed during galvanising, is allowed to settle to the bottom of the zinc bath. It is removed regularly from the bath using a perforated ladle and despatched off-site for zinc recovery.

The zinc used for galvanising, which is high purity (99.9% pure), contains a minor quantity of lead (which helps the galvanising process), and minimal cadmium as an impurity. While lead and cadmium are toxic elements, particularly if they are present in air in significant concentrations, the applicant states that the emission of these metals to air from the zinc bath are low and are not a risk to the public.

The lead component of the zinc assists in drossing, but it is more difficult to satisfactorily galvanise at lead concentrations less than 0.5%. More than minimal iron gives rise to excessive dross. Aluminium is present generally in concentrations less than 0.0007% and this element reduces the rate of oxidation of molten zinc, brightens the appearance of the work, and improves the uniformity of coating. Cadmium is present as a basic impurity as it is a contaminant in zinc ore.

Discharges to air are primarily combustion gases, ash and dust, containing zinc, lead and cadmium.

(e) ***After-Treatment***

Work is quenched in cold water containing about 0.02% potassium dichromate to protect work from "white rust". The discharge of contaminants to air is negligible, being mainly **steam** from quenching of hot work.

3.3 Wastewater Treatment and Disposal

The main wastewater source is the first pickling bath containing the spent "weak" acid pickling liquors. These liquors are pumped directly from the pickling bath into either the wastewater treatment tank or the wastewater holding tank located behind the Main Office. Each tank has a capacity of about 25,000 litres. The applicant may use this wastewater treatment tank to neutralise other spent process liquors in the future.

The spent pickling liquors are neutralised by treatment with an alkaline solution (e.g., caustic soda) and air sparging of the treatment tank. The neutralised liquors and residual sludges are pumped into a waste contractor's tanker for disposal at the Silverstream Industrial Landfill or other appropriate site. Any residual sludges from the other processing baths are also pumped into the waste contractor's tanker for disposal in this manner.

4. Other Consents and Approvals Required

No other consents or approvals are required as part of this application.

5. Consultation

The applicant provided copies of a pre-application consultation summary to its immediate neighbours on 17 April 2000, and received the following comments:

Mr Robin Walsh, Eastbourne Timber & Hardware advised that neither he nor his staff have any problems with NZGL.

Mr Dick Joyce, Seaview Engineering Limited advised that they do not get galvanising fumes into their workshop to the same degree as before the pre-application consultation. They have also moved from the back of their premises, which is close to the applicant's operations. Grey dust from outside was deposited over fittings and surfaces in their workshop and office during northerly conditions, but this has not occurred for a long time. The source of this material was unknown, but Mr Joyce was certain that it did not originate from Seaview Engineering activities.

Mr Mike Smith, Monroe Springs advised that galvanising fumes come down the driveway and drift into the plant on occasions but the situation is much better than around seven months prior to the consultation, when the fumes were highly objectionable. They would, of course, like no fumes. He thought that the eastern roller door was not always substantially closed during galvanising, although it had improved in recent months.

Further consultation and negotiation with submitters is outlined in Section 7 of this report.

6. Notification and Submissions

The application and further information lodged with the Wellington Regional Council was publicly notified in the *Evening Post* on Saturday 29 July 2000, and the *Hutt News* on Tuesday 1 August 2000, under section 93 of the RMA 1991. A sign was placed outside the NZGL site on 28 July 2000.

Persons considered by the Wellington Regional Council to be directly affected by the proposed activities were individually notified. These included surrounding heavy and light industrial companies, transport companies, and the Hutt City Council.

A total of three parties made submissions within the submission period, which closed on 29 August 2000. One of these was in opposition, and two gave conditional support. A late submission was received on 30 August 2000, in opposition to the application. This late submission was accepted. A summary of the submissions received is given in Appendix 1.

7. Further Information and Meetings

A pre-hearing meeting was held on 8 September 2000 at the Wellington Regional Council between the applicant and all submitters.

During the meeting there was some consensus reached as to undertaking several steps that may alleviate the concerns of most of the parties involved. These proposed steps included:

- The applicant drafting a monitoring proposal for sampling ambient air inside the NZGL plant. The proposal was to be submitted to the WRC, who then circulated it to all parties for comment. The deadline for the programme to be submitted to the WRC was by **13 October 2000.**

- Providing the monitoring proposal was satisfactory to all parties, the testing would be undertaken and completed by **1 December 2000.**

- The results were collated with an interpretation (prepared by Ron Pilgrim, Sinclair Knight Merz on behalf of the applicant) and were to be circulated to all parties for comment by **22 December 2000.**

- The applicant was also to draft a proposal to commission further ventilation fans, which was to be submitted to the WRC, and circulated to the other parties for comment. The proposal was to be submitted to the WRC by **13 October 2000.**

The monitoring proposal was received by the WRC on **18 December 2000**, and circulated to all submitters for comment. The WRC received the revised monitoring proposal, incorporating submitters' comments, on 5 March 2001. The monitoring was carried out on **18 April 2001**.

The WRC received the results of the Ambient Air Monitoring on **11 June 2001**, and commissioned an independent peer review of the results, which was completed on **9 July 2001**, by Emily Wilton, Environet Limited. Ron Pilgrim, on behalf of the applicant, provided comments on Emily Wilton's review, which was received by the WRC on **8 August 2001**.

All submitters advised that they were happy with the results of the monitoring and were prepared to look at draft conditions. No proposal for further ventilation fans was submitted by the applicant, but this issue was raised and addressed in consultation with submitters during the negotiation of recommended consent conditions.

Following the above actions, draft conditions were prepared by WRC in consultation with the applicant and were circulated to all submitters on 3 September 2002. Submitters raised several concerns in relation to the draft conditions, as follows:

- Hutt City Council was concerned about the suggested ten-year term of permit, and they considered that a five-year term of permit was more appropriate. They also requested clarification regarding whether air curtains had been trialled at the site, as detailed in the application, and any results of such trials, if held, and whether or not additional roof ventilation fans were installed at the site. Hutt City Council requested the inclusion of another condition, requiring management to maintain a detailed log of production rates at the site, to ensure that the galvanising process would not be overloaded.

- Regional Public Health (RPH) requested that a condition be included to ensure that the additional roof ventilation fans mentioned in the application, be installed. RPH also recommended that cadmium be included as part of the testing programme, and that a condition be added requiring the applicant to keep a record of all work completed including production rates.

- Exide Technologies had a query regarding interpretation of the draft review condition, but were otherwise happy with the draft conditions.

- Opus International Consultants were concerned that the draft conditions were not tight enough, although, they were otherwise generally satisfied with the draft conditions and considered that any changes on their part would be only tinkering.

The applicant provided a written response to the submitters' concerns and comments on 20 September 2002. After further negotiation and consultation, and a slight amendment of the draft conditions, all submitters provided written confirmation to WRC that they were satisfied and no longer wished to be heard at any hearing. All submitters had signed off on the draft conditions by 8 October 2002.

8. Statutory Reasons for Requiring Resource Consents

8.1 Discharge Permit

Section 15 of the RMA 1991, Discharge of contaminants into environment, provides as follows:

> *(1) No person may discharge any –*
> *(a) Contaminants or water into water; or*
> *(b) Contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water; or*
> *(c) Contaminant from any industrial or trade premises into air; or*
> *(d) Contaminant from any industrial or trade premises onto or into land –*
> *unless the discharge is expressly allowed by a rule in a regional plan and in any relevant regional plan, a resource consent, or regulations.*
>
> *(2) No person may discharge any contaminant into the air, or into or onto land from -*
> *(a) Any place; or*
> *(b) Any other source whether moveable or not –*
> *in a manner that contravenes a rule in a regional plan or proposed regional plan unless the discharge is expressly allowed by a resource consent or allowed by section 20 (certain existing lawful activities allowed).*

Section 2 of the RMA 1991 defines contaminant to include:

> *Any substance (including gases, liquids, solids and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar or other substances, energy or heat –*
>
> *(a) When discharged into water, changes or is likely to change the physical, chemical or biological condition of water; or*
>
> *(b) When discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged.*

The Regional Air Quality Management Plan for the Wellington Region (RAQM Plan) is relevant to this application, and assists the Regional Council to sustainably manage the Region's air resources. The proposal to discharge contaminants into air from the operation of a hot-dip galvanising or other processes for the protection of surfaces by metal coating using fluxes is *expressly excluded* from Permitted Activity Rule 12 – Metallurgical Process in the RAQM Plan.

Therefore, the proposal requires consent under sections 15(1)(c) and 15(2) of the RMA 1991, and is required to be assessed as a discretionary activity. Rule 23 of the RAQM Plan provides for the discharge of contaminants into air from any process or activity explicitly excluded from Rules 1-22 as a *discretionary activity.*

9. Matters for Consideration

Section 104 of the RMA 1991 states the matters that a consent authority must have regard to. These matters are:

- various sections of the RMA 1991;
- the Regional Policy Statement for the Wellington Region; and
- the Regional Air Quality Management Plan for the Wellington Region.

The relevant sections are listed in Appendix 2.

10. Assessment of Effects

10.1 Discharge of Contaminants to Air

Discharges to air from carefully operated hot-dipping galvanising operations are generally low and consistent with the location of such processes in heavy industrial zones. They can at times cause nuisance to immediate neighbours. If workload is high the quantity of fume emitted increases unless the hours of operation are proportionally increased. Galvanising wet work, and some work with complex forms, causes considerable white fume discharge (zinc oxide and ammonium chloride), and this can cause nuisance to neighbours, especially during adverse meteorological conditions. Discharges from degreasing, pre-fluxing, and the dichromate dip are negligible. Discharges from acid pickling, if appropriately carried out, are low.

The applicant undertook ambient air quality monitoring in April 2001, and a review of the results was carried out, on behalf of WRC, by Environet Ltd in July 2001. The purpose of the evaluation was to determine workplace ambient air concentrations of contaminants of interest at points just prior to discharge of workplace air through four roof-mounted fans into the atmosphere. All of the measured contaminant concentrations complied with the New Zealand Workplace Exposure Standard, and therefore the applicant concluded that these discharges do not pose a risk to staff or to people in adjacent factories or outside areas.

The WRC review of the results concluded that the impacts of the discharge on the environment had not been adequately assessed. Concerns were also raised in the review about the applicant's use of workplace standards to represent ambient air quality objectives, insufficient information about the actual ground level concentrations of key contaminants, and the extent to which non-health concerns such as smell, taste, and visibility were addressed by the applicant.

The monitoring undertaken by the applicant provided insufficient information from which results could be extrapolated to assess the ambient air quality in the surrounding environment. Therefore a definitive assessment of the health effects that may arise from the discharge of contaminants from the factory was unable to be made. It is for this reason that the recommended consent conditions for this application require the applicant to investigate and implement their preferred emission control equipment option and undertake associated monitoring. Without the implementation of emission control equipment and no point source discharge, any emissions monitoring carried out under the present circumstances will be meaningless.

Contaminants are discharged directly from the degreasing bath, the pickling baths, the pre-fluxing bath, the galvanising (zinc) bath, and from the quench bath, into the work place. Process ventilation air is then discharged by natural draught to atmosphere through a roof ridge vent running the length of the building and through four ceiling fan-assisted vents located approximately above the ends of the pre-fluxing and zinc galvanising baths, and through access doors. A series of side vents are located behind the walkway along the ends of the acid pickling to pre-fluxing baths, and continue into the centre of the tying up and jigging area, which is located between the zinc and pre-fluxing baths. During hot, still conditions, the factory roller doors are also left open to assist ventilation. This has resulted in complaints regarding excessive discharges of contaminants during production.

The circular ceiling vents are about 1 metre in diameter and are each fitted with a 2 HP GEC fan without external weather protection. The vents all terminate about 0.5 metres above the point of roof penetration. Discharge elevation is about 1-1.5 metres below the ridge elevation.

The volumetric discharge rate for the four fan-assisted roof vents is estimated to be $6m^3/s$ each ($24m^3/s$ total). The volumetric discharge rate for the roof ridge vent and the series of side vents, which will vary with meteorological conditions, has not been estimated.

The applicant accepts that excessive operating fumes will down draught under adverse meteorological conditions in the lee of the building – in particular into the access ways on both sides of the premises and over the buildings of the Seaview/Federal Springs manufacturing plant immediately to the east.

Products of combustion from the gas-fired degreasing, pre-fluxing and zinc bath heaters discharge to the workplace atmosphere through individual flues that each terminate about 2.5-3 metres above floor level.

10.2 Impact of Normal Discharges

(a) *Health Implications of Galvanising Discharges*

In most circumstances galvanising plant operators are subject to air contaminants at considerably higher concentration, and for longer periods, than people living or working downwind. Evaluation of occupational hygiene aspects and exposure guidelines can provide a useful method to evaluate potential physical health impacts on neighbours.

NZGL outlined the Workplace Exposure Standards (WES) for likely galvanising operation discharges, and the State of Victoria's Design Ground Level Concentrations in the 1995 application. The WES standards are occupational hygiene requirements, and Victoria's ground level concentrations are maximum short-term levels, which exclude background contributions.

Zinc metal fume is generally emitted in low concentration from the galvanising baths. At high temperatures metal fume rapidly oxidises to zinc oxide. No WES or design ground level concentrations are set for zinc metal fume. Zinc chloride fume is caustic and the 8-hour WES of $1mg/m^3$ reflects this. Zinc chloride is the main ingredient of some military smoke screens. Zinc oxide fume has relatively low toxicity, but if inhaled in excess, it may cause metal fume fever.

Ammonium chloride fume has low toxicity but can be a mild respiratory irritant. Its principal impact is reduction of visibility, as relatively small quantities of ammonium chloride can generate large volumes of relatively opaque white smoke. Ammonia is a common air contaminant resulting from biological activity. The concentrations present during galvanising (resulting from the breakdown of ammonium chloride) have low toxicity.

Lead metal fume is very toxic, however, while present in molten zinc at about 1% by weight, its vapour pressure[1] is very low at galvanising temperatures (less than 1mm Hg at 460^oC). The applicant noted in the 1995 application that the Lead Processing Regulations 1950 do not apply to galvanising operations, as the chemical test specified in the First Schedule to those regulations does not demonstrate galvanising zinc as a "lead product". Lead build-up in the body from inhalation or ingestion, can lead to lead poisoning, causing damage to the brain, kidneys, nerves and blood cells.

Cadmium metal fume is highly toxic by inhalation and is a suspected human carcinogen. It has a vapour pressure[1] of less than 10mg Hg at 460^oC, and

[1] Vapour pressure is the pressure at which a liquid and its vapour are in equilibrium at a given temperature. The vapour is said to be "pushing" against the atmosphere. In other words, the higher the vapour pressure the faster a liquid evaporates. When the vapour pressure reaches the atmospheric pressure, the liquid is at its boiling point. Vapour pressure is measured in units of atmospheres (atm), millimeters of mercury (mmHg) or kilopascals (kPa). As a point of reference, normal atmospheric pressure is 1 atm (760 mmHg or 101.325 kPa).

while more volatile than lead, it has similar volatility to zinc. Its concentration in galvanising zinc used in New Zealand is low. Cadmium is also used in silver solders, in brass brazing rods, and in the electroplating industry.

Hydrogen chloride gas is discharged from the pickling tank. It has moderate toxicity, being similar to sulphur dioxide and nitrogen dioxide, and may be fatal if inhaled. It is extremely corrosive, and skin contact with the vapour or liquid form can cause serious burns.

Occupational hygiene sampling had not been carried out by NZGL at the time of the 1995 application. The applicant stated that occupational hygiene problems do not occur in a properly managed operation, and considers the public health significance of galvanising operators in New Zealand to be minor. The applicant did recognise, however, that excessive discharges resulting from poor operation will generate nuisance conditions due to visibility problems, and some complainants may feel that their physical health is being affected.

The monitoring undertaken by the applicant concluded that all of the measured contaminant concentrations complied with the New Zealand Workplace Exposure Standard, and therefore these discharges do not pose a risk to staff or to people in adjacent factories or outside areas.

While it could be concluded that meeting the Workplace Exposure Standard does not pose a risk to neighbouring people, it is inappropriate to conclude that the ambient air quality objectives are met. As mentioned previously, the WRC review of the applicant's monitoring concluded that the impacts of the discharge could not be assessed or provide meaningful information regarding ambient air quality outside the plant. The current configuration of the plant, lack of emission control equipment and point source discharges all contribute to the difficulties in gaining meaningful monitoring data. Therefore the recommended consent conditions require the applicant to investigate and implement emission control equipment and associated monitoring.

(b) ***Atmospheric Dispersion Modelling***

While maximum ground level concentrations downwind can be predicted using gaussian dispersion models such as AUSPLUME, the applicant stated that it is not practicable to model the applicant's discharges, nor is it practicable to model discharges whose primary impact is visual.

10.3 Causes and Impact of Abnormal Discharges

(a) ***Causes of Abnormal Discharges***

The applicant outlined in the 1995 application that abnormal discharges can occur from pre-fluxing galvanising operations under the following circumstances.

- If an inhibitor is not added to the hydrochloric acid/water pickle, increasing acid attack on metal generates HCl/water mist, which is emitted to air. This discharge has minimal impact beyond the immediate work environment.
- Failure to adequately dry work before galvanising causes steam explosions, which produce considerable zinc spatter and flashing of volatised zinc generating copious zinc oxide fume. Excessive zinc bath turbulence generates spatter of molten zinc.
- Failure to adequately degrease/remove paint etc before galvanising causes excessive discharge of organic volatiles and carbonaceous matter.
- While flux dusting promotes clean zinc run-off from complicated work, and promotes seamless double dipping, it causes excessive fume discharge, and the risk of later product corrosion if flux incursions occur. The applicant does not undertake this practice.

(b) ***Prevention of Abnormal Discharges***

Abnormal discharges resulting from the above activities are preventable by good working practices. The implementation of the modifications outlined in section 10.5 of this report would substantially reduce discharges to air, and their impact down wind.

Good working practices have not always occurred at NZGL. The applicant was served with an abatement notice on 11 February 1999 for discharges to air at or beyond the boundary of the permit holder's premises, and for non compliance with condition 7 of the consent, which required the roller doors to be nearly or fully closed during activities that generate fume.

10.4 Environmental Impact of Abnormal Discharges

The environmental impact from abnormal discharges is primarily aesthetic (visual and increased soiling through deposition of particulate on surfaces). Excessive smoke from burning off oil/grease/paint on work will generate objectionable odour as well as smoke. This problem does not occur at NZGL because most painted work is sandblasted prior to receipt, and all steel is pre-treated to remove protective coatings, rust and scale prior to fluxing and dipping.

Some people may also claim respiratory distress when excessive visual fume is experienced. However, abnormal discharges from pre-fluxing galvanising operations is more an issue of visual impact, not impact on the physical health of people living or working in the area.

Complaints in the past have made reference to visual pollution and respiratory distress. As mentioned above, the roller doors may be left open to assist in ventilation through the factory in warm, still weather conditions. It was during these conditions and at times of increased production, that complaints were received regarding large discharges of fume. Under the current permit, and in the recommended conditions for this permit, there is a requirement for the permit holder to minimise fume emissions by keeping the roller door on the eastern side of the plant closed to a maximum 600mm gap at the bottom when carrying out activities that generate fume. If this proves insufficient the permit holder is required to fully close the roller doors when

carry out activities that generate fume. An abatement notice was served on the permit holder in February 1999 for not meeting this requirement of the permit.

Excessive zinc oxide fume, which can occur from the galvanising bath, is primarily visual, although some neighbours find the fume and its odour and taste irritates employees. Galvanising fume consists of zinc oxide and sublimed ammonium chloride flux. The applicant's monitoring suggests that it is most unlikely, in the concentrations experienced downwind of the plant, that such emissions will cause adverse physical health effects. From experience, the applicant notes that emissions discharged at roof height are unlikely to result in significant direct impact of fume on neighbours to any great degree, although the fume is far more visible at a distance when discharged at roof height.

Abnormal non-visual discharges are unlikely to be significant. Such discharges would include excessive hydrogen chloride gas and acid mist from pickling, and excessive volatilisation of lead and cadmium from the molten zinc bath. This is unlikely to be important beyond the immediate work area, and would only occur if the zinc bath temperature appreciably exceeded normal galvanising temperatures.

10.5 1995 Process Changes under Review

NZGL recognised in its 1995 application that some operations could be improved by process modifications that in some cases would significantly reduce the discharge of contaminants to air and improve productivity. Process changes under review included:

- *Improved Drying of Work*

  The presence of water on work during galvanising generates steam, which violently agitates the zinc. The resulting oxidation of zinc metal fume produces excessive zinc oxide fume. In practice, thorough drying of complex work (such as narrow bore open-ended tubes) is difficult, and the usual method of suspending work over the hot flux bath and over the galvanising bath to dry is seldom very successful. The design of a drying system for large work is complex. Drying systems must take into account that zinc ammonium chloride flux deposited on work is degraded at temperatures of 100^{o}C or more. NZGL has reviewed how improved drying could be carried out. The movement of large engineering works on high rail-guided lifts had to be taken into account when designing any drying system for the plant.

- *Collection of Galvanising Zinc Bath Fume*

  Although implementation of some of the above modifications would substantially reduce discharges to air from galvanising baths generally, the current practice of discharging galvanising zinc bath fume from roof vents has limitations. NZGL had already improved the building ventilation with the installation of a series of large passive side vents and four ceiling fan-assisted vents.

Because of the large volume of air inside the building and the need to move large engineering works the length of the building on high rail-guided lifts, there are few further practical options for improving the collection and ventilation of discharge.

Meteorological conditions (e.g. winds causing down draught of fumes in the lee of the building) have more influence over discharge problems than engineering at this level.

NZGL has reviewed all work practices and processes to minimise discharges from the workplace. Improved drying was seen as the main area where improvements could be cost effectively made. While process changes have been implemented, no further monitoring or adoption of emission control equipment has been undertaken by the applicant.

10.6 2000 Application

Some refinements to methods were recommended by management at NZGL, and relayed to employees of NZGL. The most appropriate management practices to minimise discharge of contaminants into air continued to be:

- Abrasive blasting of excessively painted work prior to delivery to the plant;
- Thorough degreasing of oily work and stripping of light painted work by immersion in hot caustic solution followed by water washing;
- Pickling in cold diluted hydrochloric acid containing efflorescence suppressing agents to minimise fuming, followed by water washing;
- Fluxing in a hot solution of ammonium chloride;
- Ensuring that work is as dry as practicable before galvanising by suspending it above the flux bath to drain, followed by suspending work over the galvanising bath before dipping;
- Spread work volume as evenly as possible over the working day to minimise peaks;
- Dip work liable to generate higher than normal fume in small lots;
- Dip complicated work, which may generate excessive fume, during meteorological conditions at times which will not cause nuisance to neighbours; and
- Operate with the eastern side roller door substantially closed (maximum opening of 600mm) when dipping is carried out during conditions that could carry excessive fume towards adjacent neighbours. Fully close the door as necessary.

Nuisance discharges are minimised by proper process management although it is not possible to avoid the discharge of white fume. As part of this application for a new discharge permit, management practices and process operations were reviewed to ensure that discharges into air are minimised so that nuisance situations rarely occur.

In view of the difficulty in minimising fume emissions during periods of high workload without working extended hours, NZGL reviewed options for installation of fabric filtration particulate control to substantially remove fume generated prior to discharge of ventilation air into the atmosphere.

The applicant has reviewed the following options of dedicated fluxed work drying, fume collection and extraction to particulate control equipment, and fume extraction to a high stack, to further reduce galvanising fume emissions.

- *Dedicated Work Drying (factory not large enough, still generates fume)*
- *Fume Extraction to a High Stack (visual effects)*

- *Fume Extraction to High Efficiency Particulate Control Equipment*
  - *High Efficiency Water Scrubbers (not an option)*
  - *Electrostatic Precipitation (not an option)*
  - *Fabric Filtration (Bag Filters)*

The applicant has not progressed with any of the above options, as they are either too costly given the current workload, or the current factory configuration was not appropriate for implementation of emission control equipment. To improve the risk of discharges to air from the factory, the applicant has relied to date on process improvements rather than investing in emission control equipment and monitoring.

10.7 Process Monitoring

The chemical properties of the degreasing, pickling and pre-fluxing bath liquors are monitored or adjusted primarily to ensure good quality galvanised product. The galvanising bath temperature is closely monitored.

The applicant does not currently specifically monitor discharges to air.

10.8 Hazardous Substances / Installations

The storage and handling of concentrated hydrochloric acid solutions and sodium hydroxide is a hazardous operation, which is undertaken in accordance with the requirements of the Toxic Substances Regulations 1983. The acid is received by tanker at 33% concentration, pumped directly into the baths and diluted. The caustic soda is received in plastic lined paper bags that are stored in a specific location away from all liquids, heat and acid.

The working of molten zinc is also potentially hazardous to operators and the applicant adheres to the Department of Labour's Occupational Safety and Health requirements. Pickling inhibitor Stannine LF must be added directly to pickling bath liquor without diluting. It is only added to acid – never to normal water or alkaline solutions. Workers' eyes are protected from vapours when handling the inhibitor solution. Spent solutions are removed to the industrial landfill by contractor for disposal.

10.9 Contingency Plans

Contingency plans for potential upset conditions include:

- Raw material and dry chemical spillages / leaks
- Processing bath uncontrolled discharges or spillages
  - Degreasing bath
  - Pickling baths
  - Pre-fluxing bath
  - Rinsing baths
  - Molten Zinc Galvanising bath
  - Quenching bath
- Wastewater treatment plant uncontrolled discharges or spillages
- Gas-fired bath heater shut down procedures

An inventory of all chemicals held on site, and their corresponding Material Safety Data Sheets are held at the Main Office.

An incident logbook is also kept at the Main Office to record the details of any incidents at the site.

11. Statutory Evaluation

11.1 Resource Management Act 1991

The matters to which the Wellington Regional Council (as consent authority) shall have regard to when considering applications for resource consents and related submissions are set out in Sections 104 and 107 of the Act. The circumstances in which it can make a decision to grant resource consent are set out in Section 105. Sections of the relevant policies are set out in Appendix 2.

In summary, subject to Part II of the Act, the following matters in Section 104(1) are relevant to this application:

(a) Any actual and potential effects on the environment of allowing the activity;
(c) Any relevant provisions of the Regional Policy Statement for the Wellington Region (RPS) (operative dated May 1995);
(d) Any relevant objectives, policies, rules or other provisions of the Regional Air Quality Management Plan for the Wellington Region (RAQM Plan) (operative dated 8 May 2000); and,
(i) Any other matters the consent authority considers relevant and reasonably necessary to determine the application.

Furthermore, in relation to any application for a discharge permit, Section 104(3) requires that the consent authority shall, in having regard to the actual and potential effects on the environment of allowing the activity, have regard to:

(a) The nature of the discharge and the sensitivity of the proposed receiving environment to adverse effects and the applicant's reasons for making the proposed choice;
(b) Any possible alternative methods of discharge, including discharge into any other receiving environment.

Section 105(1)(b) states that after considering an application for a resource consent for a discretionary activity, a consent authority may grant or refuse consent, and (if granted), may impose conditions under section 108.

Section 108(1) specifies the types of conditions that may be included in resource consents, and section 108(3) authorises conditions requiring monitoring.

11.1.1 *Sections 2 and 3 (Interpretation)*

Section 104(1)(a) of the Act requires that consideration be given to the actual or potential effects on the environment of allowing the activity. In the Act the terms *"environment"* and *"effects"* have been defined as follows.

The term *"environment"* includes *"…ecosystems and their constituent parts, including people and communities; all natural and physical resources; amenity values and the social, economic, aesthetic and cultural conditions…"* which affect the aforementioned matters or are affected by those matters.

The term *"effect"* includes *"…any positive or adverse effect; any temporary or permanent effect; any past, present or future effect; and any cumulative effect which arises over time or in combination with other effects regardless of the scale, intensity, duration, or frequency of the effect, and also includes; any potential effect of high probability; and any potential effect of low probability which has a high potential impact."*

11.1.2 ***Section 5 – Purpose and Principles***

The purpose of the Act is to promote the sustainable management of natural and physical resources.

The considerations of Section 104 are all subject to Part II of the Act. "Subject to" gives primacy to Part II and is an indication that this provision shall prevail. In the case *Gardner v Tasman DC* (1994) NZRMA 513 the then Planning Tribunal expressed the view that "subject to" meant that the purpose and principles are an overriding guide when construing the provisions of the RMA.

Within this framework, it is considered that approving this resource consent application, subject to conditions, will enable the applicant to provide a galvanising service for the social, and economic well-being of people and communities in the Lower North Island.

11.1.3 ***Section 6 – Matters of National Importance***

In exercising its powers and functions under the Act, the WRC is required to recognise and provide for the matters set out in Section 6, which are considered to be of national importance.

The effects of the discharge on these matters is discussed in section 10 of this report, and the general conclusion in that regard is that the discharge of contaminants to air may potentially have serious adverse effects on the receiving environment. However, such effects can be minimised if appropriate controls are put in place to minimise the risk. In that respect, the recommended conditions of consent provide some control measures which recognise and provide for the matters listed in section 6.

11.1.4 ***Section 7 – Other Matters***

The other matters to which the WRC must have regard are listed in Section 7 of the Act.

Section 7 provides opportunities for tangata whenua, through the practical expression of kaitiakitanga (the exercise of guardianship) to be involved in managing the use, development and protection of their ancestral taonga (resources). This highlights the importance of consultation with tangata whenua regarding the effects of the discharge of contaminants to air.

Tangata whenua were notified of the application, however, no submissions were received regarding this application.

11.1.5 *Section 8 – Principles of the Treaty of Waitangi*

In considering the application, the WRC is required to take into account the principle of the Treaty of Waitangi (Te Tiriti o Waitangi). The Waitangi Tribunal and Courts continue to establish the principles of the Treaty of Waitangi, and it is recognised that the principles are continuing to evolve.

11.2 Regional Policy Statement for the Wellington Region (RPS)

The RPS (operative in May 1995) is a statement about the resource management issues of significance to the Region, and the objectives, policies and methods, which are designed to achieve integrated management of the natural and physical resources of the whole Region. The WRC in exercising its functions and powers needs to have regard to the relevant provisions of this document as follows.

11.2.1 *Chapter 4 – The Iwi Management System*

Chapter 4 states that the broad issues of resource management significance to tangata whenua of the Region. In general, it states that: there are increased opportunities for the cultural aspirations and tikanga of tangata whenua with regard to resources; and the principles of the Treaty of Waitangi need to be taken into account in resource management.

11.2.2 *Chapter 8 – Air*

Chapter 8 contains objectives, policies and methods, which address air quality issues in the Region. Although the prevalent winds are seen to either disperse pollutants or transport them elsewhere for environmental assimilation, the Region does have its own set of local and more widespread air pollution problems.

I consider that the continued operation of the plant in accordance with the Operations and Maintenance Manual, together with the suggested conditions of consent will contribute to mitigation of the effects of the galvanising plant operations.

The applicant has stated that the installation of improved emission control technology is cost prohibitive, which is not consistent with the intent of Policy 6, which focuses on ways to manage air pollution at source. The philosophy of preventing or minimising emissions at source is consistent with the concepts of waste minimisation and cleaner production, and is one way of avoiding, remedying or mitigating the adverse effects of discharges. Method 4 seeks to require those activities and industries that require resource consent to carry out emissions monitoring as part of the resource consent requirements, where appropriate. This is considered appropriate if information about the specific quantity, composition or effects of the discharge will assist in avoiding, remedying or mitigating any adverse effects of the discharge. Without the implementation of emission control equipment and no point source discharge, any emissions monitoring carried out under the present circumstances will be meaningless.

However, the recommended consent conditions require the applicant to investigate emission control equipment options, and associated emission monitoring, which is to be implemented within four years of the date of commencement of this permit.

11.3 Regional Air Quality Management Plan for the Wellington Region (RAQM Plan)

Rule 12 of the RAQM Plan specifically excludes *"…(d) hot dip galvanising or other processes for the protection of surfaces by metal coating using fluxes"* as a *permitted activity.* Hot-dip galvanising is therefore classified as a *discretionary activity* under Rule 23 of the RAQM Plan and requires resource consent.

The RAQM Plan contains issues, objectives, and policies relevant to this application. In particular, Policy 4.2.1 seeks to have regard to the Regional Ambient Air Quality Guidelines in Appendix 2, in managing the Region's air resource. Ambient air quality guidelines set out the desired levels of specified contaminants in the air. Ambient air quality reflects the cumulative effects of all activities. Policy 4.2.4 seeks to avoid, remedy or mitigate any adverse effect of the discharge of contaminants to air that is noxious, dangerous, offensive, or objectionable. The recommended consent conditions reflect the intent of this policy, as well as the general duty under sections 5 and 17 of the RMA 1991. Policy 4.2.7 seeks to avoid, remedy or mitigate the adverse effects of the discharge of contaminants to air on amenity values, which recognises the need to protect amenity values affected by the emission of smoke, dust or odour.

Policy 4.2.9 sets out the matters to which the Council will give particular consideration when assessing an application to discharge a contaminant to air. These include assessment of the nature of the discharge, the effects of the discharge, the potential for the effects of the discharge to be reduced through the use of emission control technology, and the actual and potential effects that a discharge may have on various aspects of the environment.

I consider that the current operations and processes outlined in the application, together with the recommended conditions of consent, will meet the intentions of the relevant policies.

12. Matters Relating to Grant of Discharge Permit Application

This application does not require assessment under section 107 of the RMA 1991.

13. Conclusions

While the monitoring undertaken by the applicant could not be used to extrapolate for a definitive assessment of health effects from the operations undertaken at the factory, I consider that effects of the galvanising processes are likely to be minor under normal operating conditions. The adverse effects on the environment can be sufficiently avoided, remedied or mitigated by imposing the recommended consent conditions.

The applicant has acknowledged the potential for adverse environmental effects from the galvanising process. However, in addition to normal, good working and management practices, the applicant will install an additional roof ventilation fan within three months of the date of commencement of this permit. The applicant has

also agreed to investigate a preferred emission control equipment option and associated emission monitoring within two and a half years of the date of commencement of this permit, and will implement the preferred option within four years of the date of commencement of this permit.

I consider that these investigations and implementation of equipment and monitoring will avoid, remedy or mitigate adverse effects resulting from the operation of the site.

14. Recommendation

I recommend, pursuant to sections 105 and 108 of the Resource Management Act 1991, that the Environment Committee grant the permit WGN000110 [20293], subject to the recommended conditions of consent in Attachment 2.

If the permit is granted, I recommend the following term for the permit and recommended conditions to avoid, remedy or mitigate adverse environmental effects.

15. Term of the Permit

The applicant has requested a longer-term consent than the existing five-year permit WGN950003. After consultation and negotiation between the WRC, the applicant, and submitters, a term of ten years is recommended for this permit, WGN000110. This term provides certainty for the applicant enabling investigation and investment in emission control equipment and associated emission monitoring to further reduce any adverse effects resulting from the operation of the hot-dip galvanising processes at this site.

Report prepared by:	Recommendation approved by:
KIRSTY FERGUSON Resource Advisor	PAULA HAMMOND Manager, Consents Management