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FINAL REPORT

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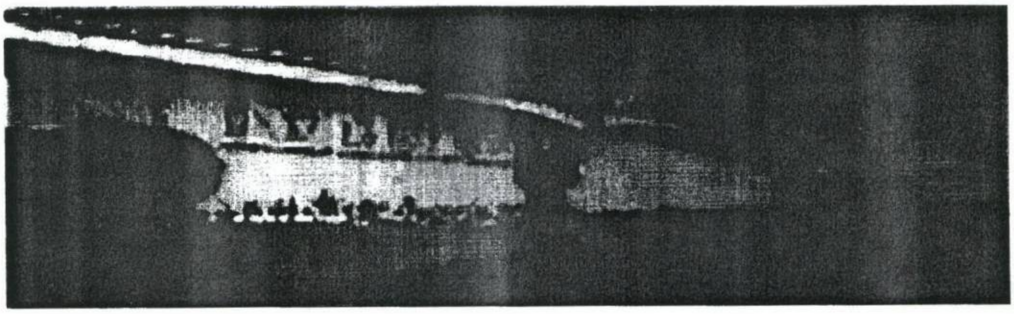
AUCKLAND HARBOUR BRIDGE MAINTENANCE PROGRAMME



Resource Consent Applications for Discharges to Land, Air & Coastal Water

Prepared for:

TOTAL BRIDGE SERVICES

TRANSIT NEW ZEALAND ARARAU AOTEAROA

March 2000

Woodward-Clyde

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INTRODUCTION

The Auckland Harbour Bridge (the 'Harbour Bridge') is part of the State Highway Network, and is owned by Transit New Zealand, the government land transport authority. The Harbour Bridge is sited in a marine environment, and as a steel structure, this makes it vulnerable to paint deterioration and corrosion. A continual programme of maintenance painting is required to preserve the coating on the steel.

Total Bridge Services (TBS) is responsible under a Professional Services Contract for the maintenance of the Harbour Bridge.

Abrasive blasting is used during the maintenance process, generating discharges of spent blast product and worn paint to the surrounding air, the land at both ends of the bridge, and to the Waitemata Harbour. For these discharges, resource consents are required under the Resource Management Act 1991. Under the Auckland Regional Plan: Coastal (September 1999), the discharge of contaminants from the Harbour Bridge maintenance programme is a Controlled Activity (pursuant to Rule 20.5.4). However, parts of the activity will occur over land and are not within the Coastal Marine Area, therefore, not covered by the Regional Coastal Plan. Approximately 60% of the Harbour Bridge spans over the sea, and 40% spans over land.

Transit New Zealand holds existing consents for the discharges, which were issued in 1994 and are due to expire in December 2000. The regulatory authority for the consents is the Auckland Regional Council. The consent term sought is ten years.

Woodward-Clyde (NZ) Ltd has been engaged to assist with the resource consent application process and the assessment of environmental effects of the bridge maintenance programme.

DESCRIPTION OF OPERATIONS

The maintenance programme on the Harbour Bridge involves surface preparation and painting of the steelwork.

The preparatory work involves wet abrasive blasting, high pressure water blasting and dry abrasive blasting. Dry abrasive blasting is used only when paint is removed back to bare steel in areas where visibility and access make wet blasting difficult.

The current paint system comprises one primer coat, one intermediate coat and one topcoat. The primer coats are made up of a zinc pigment suspended in a urethane binder, and the intermediate and topcoats comprise an iron oxide pigment in a urethane binder. The total paint system covers an area of approximately 150,000 m^2 with an average thickness of 770 μm.

There have been some significant changes since the lodgement of the resource consent applications in 1994 that have implications on the environmental effects of the maintenance programme. These include:

- Zinc chromate primer is no longer used; this was replaced initially by a zinc phosphate primer (which has less effect on the environment) and later by a zinc rich urethane primer.
- Wet abrasive blasting and high pressure water blasting are now the main blasting techniques used.
- The use of dry abrasive blasting has been substantially reduced.

- Lead primer paint has not been used on the Harbour Bridge since the very limited applications in 1959.
- The use of garnet abrasive has increased, which significantly reduces the amount of dust generated.
- Regular washing down critical areas of the steelwork maximises the life of the paint coatings. This in turn reduces the frequency of repainting and therefore the quantities of maintenance debris discharged.

The above changes, together with the mitigation measures in place, have significantly reduced the effects of the paint maintenance system on the receiving environments.

ASSESSMENT OF ENVIRONMENTAL EFFECTS

Discharges to the Harbour from the paint maintenance programme since the construction of the Harbour Bridge will have a transient effect on the receiving water quality. The discharge scenarios considered in the assessment of environmental effects were:

- Discharges of paint product resulting from the application of the current paint system
- Discharges of blast product; and
- Paint debris from the original paint system.

The assessment of effects considered the worst case discharge scenario, where the activity took place for a maximum duration of 6 hours during a working day.

Discharges to Water

A quantitative assessment by Woodward-Clyde showed that the typical concentrations of the components in the current paint system exceed the Australia and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Waters (1992). However, the effects will be minimal due to dilution through wave action, mixing and rapid dispersion due to tidal flushing. It was not possible to quantitatively assess some of the components in the original paint system (such as the zinc chromate discharged in paint debris). In such cases a qualitative assessment of the effects on the receiving environment has been made.

The discharges of spent blast media will not contribute significantly to the suspended solids loading in the Harbour; due to their density they will sink and become mixed with bottom sediments. The blast media is made up of naturally occurring minerals, so there will be no adverse environmental effects as a result of this discharge. Discharges of paint debris from the old paint system during blasting are small in volume (less than $0.05m^3$ per year) and will not have a significant effect on the receiving environment.

Discharges to Land

The predicted concentrations of lost product from the current paint system in soil were insignificant when compared to the ANZECC Guidelines. The concentration of blast products was also minor, and due to the fact that the minerals in the blast media are naturally occurring, no adverse environmental impact will result. The volume of debris from the original paint system discharged to land as a result of blasting was less than $0.03m^3$ per year.

In the past, the main effect on the land environment from the paint maintenance programme was the dust nuisance caused by the settlement of the finer fraction of the blast product. Due to a significant decrease in the use of dry abrasive blasting and the mitigation measures in place, dust nuisance from the paint maintenance programme should no longer be a significant issue. The discharge from the paint maintenance programme will not have an adverse health or environmental effect on the surrounding environment.

Discharges to Air

The concentrations of material in air discharged from the paint maintenance programme were compared with workplace exposure standards in the absence of air quality guidelines.

The concentrations slightly exceeded the standards (where available) however, the volume of air used in the calculations was conservative, and the concentrations of paint product, spent blast media and paint debris would be further diluted and dispersed before reaching ground level. In this respect there would be no adverse effect on the receiving air quality as a result of the discharges to air.

The ARC has received no complaints regarding dust emissions from the paint maintenance programme since 1995. This, together with the recent public survey results, provides sound evidence that any nuisance effects of dust have been abated.

Mitigation Measures

The current mitigation measures used by TBS and their contractors to minimise the effects of the Harbour Bridge paint maintenance system include:

- Limitation of Blast Activities - blasting is confined to specific wind conditions. No blasting is carried out when the wind is blowing at a speed greater than 7 m/s (approximately 14 knots).
- Removal of Blast Product – this involves ground collection of the blast product and paint debris from the surface of the Harbour Bridge structure, where possible. The material is disposed of in a manner that minimises the effects on the environment.
- Screens - large moveable, woven polypropylene screens with weighted hems are deployed while blasting north of Pier 1 and south of Pier 6 to stop the spread of any blasting products.
- Catchpit covers - roadside catchpits draining to the stormwater system are covered with wooden boards during abrasive blasting south of Pier 6 and north of Pier 1 to prevent contamination of stormwater conducted directly over the water.
- Sweeping of structure - the structure of the Harbour Bridge, including the carriageway and all sealed areas in the vicinity of the Bridge are swept after blasting.
- Transportation - All of the blast debris is transported from the site in a purpose-built vehicle with coverings to ensure no spillage during transport.
- Public notification –Advanced notice of any work at or near to either of the abutments, especially blasting, is given to potentially affected persons. Surrounding businesses and residents are forwarded blasting and painting programmes at regular intervals.
- Monitoring of blast activities - To further identify and address the potential nuisance effects of the Harbour Bridge paint maintenance programme, TBS keep a file of all written and verbal complaints regarding the programme.

Alternatives

There are various surface preparation techniques that can be used in heavy industrial applications. Surface preparation techniques used in domestic and light industrial applications (such as sanding and power tool cleaning) are not suited to heavy industrial applications due to the magnitude of the operation although they are used to a limited extent. The most suitable form of surface preparation for this structure based on the methodology of spot removal of paint and corrosion products is wet or dry abrasive blasting.

Public and Iwi Consultation

The public consultation process to date has involved the distribution of a letter to residents and other identified parties that may be potentially affected by the paint maintenance programme. The letter describes the application, the assessment of environmental effects, and explains that TBS intend to consult with neighbours and interested parties so that their concerns can be considered when preparing the resource consent application. In addition to this specific consultation, TBS run an ongoing public survey to address concerns or issues in general that any member of the public may have regarding the Harbour Bridge paint maintenance programme. This service will be continued and monitored by TBS and their contractors.

Iwi consultation was undertaken with Te Hao o Ngati Whatua, who have been identified as the Iwi most affected by the activities of the paint maintenance programme. Ngati Whatua have responded to the consultation and stated that they do not oppose the application.

Conclusions

Abrasive blasting is necessary to maintain the structural integrity of the Harbour Bridge. As far as possible, the blasting product is contained and disposed of offsite. Many mitigation measures are in place to minimise the effect of the operation on the receiving environments. It is evident from the lack of complaints and public survey results that these measures are effective.

The area in the vicinity of the Harbour Bridge is subject to extreme tidal flushing and any debris discharged into the Harbour will be rapidly dispersed. Nuisance effects as a result of the programme have been abated via the use of mitigation measures and changes in operational practice. Therefore the discharges to air, land and water from the paint maintenance programme will not have a significantly adverse health or environmental effect.

The Auckland Harbour Bridge is part of the State Highway Network, and is owned by Transit New Zealand, the government land transport authority.

Total Bridge Services (TBS) has been awarded a ten year Contract for the overall management and maintenance of the Auckland Harbour Bridge (the 'Harbour Bridge'). TBS is a joint venture owned by Opus International Consultants Ltd, Fulton Hogan Ltd and TBS Farnsworth Ltd.

Maintenance of the steel surface of the Harbour Bridge is an ongoing activity. The maintenance involves surface preparation, priming, and painting. Abrasive blasting is used during the process of surface preparation, generating discharges of spent blast product and worn paint to the surrounding air, the land at both ends of the bridge, and discharges to the Waitemata Harbour, a Coastal Marine Area. For these discharges, resource consents are required under the Resource Management Act 1991.

Transit NZ holds existing consents for the discharges, which were issued in 1994 and are due to expire in December 2000. An application for the renewal of these consents is due to be lodged in April 2000. The regulatory authority for the consents is the Auckland Regional Council, to whom this application is made. The term of the consents sought is ten years.

Woodward-Clyde (NZ) Ltd has been engaged by TBS to assist with the resource consent application process and the assessment of environmental effects of the bridge maintenance programme.

The Harbour Bridge connects Auckland's north shore with the downtown central business district. The Harbour Bridge was constructed in 1959, and at the time of construction comprised a four lane, one kilometre long steel structure. To cope with increasing traffic volumes, steel girder extensions were added to both sides of the bridge in 1969. Approximately sixty percent of the total surface area of the Harbour Bridge extends over water; the remaining forty percent extends over land. Figure 2-2 shows the location of the Harbour Bridge.

2.1 SURROUNDING AREA

The Harbour Bridge spans the Waitemata Harbour with the southern abutment adjacent to the Westhaven Marina and the northern abutment located within the residential area of Northcote Point. Waitemata Harbour is Auckland's main commercial and recreational Harbour.

Figure 2-1 shows the Harbour Bridge in relation to some of the more significant features of the surrounding area.

Figure 2-1 Auckland Harbour Bridge and Surrounding Area

On the southern side of the bridge, the Port of Auckland is located to the east, and the residential area of Herne Bay is located to the west.

On the northern side of the bridge the Devonport Naval Base and the residential areas of Bayswater and Belmont are located to the east, and the residential areas of Northcote and Birkenhead are located to the west.

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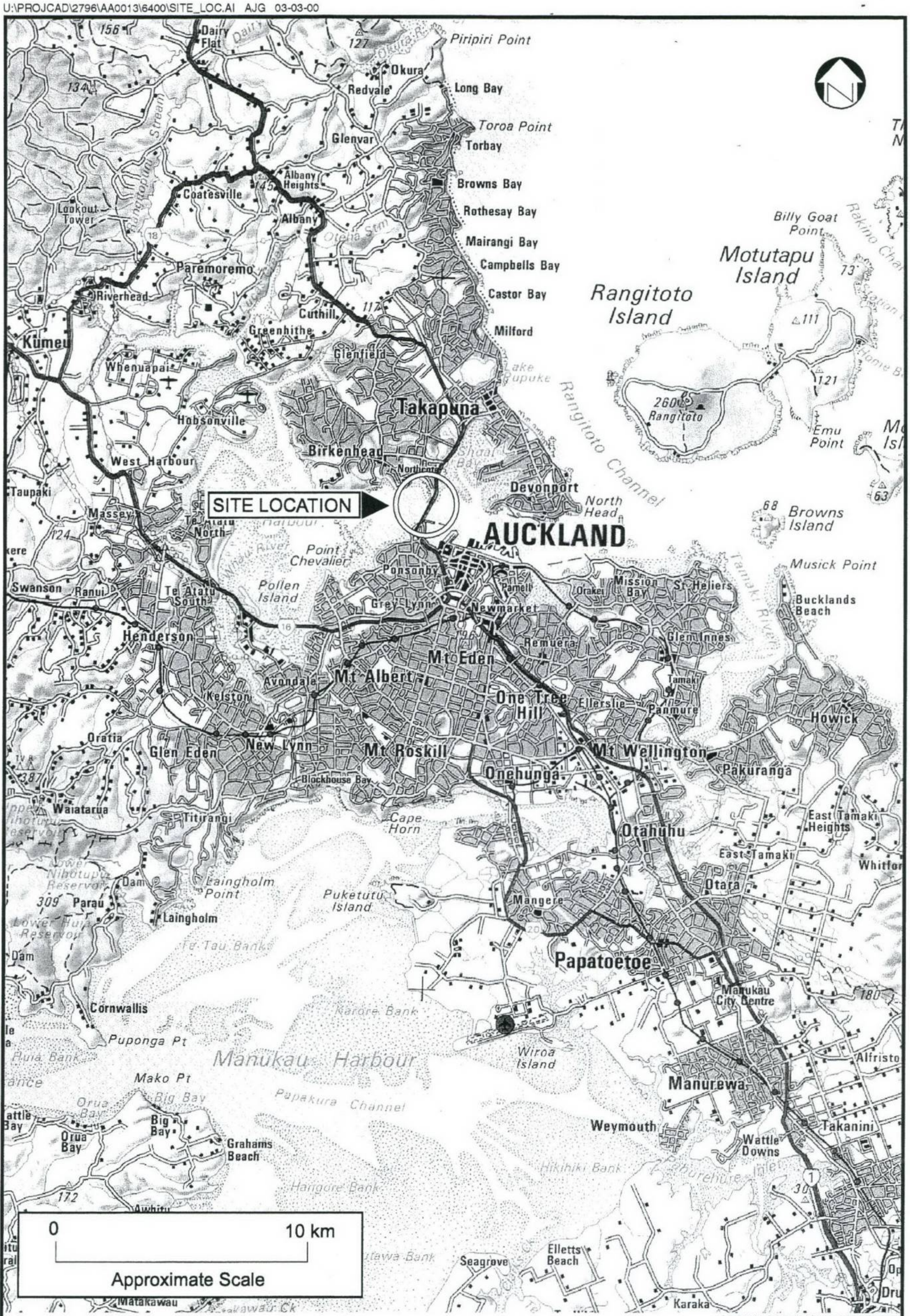

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Approximate Scale

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SITE LOCATION
FIGURE 2-2

The main destinations for ships entering the Waitemata Harbour are the Devonport Naval Base and the Ports of Auckland, therefore these vessels do not pass under the Harbour Bridge. Approximately ten cargo ships pass under the Harbour Bridge per year, and these are destined for the Chelsea Sugar Refinery. The Chelsea Sugar Refinery is located in Birkenhead, towards the west on the northern side of the bridge.

Under maritime regulations, anchorage is prohibited within approximately 2000 m of the bridge in the main channel.

3.1 RESOURCE MANAGEMENT ACT (1991)

In this instance the Council when considering the applications for discharge consents, shall have particular regard to Sections 5, 6, 7, 8 (Part II), 15 (Discharges), 104 and 105 of the Resource Management Act 1991 (RMA).

Section 15 (1) (c) of the RMA states that any discharge from an industrial or trade premises requires a Resource Consent unless that discharge is expressly allowed by a regional rule, a resource consent or regulations. A Regional Air Plan, which would set out the regional rules governing discharges to air, has yet to be notified for the Auckland region.

Section 104 (1) which is subject to Part II of the RMA, requires the consent authority have regard to:

"(a) Any actual and potential effects on the environment of allowing the activity; and

....

(d) Any relevant objectives, policies, rules or other provisions of a plan or proposed plan; and

....

(e) Any relevant district plan or proposed district plan, where the application is made in accordance with a regional plan; and

....

(i) Any other matters the consent authority considers relevant and reasonably necessary to determine the application."

Part II of the RMA sets out the purposes and principles of the Act and particularly relevant is Section 5 thereof, which states:

"In this Act, "sustainable management" means managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide to their social, economic and cultural well-being and for their health and safety, while:

> *(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
>
> *(b) Safeguarding the life supporting capacity of air, water, soil and ecosystems; and*
>
> *(c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment".*

The Resource Management Act's use of the phrase *"use, development and protection"* is indicative of the general philosophy of the Act. All resources are to be used, but in a sustainable way, at a rate which enables the social, economic and cultural aspirations of society to be provided for, while meeting the three constraints in Section 5 (2) (a) (b) and (c).

Section 5 must be read in conjunction with Sections 6 to 8 of the Act.

Section 6 sets out a number of matters of national importance, including the preservation of the natural character of the coastal environment, wetlands, and lakes and rivers, the protection of outstanding natural features and the protection of areas of significant indigenous vegetation and habitats of indigenous fauna.

In addition, Section 7 requires the consent authority to have particular regard to the efficient use and development of natural and physical resources, the maintenance and enhancement of amenity values, and the maintenance and enhancement of the quality of the environment.

Finally, Section 8 requires those exercising powers under the Act to take into account the principles of the Treaty of Waitangi.

It is considered that the granting of the discharge consent applications would not be contrary to the purpose of the Act. The proposal will enable people and communities to provide for their economic and social well-being and their health and safety without compromising the needs of future generations or the life supporting capacity of natural resources such as air, water and soils.

Any actual or potential effects on the environment of the proposal have been addressed in Section 6 of this report. It is considered that the proposal will have no more than minor actual or potential adverse effects on the environment, and that subject to conditions of consent any effects can be adequately avoided, remedied or mitigated. The potential effects are minor and extensive mitigation measures are in place to ensure that the natural character of the coastal environment is protected.

The proposed activity is not contrary to Section 6 or 7 of the Act. It is also considered that the principles of the Treaty of Waitangi have been satisfactorily taken into account with respect to this application and that there will be no adverse effects on tangata whenua as a result of granting this application. The proposal is not contrary to this section of the Act.

3.2 AUCKLAND REGIONAL POLICY STATEMENT

The Auckland Regional Policy Statement (ARPS) provides for the management of specific resources in a manner which is sustainable and co-ordinated across the Auckland Region. The relevant Chapters of the ARPS include Chapter 3 Matters of Significance to Iwi, Chapter 7 Coastal Environment, Chapter 8 Water Quality and Chapter 10 Air Quality. In addition, the Waitemata Harbour, West of the Harbour Bridge, has been identified in the ARPS as being a coastal area susceptible to degradation.

It is considered that the proposed activity is not inconsistent with the strategic direction outlined by the ARPS and that no further assessment is required in respect of this document.

3.3 AUCKLAND PROPOSED REGIONAL PLAN: COASTAL

Shoal Bay in the vicinity of the Harbour Bridge is located within the Coastal Protection Area (CPA) under the Auckland Proposed Regional Plan: Coastal. The purpose of the CPA is to give effect to the requirements of section 6 of the RMA by preserving and protecting the natural and physical resources of the area.

Two Mooring Management Areas are located on either side of Northcote Point in the Waitemata Harbour. The purpose of these areas is to encourage the concentration of moorings for management purposes and to ensure efficient use of the Coastal Marine Area.

The coast around Northcote Point has been identified as a regionally significant landscape in the Auckland Proposed Regional Plan: Coastal. The Plan seeks to manage development in the area whilst ensuring that the key elements which contribute to landscape value are not degraded or disturbed. However, the focus is upon integration of existing and new use and development, rather than preservation.

Consideration should be given to whether any adverse effects on the environment, including people and communities can be satisfactorily avoided, remedied or mitigated. As discussed in Section 6, it is recognised that there are no adverse effects associated with the proposed maintenance programme which have the potential to significantly affect the surrounding coastal environment. On balance, it is considered that the proposal is not inconsistent with the relevant policies, objectives and provisions contained in the Auckland Proposed Regional Plan: Coastal.

The Auckland Proposed Regional Plan: Coastal recognises the need for maintenance of structures in the coastal marine area. The maintenance of such structures is a controlled activity pursuant to Rule 12.5.6, which is applicable to the Harbour Bridge paint maintenance programme and states:

12.5.6 *the maintenance, repair or reconstruction of any existing lawful structure which does not comply with Rules 12.5.1 (Permitted Activities) or Rule 12.5.8 (structures listed in the Cultural Heritage Schedules)'* [is a Controlled Activity].

The discharge of contaminants from the Harbour Bridge paint maintenance programme is a controlled activity in accordance with Rule 20.5.4 of the Auckland Proposed Regional Plan: Coastal, which states:

20.5.4 Discharges of contaminants from the maintenance of existing lawful structure in the coastal marine area, excluding hazardous substances as defined in the Hazardous Substances and New Organisms Act 1996, which are not permitted by Rule 20.5.3, subject to the following standards and terms:

- a. *the discharge is not into any Coastal Protection Area 1 other than those listed in Rule 20.5.8; and*
- b. *the discharge will not, after reasonable mixing give rise to all or any of the following effects:*
  - *i. the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials; or*
  - *ii. any conspicuous change in the colour or visual clarity water in coastal marine area; or*
  - *iii. any emission of objectionable odour; or*
  - *iv. any significant adverse effects on aquatic life.*

20.5.4.1 The ARC will have control over the following matters under Rule 20.5.4:

- a. *the volume and level of contamination; and*
- b. *the method of discharge and the effects arising from the method chosen; and*
- c. *the provision of adequate facilities for the collection, treatment, disposal of any discharge; and the duration of the consent; and the monitoring of the consent.*

Applications for controlled activities will be considered without notification or the need to obtain written approval of affected persons, in accordance with Section 94(1)(b) of the RMA, unless in the opinion of the ARC there are special circumstances justifying notification.

3.4 AUCKLAND CITY PROPOSED DISTRICT PLAN

The Auckland City Council's responsibility for the coastal environment extends from the landward side of the Mean High Water Spring Tide. The land adjoining the southern end of the Harbour Bridge lies within the Auckland City Council's Coastal Management Area. This area contains significant natural features and habitats, many of which have already been affected by development. However, it is intended that these be protected as far as practicable from further modification and degradation.

The land adjoining the southern end of the Harbour Bridge is zoned Open Space Activity 5 and Special Purpose Activity 3. The objective of the Open Space Activity 5 zone is to provide for a wide range of recreation and leisure activities while ensuring that any adverse effects from such activities are avoided or mitigated. The site is subject to the Westhaven Concept Plan.

The Special Purpose Activity 3 zone is a transport corridor zone and in this instance the District Plan seeks to preserve the strategic route (motorway and Harbour Bridge) for the purpose of maintaining transport corridors throughout the Isthmus.

Clearly, the intent of the Proposed Plan with respect to the coastal environment and transportation is to ensure that the adverse effects of activities are minimised and that activities that have an identified significant adverse effect are directed away from sensitive areas. As has been discussed, it is considered that the proposal would not have a significant adverse effect on the coastal environment or transportation network.

3.5 NORTH SHORE CITY PROPOSED DISTRICT PLAN

The land adjoining the northern end of the Harbour Bridge is zoned a mixture of Residential (zones 3A, B and C) and Recreation (zones 1, 2 and 3). Shoal Bay (east of the motorway designation) is identified as a 'Site of Special Wildlife Interest'. A substantial proportion of the motorway north of the Harbour Bridge is also located within the Plan's Coastal Conservation Area. The motorway is designated.

The Residential 3 zone seeks to ensure that the historical and architectural character of certain distinctive areas of the City is retained; in this instance, the Northcote residential area. The Recreation zones, 1 (conservation), 2 (neighbourhood activities) and 3 (water-related activities) generally seek to provide appropriate recreational opportunities to serve the local community and to protect areas of high environmental value.

As discussed in the assessment of effects, Section 6, it is considered that the proposed works will not significantly impact on the coastal environment, in particular Shoal Bay. In addition, the proposed works will not detract from the character or amenity values of the surrounding residential neighbourhood at Northcote Point.

Overall, it is considered that the proposed works will not generate any significant adverse effects.

This section describes the operations associated with maintenance painting of the Harbour Bridge (the primary activity for which consent is sought) as well as the preparation and painting of any new structures.

The Harbour Bridge is sited in a marine environment, and as a steel structure, this makes it vulnerable to paint deterioration and corrosion. A continual programme of maintenance painting is required to preserve the coating on the steel.

An initial surface coating of thermal zinc-aluminium was applied to the Harbour Bridge at the time of construction in 1959. This coating was applied to about 99 % (approximately 60,000 m^2) of the total surface area to provide cathodic protection to the steelwork.

The remaining 1 % of the surface area (approximately 600 m^2) was coated with lead primer during construction. The lead primer was applied to localised area of steelwork in Span 7 (adjacent to Pier 6).

Full details of the location and extent of blasting, the abrasive products used, recovery and disposal of blast products on an annual basis can be found in the Opus International Consultants Ltd Annual Reports. These are submitted to the ARC in July each year, in accordance with the existing resource consent conditions. The reports are entitled *'Auckland Harbour Bridge – Resource Consents for Discharges of Abrasive Blast Products'* and have been produced for the years 1994 to 1999 inclusive. To avoid repetition, the Annual Reports will not be quoted in this assessment (they will be referenced only).

4.1 PAINT MAINTENANCE PROGRAMME

The maintenance programme can be broken down into three distinct stages: preparation, priming, and topcoating.

4.1.1 Preparation

The surface preparation is fundamental to the performance of any paint system. Blasting of some form is necessary to:

a) Completely remove any deteriorated material (paint, rust, products of corrosion and weathering), and

b) Provide a suitable anchor pattern or 'profile' on the surface of the steel, to which the paint can adhere. The process involved in providing the profile is critical to the success of the paint system. The abrasive used for the profiling process is chosen for specific grading and hardness properties.

The life of a paint system is highly dependent on the quality of the prepared surface. The surface preparation specification for the Harbour Bridge is a 'Near White' finish, which is defined as 'less than five percent rust after blasting'. 'Near White' is the internationally accepted specification for the minimum standard for a high performance paint system and can only by achieved by abrasive blasting or ultra high pressure water blasting. Abrasive blasting and ultra-high pressure water blasting are the only methods of surface preparation that can be used in heavy industrial applications.

For the preparatory work on the Harbour Bridge, garnet sand and crushed basalt are the abrasive media used. Wet abrasive blasting and high pressure water blasting are the main types of blasting used; dry abrasive blasting is used only when paint is removed back to bare steel in areas where visibility or access constraints make water blasting difficult. TBS are utilising the wet system on a more frequent basis to minimise the effects of any dust generated during surface preparation.

Wet Abrasive Blasting

In wet abrasive blasting, abrasive media is injected into a pressurised water stream. The media and the water are then projected onto the surface of the steel. The blasting methodology allows for high-pressure water washing to remove salt, grease, oil, dirt, loose paint and corrosion products from the existing paint surface. Injection of abrasive enables removal of more resistant areas of paint deterioration and corrosion. Removal of paint back to bare steel will be required only over 5-10% of the total surface area to be painted. Abrasive is only injected into the water jet for the purposes of spot blasting, where paint is removed back to bare steel. When abrasive is not used, the process is defined as water blasting (see below).

Addition of rust inhibitors is required in areas where bare steel has been exposed. Where inhibitors are necessary, the inhibitive solution added to blasting water comprises sodium nitrite (0.32% by weight) and diammonium phosphate (1.28% by weight). Water-soluble inhibitors can have serious detrimental effects on paint coatings, so it is imperative that the inhibitor used is compatible with the current paint system.

Crushed basalt is the media used for wet blasting. The MSDS for crushed basalt is contained in Appendix B.

In addition, surfaces with salt concentrations exceeding 75 mg/m^2 are washed with water containing a 1% solution of Chlor*Rid salt solubilising solution. The salt concentrations in areas of the Harbour Bridge currently being maintained are well below the minimum acceptable level and the use of Cholr*Rid is not necessary[1]. It is anticipated that only limited use of this product will be necessary in the next 10 years. If Chlor*Rid is required it will most likely be limited to the southern spans of the Harbour Bridge only (Spans 5, 6 and 7) which are the closest spans to sea level.

Water Blasting

As mentioned, abrasive is not always used in the wet blasting process. When no abrasive is injected, the process is analogous to high pressure water blasting. Water blasting is used for the steelwork to remove loose surface paint layers. However, paint is not generally removed back to bare steel using water blasting.

Dry Abrasive Blasting

Dry blasting is a process in which abrasive media are projected onto a steel surface to remove surface contaminants and to provide a roughened surface for paint adhesion. It is used primarily in areas where access for wet blasting is not possible. There may be some limited use of dry blasting in areas where operator visibility requirements make wet blasting difficult or dangerous.

When dry blasting is required on the southern and northern approach spans, a low dust content abrasive (garnet sand) is used. In other dry blasting instances crushed basalt will be used. Garnet sand comprises 97% garnet, less than 2.5% limonite and less than 0.5% quartz. The Material Safety Data Sheet (MSDS) for garnet sand is contained in Appendix B.

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[1] Total Bridge Services Ltd, personal communication 05 August 1999.

Due to issues associated with discharges to air (spent blast debris and dust) in the past, the quantity of garnet sand now used has been significantly reduced, resulting in minimal discharge of blasting debris.

The quantity of abrasive product used historically on each span of the Harbour Bridge annually is detailed in the Opus International Consultants Ltd Annual Reports. The change in the type of abrasive material used and the decrease in quantity used are apparent in the Annual Reports.

An estimate of the total surface areas to be treated using abrasive blasting and the quantity of abrasive and paint removed per span is indicated in Table 4.1:

Table 4-1
Estimated Surface Areas for Dry Abrasive Blasting and Quantities of Abrasive Used[2]

Span	Total Surface Area (m^2)	Area of Paint Removed (m^2)	Volume of Abrasive (m^3)	Dry	Wet	Volume of Paint Removed (m^3)
1	16,000	2,400	15.2 (Garnet)	3	12	1.92
2	7,500	1,125	7 (Garnet)	1.4	5.6	0.9
3	16,000	2,400	21.3 (Basalt)	4.3	17	1.92
4	6,000	900	8 (Basalt)	1.6	6.4	0.72
5	11,000	1,650	14.7 (Basalt)	2.9	11.7	1.32
6	4,200	840	4 (Garnet)	0.78	3.12	0.67
7	6,000	1,500	8 (Garnet)	1.6	6.4	1.2
East extension	32,000	3,200	35 (Garnet/Basalt)	7	28.1	2.56
West extension	(all maintenance on the west extension will be completed prior to consent renewal)					

4.1.2 Primer & Top Coat Application - The Current Paint System

Maintenance painting differs from painting of new structures in that only a relatively small area of the steel surface receives the full paint system. The paint system used by TBS is a moisture-cured urethane; the proprietary names of each paint and the thickness of each coating are shown in Table 4.2.

The maintenance painting programme involves spot-blasting and repriming the deteriorated or defective areas of paint whilst leaving the sound paint intact. Then three coats of paint are applied to the section; a primer (if necessary), an intermediate coat and a top coat.

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[2] Total Bridge Services, August 1999

Table 4-2
Paint Usage Rates for the Paint System Maintenance Contract

Coat	Proprietary Name/ Paint Type	Paint Usage (Dry Film Thickness/ Wet Film Thickness)
Primer Coat (if required)	MC Miozinc	75µm DFT/ 150 µm WFT
Stripe Coat (if required)	MC Miomastic	75µm DFT/ 150 µm WFT
Spot Coat (if required)	MC Miomastic	75µm DFT/ 150 µm WFT
Intermediate Coat	MC Miomastic	75µm DFT/ 150 µm WFT
Stripe Coat (if required)	MC Ferrox A	75µm DFT/ 150 µm WFT
Top Coat	MC Ferrox A	75µm DFT/ 150 µm WFT

For the purposes of defining the paint quantities and types used in the paint system maintenance work, the Harbour Bridge can be divided into five main areas:

1. The West & East Extension Box Girders (Including Supports)
2. Truss Spans 2, 4, 5, 6 & 7
3. Truss Spans 1 & 3
4. Northern Approach Viaducts
5. Southern Approach Viaducts

The paint system on each of the above sections varies slightly, however all sections receive the coatings shown in Table 4.2. The current painting programme is outlined in the Opus International Consultants Ltd 1999 Annual Report.

The current paint system comprises one primer coat, one intermediate coat and one top coats. Specific sections of the steelwork require a primer coat (where paint is removed back to bare steel); a stripe coat or a spot coat (around bolts, exposed edges and where paint is removed back to bare steel). The primer and intermediate coats (MC Miozinc and MC Miomastic) are each approximately 70 to 100 µm in thickness, and are made up of a zinc pigment suspended in an aliphatic urethane binder. The zinc sacrificially corrodes in preference to the steel.

The paint used for the topcoat comprises an MIO pigment in a urethane binder. The purpose of the topcoats is two-fold; to act as a barrier coat to minimise the amount of water able to reach the steel surface, and for aesthetic reasons. The total thickness of each topcoat is approximately 75µm.

The total paint system covers an area of approximately 150,000 m^2 at an average thickness of 800 µm. The total volume of paint on the Harbour Bridge is approximately 120 m^3. This comprises[3] some 4.4 m^3 of zinc (applied at the time of construction), 43 m^3 of primer, 0.6 m^3 of red lead primer (also applied at the time of construction), and 37 m^3 of topcoat. Since

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[3] Works Consultancy Services Ltd., Auckland Harbour Bridge - Assessment Of Effects On The Environment Of Steelwork Maintenance By Abrasive Blasting Methods, Prepared For Transit New Zealand, March 1993.

construction approximately 18 m^3 zinc phosphate primer and 17m^3 micaceous iron oxide topcoat have also been applied.

4.1.3 New Structures

Any new steel structures are painted with the three-coat moisture cured urethane paint system as soon as practicable.

4.1.4 Frequency Of Blasting And Painting

Overall productivity for painting related activities is approximately 70% of the available work time (i.e. an average 40 hour week). The working week is defined as an 8 hour day, 5 day per week operation. During peak times (such as around Christmas), TBS may work a 7 day week for a short period of time to make maximum use of long term lane closures. Due to the particular physical properties of the moisture cure urethanes it is possible to paint when conditions for conventional paint systems would be outside specification. These coatings can be applied in conditions where humidity is up to 99%, on to damp surfaces, in light fog conditions, etc.

4.1.5 Frequency Of Abrasive and Water Blasting

As previously mentioned, abrasive will only be injected into the water jet for the purposes of spot blasting. This equates to approximately 5 -10% of the total surface area. Areas where the paint remains sound will only be water blasted.

Typically, 2 to 3 weeks at a time are spent on surface preparation, including blasting and spot painting with zinc primer. This is followed by a similar period applying intermediate and finish coats.

4.1.6 Frequency of Coatings Application

Coatings application includes application of the primer, intermediate and finish coats inclusive of striping along edges, bolts, rivets and welds. The application of coatings includes spot painting and striping, full coverage with the intermediate coat followed by striping with the finish coat and application of the full topcoat. Coatings application is typically carried out over a two to three week period following surface preparation.

4.1.7 Volumes Of Material

The quantities of materials used are approximately as stated in the following table. The volume of moisture cure urethane paint is based on painting being carried out only in Spans 2, 4, 5, 6 and 7 on the truss bridge, the northern and southern steel approach viaducts and the east extension.

Based on the current programme the west extension will have been completed by December 2000. Spans 1 and 3 of the truss bridge will not be fully re-coated but will only be "spot" painted as corrosion or coatings defects are identified. The volumes of abrasive and paint material used annually are shown in Table 4.3.

Existing coating thickness varies between 300 μm and 1,500 μm depending on the location on the Harbour Bridge. An average coating thickness of approximately 800 μm can be assumed for the external steelwork on the structure.

Table 4-3
Volumes of Material (Abrasive and Paint) Used

Material	Surface Area (m^2)	Units	Rate	Amount
Dry Abrasive	4,500	T/m^2	$4 * 10^{-3}$	18 tonne
Wet Abrasive	10,905	T/m^2	$4 * 10^{-3}$	43 tonne
MC Miozinc	7,272	ℓ/m^2	0.075	550 litres
MC Miomastic	72,720	ℓ/m^2	0.075	5,540 litres
MC Ferrox-A	72,720	ℓ/m^2	0.075	5,540 litres
Alkyd Zinc Phosphate	2,720	ℓ/m^2	0.2	550 litres
Alkyd MIOx	2,720	ℓ/m^2	0.2	730 litres

4.1.8 Original Paint Maintenance System

The original protective coatings system was a five-coat alkyd/phenolic system comprising 3 coats of zinc chromate pigmented primers over-coated by MIO pigmented finishing coats. In 1994 the original paint maintenance system was replaced with a four coat modified alkyd system. The 1994 resource consent applications document prepared for Transit NZ by Works Consultancy Services Ltd contains full details of the nature and effects of the original paint maintenance system. Full details of the specific changes to the paint maintenance system can be found in the 1994 to 1999 (inclusive) Opus International Consultants Ltd Annual Reports. The most important point to note here is the replacement of the zinc chromate primer with a zinc phosphate primer.

Discharges form the original paint system comprise flakes and debris removed during blasting. As it is not possible to quantitatively assess the effects of these discharges on the receiving environment (accurate discharge data does not exist), a qualitative assessment has been made.

4.1.9 Significant Changes to the Paint Maintenance System

In summary, the most significant changes to the paint maintenance system since the lodgement of the resource consent applications in 1994 that have implications on the consent renewals are:

- Zinc chromate primer is no longer used; this has been replaced by a zinc phosphate primer. Therefore only residual zinc chromate will be discharged as a result of the paint maintenance programme, and the quantity of zinc chromate discharged will have no worse effect on the environment than that already covered by the existing resource consent.
- The use of dry abrasive blasting has been substantially reduced.
- Wet abrasive blasting and high pressure water blasting are now the main blasting techniques used.

- Lead primer paint has not been used on the Harbour Bridge since the very limited applications in 1959.

The above changes, together with the mitigation measures in place, have significantly reduced the effects of the paint maintenance system on the receiving environments.

The technical data supporting the assessment of effects is contained in Appendix A to this document. Appendix A describes the general discharge characteristics of the spent blast media and paint debris, the typical volumes discharged, and the predicted typical concentrations in the receiving environment. The discharge scenarios considered were:

- Discharges of paint product resulting from the application of the current paint system
- Discharges of blast product, and
- Discharges of paint debris from the original paint system.

The following assessment of effects addresses all discharge scenarios.

5.1 DISCHARGES TO SEAWATER

Discharges to the Harbour from the paint maintenance programme since the construction of the Harbour Bridge will have a transient effect on the harbour water quality. The quantitative assessment carried out (Appendix A) shows that the concentrations of the original paint system, the blast media, the monocyclic aromatic hydrocarbons (MAHs) and the polyaromatic hydrocarbons (PAHs) in the current paint system exceed the ANZECC Guidelines (1992). However, the effects will be significantly decreased due to dispersion through wave action, mixing and rapid dilution due to tidal flushing. In addition, the calculation methodology used in this assessment assumes that painting and blasting occur for a full six hours per day. In reality, these activities occur for only two to three hours per day, once the time for equipment set up and preparation is taken into account.

The effect of spent blast media on water quality is minor due to the inert nature of the material used in blasting. Garnet, silica and limonite are naturally occurring minerals and basalt is also naturally occurring. The blast product would have an insignificant effect on the suspended solids load and turbidity of the Harbour water due to both the density of the material (it will sink rather than contribute to suspended solids load) and the flushing effects of the tide. The total natural suspended solids load carried by the Harbour in each six-hour tidal cycle is in the order of 2,500,000 kg, thus the contribution from blasting and the paint maintenance programme is insignificant by comparison. In addition, given that around 60 % (170,000,000 m^3) of the water in the Harbour is exchanged in each tidal cycle, and that tidal velocities in the vicinity of the Harbour Bridge effect good flushing, much of the finer material from blasting is dispersed by tidal action.

The components making up the blast debris will comprise paint flakes from the original paint system. It has been predicted that a total quantity of less than $0.05m^3$ of paint flakes will be discharged into the Harbour per year. As this material is not soluble, it will not become dissolved in seawater, and will be diluted and dispersed due to wave and tide action.

The current aquatic and submarine environment in the Auckland Harbour is in a substantially modified and moderately polluted state[4]; discharges from the blasting and painting work will result in a minor and temporary effect on the water quality.

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[4] Works Consultancy Services Ltd., Auckland Harbour Bridge - Assessment Of Effects On The Environment Of Steelwork Maintenance By Abrasive Blasting Methods, Prepared For Transit New Zealand, March 1993.

5.2 DISCHARGES TO LAND

In the past, the main effect on the land environment from the paint maintenance programme was the dust nuisance caused by the settlement of the finer fraction of the blast product on residential properties, commercial properties, boats and vehicles. Due to a significant decrease in the use of dry abrasive blasting, the increased use of wet abrasive blasting, and the mitigation measures in place (described in Section 6 of this report) dust nuisance from the paint maintenance programme should no longer be a significant issue.

Redistribution of deposited blast product could potentially occur due to air currents around the abutments, which may give rise to nuisance effect in specific locations. Due to the 'Recovery and Disposal Programme' (refer to Section 6 of this document), nuisance effects as a result of redistribution will be minimal.

The paint maintenance programme will have a negligible effect on the open areas at the northern and southern ends of the Harbour Bridge, and on the bridge expanse. Any debris will have a short residence time due to the washing effects of rain and sea spray.

The concentrations of each of the components of the paint coatings and the blast products in soil were calculated as for the discharges to seawater. The full calculation methodology is contained in Appendix A. Where applicable, all of the components of the paint system once on land were well within the ANZECC Guidelines (1992). The discharge of paint debris from the original paint system is less than 0.03m^3 per year; most of this volume will be collected in the screens used during blasting over land. There are not expected to be any adverse health or environmental effects due to the discharges to land from the paint maintenance programme.

5.3 DISCHARGES TO AIR

The ultimate receiving environments are the Auckland Harbour and the land in the vicinity of the Harbour Bridge, however, the discharges to air from the paint maintenance system have been assessed.

The paint blast products are initially discharged into the air around the area of the Harbour Bridge. Before settling in the Harbour or on land, the products undergo redistribution and dispersion by wind currents. This may continue for a considerable period of time depending on the meteorological conditions, wind speeds and quantity discharged, etc. Given that the predominant wind direction in the greater Auckland area is in a south-westerly direction, it is probable that the majority of deposition occurs in (but is not limited to) this direction. Due to the wind tunnelling effect of the Harbour, the wind direction in the area surrounding the Harbour Bridge will be variable.

While the discharge will have a minor effect on air quality close to the discharge source, winds will disperse the low density material, while the high density material (such as the abrasive media) will fall out of suspension rapidly. The discharge will not have an adverse health or environmental effect on the surrounding environment. Due to the increased use of wet abrasive blasting, the decrease in use of dry abrasive blasting, and the mitigation measures in place (refer to Section 6 of this report), the nuisance effects of the discharge (particularly at the northern and southern abutments) should be minimal.

In the absence of air quality guidelines, it is appropriate to use occupational Safety and Health Workplace Exposure Standards (WES) divided by thirty to assess effects on air quality. The concentrations discharged during paint application slightly exceeded the WES/30, indicating minor effects on the receiving environment. Due to the conservative nature of the calculation methodology (as previously explained), and further dispersion in air, it is unlikely that discharges to air from the paint maintenance programme will have an adverse effect on the receiving environment. Further details of the assessment of the individual components of the paint coatings and the blast media are contained in Appendix A.

No complaints regarding dust emissions from the paint maintenance programme have been received by the ARC since 1995. This, together with the recent survey results (a copy of which is contained in Appendix C), provides sound evidence that any nuisance effects of dust have been abated.

A number of different control measures exist for the control of emissions from abrasive blasting. These methods include blast enclosures; vacuum blasters; drapes; water curtains; wet blasting; and reclaim systems. Wet blasting controls include not only traditional wet blasting processes but also high pressure water blasting, high pressure water and abrasive blasting, and air and water abrasive blasting. For wet blasting, control efficiencies between 50 and 93 % have been reported[5]. Fabric filters are used to control emissions from enclosed abrasive blasting operations.

The current mitigation measures used by TBS and their contractors to minimise the effects of the Harbour Bridge paint maintenance system include:

6.1.1 Limitation Of Blast Activities

To minimise any effects on the surrounding environment, blasting is confined to specific wind conditions. No blasting is carried out when the wind is blowing at a speed greater than 7 m/s (equivalent to approximately 14 knots) from the south westerly or south easterly quarters while working north of Pier 1 or south of Pier 6. Similarly, no blasting is carried out south of Pier 5 when the wind is blowing from the north-westerly quarter.

6.1.2 Removal Of Blast Product

An effective mitigation method is the ground collection of the blast product and paint debris. The material is disposed of in a manner that minimises the effects on the environment. Disposal of this material eliminates the potential for redistribution by wind. The official recovery and disposal programme utilises the following measures to minimise the impact of the paint maintenance programme on the environment:

Auckland Harbour Bridge Recovery and Disposal Programme

reads

- Screens - large moveable, woven polypropylene screens with weighted hems are deployed while blasting north of Pier 1 and south of Pier 6 to stop the spread of any blasting products.
- Windspeed - blasting is kept to wind speeds under 7 m/s (14 knots) to minimise the spread of blasting debris.
- Catchpit covers - roadside catchpits draining to the stormwater system are covered with wooden boards during abrasive blasting south of Pier 6 and north of Pier 1 to prevent contamination of stormwater. Most of the abrasive material is caught on the boards, and removed from the site for disposal. The change to the wet abrasive blasting practice will have little effect on the level of contaminants reaching stormwater. The volume and flow of water associated with any abrasive debris that may fall in the vicinity of the stormwater drains is minimal. In the worst case, a portion of the particulate material would be transported to the stormwater catchpits, and catchpits are designed to trap such material. The volume and flow of water through the catchpits would allow the material to settle quickly, minimising onward discharges to the Harbour. In the event that material is discharged to the Harbour, the effect on the environment would be negligible; less than that described of the blasting conducted directly over the water.

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[5] United States Environmental Protection Agency (US EPA) Air Chief Document AP-42, Fifth Edition and Supplements.

- The new paint system used by TBS utilises a smaller volume of paint than the previous system, thereby reducing the volume of discharged material.
- Sweeping of structure - the structure of the Harbour Bridge, including the carriage way and all sealed areas in the vicinity of the Bridge are swept as practicable by the Contractor using compressed air. This is carried out on a daily basis following blasting. The swept material is collected and removed for disposal as practicable.
- Sweeper truck - the blasting debris is manually swept by the Contractor from the pavement onto the road, where it is collected. The ground in the Anchorage area is swept using a vacuum sweep truck when required. The material is then collected and taken away for disposal.
- Manual collection - the south abutment yard is not accessible to the sweeper truck and is manually swept by the Contractor and debris removed from the area. A large amount of the blasting debris is collected via manual collection - approximately 85 % compared to 15 % collected by the sweeper truck.
- Transportation - All of the blast debris is transported from the site in a purpose-built vehicle with coverings to ensure no spillage during transport. The debris is then taken to the Northern Disposal Systems' Special Waste Landfill at Greenmount, East Tamaki.
- Disposal - The disposal debris, deemed a 'hazardous or special waste' in accordance with the United States Environmental Protection Agency (US EPA) TCLP standards, is treated to levels specified in the Trade Waste By Law, the RMA, and the Northern Disposal Systems' Management Regulations for Special or Hazardous Waste.

6.1.3 Public Notification

TBS takes a proactive approach to the public notification process. Currently public notification involves delivery of a newsletter and visits to residents and occupiers. Advanced notice of any work, especially blasting, at or near to either of the abutments, is given to potentially affected persons. Surrounding businesses and residents are forwarded blasting and painting programmes at regular intervals. Signage is displayed advising motorists and the public of abrasive blasting and painting operations.

6.1.4 Monitoring Of Blast Activities

To further identify and address the potential nuisance effects of the Harbour Bridge paint maintenance programme, the management of the Bridge keep a file of all written and verbal complaints regarding the programme. The file is regularly assessed to identify any problems caused by the programme, and all reasonable steps are taken to reduce the effects on the surrounding environment.

The paint maintenance contractors as far as practicable avoid, remedy or mitigate adverse effects on the environment from the abrasive blasting process. Methods to specifically reduce the effects to the water and land environments include:

- Use of garnet abrasive for blasting where possible. This is actually a more expensive material, however using garnet significantly reduces the amount of abrasive dust generated when blasting. Due to its efficiency as an abrasive a smaller quantity of garnet can be used, which results in a reduction in the potential quantity lost to the environment.

high standard of surface preparation would not be achieved with vacuum blasting. The consequence of inadequate surface preparation is failure of the coating system and premature maintenance requirements. Vacuum blasting is therefore not considered a viable option for the Harbour Bridge.

7.2.3 Alternative Blasting Media

Alternative blast media have been continuously trialed on the steelwork of the Harbour Bridge over a number of years. The aim of the trials is to find more economic and effective blast media that can be efficiently recovered. Basalt, garnet and crushed glass were trialed, as was captive steel shot blasting. Full details of the trials can be found in the Opus International Consultants Ltd annual report. Garnet is considered the most cost effective and efficient means of removal in built up areas with basalt being suitable for spans well away from these areas.

7.3 ALTERNATIVE PAINT SYSTEMS

Investigations and trials using alternative paint systems is carried out on an ongoing basis to identify paints that comply with health and safety legislation, and that have minimal effects on the receiving air, land and water environments.

The aim of the most recent trials was to find paint coatings with superior performance and application characteristics to those already used, and preferably with a lower volatile organic carbon (VOC) content than those already used.

Again full details of the paint systems trialed can be found in the Opus International Consultants Ltd Annual Reports.

8.1 INTRODUCTION

Since the granting of the existing consents in 1994, consultation with the local community and identified affected parties has been an ongoing process. It is proposed that the existing forms of communication are continued.

8.2 PREVIOUS COMPLAINTS

One complaint relating to the Harbour Bridge maintenance programme was recorded in October 1995, where a resident of Northcote Point was concerned about debris from the maintenance programme littering a nearby park (Stoke's Point Domain). Officers of the Auckland Regional Council investigated the complaint and found evidence of sand washed off a nearby concrete platform on the Harbour Bridge. The contractors working on the Bridge at that time were contacted, and it was discovered that the contractors were not actually working in that area of the Bridge at the time of the complaint.

Since this time the ARC has received no further complaints regarding the paint maintenance programme on the Harbour Bridge.

8.3 PUBLIC CONSULTATION

The public consultation process to date has involved the distribution of a letter to residents and other identified parties that may be potentially affected by the paint maintenance programme. The letter describes the application, the assessment of environmental effects, and explains that TBS intend to consult with neighbours and interested parties so that their concerns can be considered when preparing the resource consent application.

A list of the parties to whom this letter was distributed, a copy of this letter and any responses received are contained in Appendix C to this report.

8.4 COMMUNITY SURVEY

As required by condition 9 of the existing air discharge consent, survey questionnaires are sent to the residents and businesses adjacent to the Harbour Bridge on an annual basis. The results of the questionnaires, including copies of the responses, can be found in the Opus International Consultants Ltd Annual Reports. The questionnaire asks the identified parties to comment on the:

- Adequacy of the screening provided
- Availability of the contractor's work programme
- Adequacy of the street cleaning after blasting operations
- Adequacy of the signage provided
- Comments on any other issues.

For the 1999 survey, no written responses were received, however one verbal response was received[8], from a resident in Northcote (near to the northern abutment of the Harbour Bridge). The resident stated that they had no concerns over the blasting and painting operations, and

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[8] Opus International Consultants Ltd Auckland Harbour Bridge Annual Report July 1999

they have not been adversely affected by dust from the paint maintenance programme. Six responses to the 1998 survey were received, and all were of a positive nature.

The Public Survey is an ongoing scheme that will be continued and monitored by TBS and their contractors. It is expected to be a condition of the renewal of the resource consent for discharges to air.

8.5 IWI CONSULTATION

The Iwi identified as most affected by the Harbour bridge maintenance programme is Ngati Whatua, who were consulted as part of the previous resource consent application process. As agreed with the ARC Officer handling this application[9], Ngati Whatua were again consulted during this application process.

After discussing the nature of the application with a Ngati Whatua representative, a letter was sent, together with a summary of the assessment of environmental effects, to the representative.

Subsequent to this, a meeting between Woodward-Clyde and Ngati Whatua was held to discuss issues regarding the environmental effects of the discharges. Ngati Whatua were interested in the environmental effects of the paint maintenance programme, particularly discharges to the Waitemata Harbour in that the Mauri of the water may be affected. Other issues regarded the stormwater discharges from the deck and road surface of the Harbour Bridge, which is not part of this consent process. Overall, Ngati Whatua were not opposed to the application and were satisfied with the mitigation measures in place to ensure that the effects of the discharges to land, air and coastal water were minor.

A copy of the response from Ngati Whatua is included in Appendix C to this document.

8.6 LOCAL AUTHORITIES

Consultation was carried out with the North Shore City Council and the Auckland City Council. Neither Authority had an objection to the consent application. Copies of correspondence are contained in Appendix C.

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[9] ARC, email communication 20 July 1999

Appendix A
Technical Data – Discharges to Water, Land & Air

In this assessment, the discharge scenarios considered were:

- Discharge of paint (as product lost) from the current paint system.
- Discharge of blast product.
- Discharge of paint debris from the original paint system during blasting.

In both scenarios, the 'worst case' discharge has been assumed i.e. that blasting of the original paint system or paint application takes place on all sections of the Harbour Bridge at one time.

GENERAL DISCHARGE CHARACTERISTICS[10]

The discharges from the current paint system comprise lost product i.e. the paint spray that does not contact the bridge surface, and falls to the sea or land below the Harbour Bridge.

The discharge produced by the wet abrasive blasting operation is a mixture of 90 % spent blast media and 10 % paint debris by volume, suspended in water. The paint debris is variable depending on which section of the Harbour Bridge is blasted. In this assessment, blast debris and paint debris are assessed separately.

The paint particles from blasting (excluding the red lead painted part of Span 7) contain, on average, 39 % topcoat debris, 55 % primer debris, and 6 % zinc debris from the original and spot coatings. The average composition of paint debris from the lead painted section of Span 7 is 56 % iron oxide topcoat, 39 % primer, 2 % zinc spray and 3 % red lead paint. The amount of lead paint discharged is diminishing with time, as it is not replenished.

The blast media comprises garnet sand (97% garnet sand, less than 0.5% free silica, less than 2.5% limonite) and crushed basalt. Garnet, silica and limonite are naturally occurring minerals, as is basalt.

Laboratory tests on the combined discharge of paint debris and abrasive media from the blasting process have revealed that around 70 % of the material falls within the 850 to 180 µm particle size range. Any material with a particle diameter of greater than about 20 µm is classed as deposited particulate. Deposited particulate has the potential to cause nuisance effects by settling on houses, cars, etc. Approximately 4 to 5 % of the paint debris and blast media mixture has a particle diameter of 10 µm or less, which comes under the classification of suspended particulate. Suspended particulate is more likely to cause health effects than deposited particulate; worker health and safety issues are addressed by the use of appropriate personal protective equipment (PPE).

Volumes Discharged Annually

With the increased use of wet abrasive blasting and high-pressure water blasting, the volume of blast product discharged annually has been reduced from 150 tonnes to 60 tonnes per year (the equivalent of approximately 16m^3 year).

In 1993, Works Consultancy Services Ltd estimated that the upper limit of the total volume of lead paint that would be removed from the area painted was less than 0.0007 m^3. This quantity would never be discharged at one time as, due to constraints on the Contractor's

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[10] Works Consultancy Services Ltd., Auckland Harbour Bridge - Assessment Of Effects On The Environment Of Steelwork Maintenance By Abrasive Blasting Methods, Prepared For Transit New Zealand, March 1993.

resources, the entire area painted with red lead paint would not be programmed for maintenance at one time.

DISCHARGES TO WATER (THE COASTAL MARINE ENVIRONMENT)

The following assessment of effects is based on a 'worst-case' scenario where the entire product lost during paint maintenance falls into the sea in one day. In reality the quantity discharged (hence the typical concentration in seawater, on an instantaneous basis) would be spread out over the number of hours the activity was carried out. Thus the effect on the seawater environment would be even less than described here.

The assessment of effects of the blast media and paint debris in seawater has been carried out based on the following assumptions:

- Approximately 60 % of the total surface area of the Harbour Bridge spans over water; therefore the total quantities calculated were multiplied by 0.6 to give a more realistic numeration of the quantity of lost product or blast debris that would be discharged into the Harbour.
- When any of the paint coats are sprayed onto the surface of the Harbour Bridge, there is a maximum of 15 % loss of product.
- The entire 15 % lost product falls into the sea below the area being painted.
- The volume of seawater available for dilution equates to 10 m^3, based on a surface area affected by the product loss of $100m^2$ and an estimated mixing depth of 0.1m.
- The assessment is instantaneous and does not take into account dilution and dispersion due to tidal flushing.
- Any volatile components of the primer coat are expected to be volatilized before reaching the sea.
- The predicted daily concentrations used in this assessment assume that the paint coating application typically takes place for a maximum period of 880 hours per year. This is a typical period of application only, which may vary from year to year, and depend on the part of the Harbour Bridge being maintained. Typical concentrations are used in this report for assessment purposes in the absence of real data. A 6 hour working day has been assumed, and for worst case assessment purposes, the calculation methodology utilises a 6 hour duration for paint application. In reality the duration of paint application would be around half this time.
- The predicted daily concentrations used in this assessment assume that blasting takes place for a maximum of 650 hours per year. Again this is a typical period of application only, that may vary from year to year, and depend on the part of the Harbour Bridge being maintained. In any one day, no more than 6 hours of blasting would take place, and generally this time is around 2 to 3 hours, allowing for set up of equipment. The calculation methodology used here assumes that blasting takes place for a full 6 hours per day.
- It has been assumed that the non-hazardous proprietary ingredient (NHPI) content of the all the paints is inert, and, in the absence of further information, this constituent was unable to be assessed.

The concentration of each known non-volatile component was compared to the Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Waters (1992).

Current Paint System – Primer Coat (MC Miozinc) Application

The primer coat is made up of the components in Table A-1. The total surface area of the Harbour Bridge covered by the primer coat is 7,272 m^2, where 10% of surface area is primed. The average coat thickness is 0.075 mm (75 μm). The total volume of paint used is 550 litres. At 61% solids this equates to a total mass of 840 kg. Annually this equates to 12.6 kg/yr lost product at a 15% loss rate (meaning 15% of the paint sprayed on to the bridge does not contact the surface and falls into the sea below).

The components of the primer coat assessed here are Aromatic 100 (a naptha-derivative), zinc powder and NHPI. Due to their volatility and high evaporative degradation rate, polyurethane prepolymer and xylene were not assessed. Table A-1 shows the predicted concentrations of the primer coat MC Miomastic in seawater:

Table A- 1

Typical Concentrations of MC Miozinc Constituents in Seawater

Contaminant	Concentration in primer (% by weight)	Mass of lost product (as 15% of total), Annual (g)	Typical Equivalent Daily Concentration of lost product in seawater (g/m^3)	ANZECC Guideline (g/m^3)
Aromatic 100	7	89	0.362	0.003
Zinc powder	62	785	3.21	0.05

The typical concentrations shown in Table A-1 were calculated on an annual and on an equivalent daily basis. For a more realistic assessment, the maximum daily concentration of MC Miozinc that could end up in the harbour was determined for comparison with the ANZECC Guideline. The concentrations of both the aromatic component and the zinc component exceed the ANZECC guideline levels, however due to dilution and tidal flushing, there will be no more than a transient effect on the receiving water quality.

Current Paint System – Intermediate Coats (MC Miomastic) Application

The intermediate coats are made up of the components in Table A-2, which also shows the typical concentrations of each component. The total surface area of the Harbour Bridge covered by the intermediate coat is 72,720 m^2. The average coat thickness is 0.075 mm (75 μm). The total volume of paint used is 5,540 litres; at 61% solids this equates to a total mass of 7,088 kg. Annually this equates to a product loss of 223 kg based on a 15% loss factor.

The components of the intermediate coat assessed are high flash naptha, and micaceous iron oxide (MIO). Due to their volatility and high evaporative degradation rate, polyurethane prepolymer, methylethylketone (MEK) and xylene were not assessed. The NHPI were not assessed, as they are not expected to have an adverse effect on the receiving environment.

Table A- 2

Typical Concentrations of MC Miomastic Constituents in Seawater

Contaminant	Concentration in intermediate % by weight	Mass of lost product (as 15% of total), Annual (g)	Typical Equivalent Daily Concentration of lost product in seawater (g/m^3)	ANZECC Guideline (g/m^3)
High flash naptha[11]	6	623	2.54	0.003[12]
Micaceous Iron Oxide	42	4683	17.81	No guideline level

There is no guideline level for MIO, however it is assumed that the components of this contaminant would dissolve in seawater, be dispersed with tidal activity and eventually be flushed out of the Harbour. The concentration of high flash naptha (a polyaromatic hydrocarbon or PAH) exceeds the ANZECC guideline level. However due to dilution through wave action and rapid dispersion due to tidal currents, the effects of this component would be reduced.

Current Paint System - Topcoat (MC Ferrox A) Application

The topcoat is made up of the components in Table A-3. The total surface area of the Harbour Bridge covered by the top primer coat is 72,720 m^2. The average coat thickness is 0.075 mm (75 μm). The total volume of paint used is 5,540 litres. This equates to an annual loss of product of 169 kg based on 15% loss factor.

The components of the primer coat assessed are high flash naptha, the PAHs and the monocyclic aromatic hydrocarbons (ethylbenzene and trimethylbenzene). Due to their volatility and high evaporative degradation rate, the polyurethane prepolymer, MEK, and xylene were not assessed. The NHPI content was not assessed for reasons previously explained. Table A-3 shows the typical annual and equivalent daily concentrations of each component of the topcoat:

Table A- 3

Typical Concentrations of MC Ferrox-A Constituents in Seawater

Contaminant	Concentration in topcoat % by weight	Mass of lost product (as 15% of total), Annual (g)	Typical Equivalent Daily Concentration of lost product in seawater (g/m^3)	ANZECC Guideline (g/m^3)
Methyl oxypropylacetate	12	7767	3.17	No guideline level

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[11] High flash naptha is assumed to be non-volatile

[12] High flash naptha is assumed to be a polyaromatic hydrocarbon (PAH); hence the ANZECC Guideline was used to assess this component

Contaminant	Concentration in topcoat % by weight	Mass of lost product (as 15% of total), Annual (g)	Typical Equivalent Daily Concentration of lost product in seawater (g/m^3)	ANZECC Guideline (g/m^3)
Aromatic 100	4	2589	1.06	0.003[13]
Ethylbenzene	2	1295	0.528	0.3[14]
1,2,4 Trimethyl benzene	1	647	0.264	0.3[12]

There is no ANZECC guideline level for methyloxypropylacetate. The concentration in seawater is higher than the PAHs; again due to dispersion the effect on the receiving water quality would be minimal.

The typical concentration of PAHs in the topcoat exceed the ANZECC guideline level. Due to dilution through wave action and rapid dispersion due to tidal currents, the effects of these components would be reduced to a minimum. The concentration of the monocyclic aromatic hydrocarbons (MAHs) ethylbenzene and 1,2,4 trimethylbenzene slightly exceed and are within the guideline levels respectively. Again tidal effects would mean that the impact of ethylbenzene on the receiving water quality was minimal.

Current Paint System – Alkyd Zinc Phosphate and Alkyd MIO Application

The modified alkyd system (alkyd zinc phosphate and alkyd MIO) is spot applied where necessary, and is not a full cover system. For assessment purposes for the discharges to seawater, land and air presented in this report, it has been assumed that these coatings are applied as full coats (no data exists for the exact spot coat surface areas). Therefore the quantities of paint in this assessment are greater than in reality.

The main components of the alkyd zinc phosphate are alkyd polymers, talc, zinc phosphate, and an aromatic hydrocarbon mixture. Of these, the effects in seawater of zinc phosphate and aromatic hydrocarbons have been assessed. Zinc phosphate was assessed as a compound, however it is likely that, once in seawater, the zinc and phosphate would dissociate and behave as separate species. The maximum zinc phosphate content of the coating of 30 % was used in this assessment.

In the absence of further information, it was not possible to assess the alkyd polymers in the alkyd zinc phosphate coating. It has been assumed that the polymer is an inert coating that is not water soluble, and will not have an adverse effect on the receiving environment.

The alkyd MIO comprises mainly alkyd polymers (again in the absence of further information the effects of which could not be assessed), an aromatic hydrocarbon mixture, and a small quantity (less than 10%) of aluminium paste. The aluminium is a minor constituent and was not included in the assessment. The aromatic hydrocarbon content was assessed in terms of effects on the environment.

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[13] High flash naptha is assumed to be a polyaromatic hydrocarbon (PAH); hence the ANZECC Guideline was used to assess this component

[14] the ANZECC Guideline for benzene was used to assess ethylbenzene and 1,2,4, trimethlybenzene

Table A- 4

Typical Concentrations of Alkyd Paint System Constituents in Seawater (Annually)

Components of Alkyd zinc phosphate assessed	Content (weight %)	Mass of lost product (as 15% of total), Annual (g)	Typical Equivalent Daily Concentration of lost product in seawater (g/m^3)	ANZECC Guideline g/m^3
Zinc phosphate	30	1960	8	0.001 – 0.01[15]
Aromatic hydrocarbon mixture	30	1960	8	0.003
Components of Alkyd MIO assessed	**Content (%)**	**Mass of lost product (as 15% of total), Annual (g)**	**Typical Equivalent Daily Concentration of lost product in seawater (g/m^3)**	**ANZECC Guideline g/m^3**
Aromatic hydrocarbon mixture	20	3213	14	0.003

The analysis shown in the above table indicates that the typical equivalent daily concentrations of all of the components of the original paint system are above the ANZECC guideline levels. As previously mentioned, the modified alkyd coat is spot coated (it is not a full coat), so the concentrations presented here are greater than in reality. Due to dilution through wave action and rapid dispersion due to tidal currents, the effects of these components would be further reduced.

Blast Media

The quantity of dry abrasive used per year is 18 tonne (18,000 kg). The surface area on which dry abrasive blasting is applied is approximately 45,000 m^2, with an application rate of 0.004 t/m^2. Garnet sand is used as the dry abrasive media for the spans north of Pier 1 and south of Pier 5. The components of garnet sand have already been discussed. There are no guidelines for the assessment of garnet, free silica and limonite; these constituents are assessed based on the effect on the suspended solids concentration of the receiving waters.

Crushed basalt is used in wet abrasive blasting, and a quantity of 43 tonnes per year is used on the Harbour Bridge. The surface area exposed to wet abrasive blasting is 7,270 m^2, and the (10% only) application rate used for blasting is 0.004 t/m^2.

The same assumptions used in assessing the effects of the paint system are used for the assessment of the blast media, with the exception that:

- The volume of seawater available for dilution equates to 100 m^3, based on a surface area affected by the product loss of 100 m^2 and an estimated mixing depth of 1 m (as the blast media will not float within the top few centimetres of water).
- 90% loss of product.

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[15] ANZECC indicative concentration range (in the absence of a guideline) for phosphorus in coastal waters, provided as an indication of levels at or above which problems have been known to occur.

- In order to determine a worst case scenario, it was assumed in this assessment that abrasive blasting takes place for 650 hours per year. As previously noted, this is a typical period of application only used for assessment purposes, and may vary from year to year, and depend on the part of the Harbour Bridge being maintained.

Table A-5 shows the predicted effect on the suspended solids concentration as a result of dry abrasive blasting.

Table A- 5

Typical Concentrations of Spent Blast Media in Seawater (Annually)

Dry Abrasive Blasting Component	Total Mass Of Component (kg)	Mass Of Lost Product 90% (kg)	Typical Equivalent Daily Concentration Of Lost Product In Seawater (g/m^3)	ANZECC Guideline (g/m^3)
Garnet sand (97%)	17,460	15,714	873	Suspended solids 8 – 12 g/m^3 ± 10 %
Free silica (< 0.5%)	90	81	5	
Limonite (< 2.5%)	450	405	23	
Wet Abrasive Blasting	**Total Mass Of Media (kg)**	**Mass Of Lost Product (kg)**	**Equivalent Daily Concentration Of Lost Product In Seawater (g/m^3)**	**ANZECC Guideline (g/m^3)**
Crushed basalt	43,000	38,700	2150	Suspended solids 8 – 12 g/m^3 ± 10 %

The typical blast media concentrations in seawater can be compared to the ANZECC Guideline for suspended solids concentration. The existing mean suspended solids concentration in the Auckland Harbour in the vicinity of the Harbour Bridge is in the range 8-12 g/m^3 ± 10 %.

As can be seen from the above analysis, the typical contribution of spent blast media from the paint maintenance program on a daily basis with 90 % of the spent blast material entering the Harbour is greater than the Guideline levels. However, because the minerals in the blast media are naturally occurring, and will contribute to bottom sediment quantity rather than suspended solids loading, their discharge would not have an adverse effect on the receiving environment. On a yearly basis the contribution would also be negligible due to tidal flushing.

Inhibitors

The inhibitors used in wet abrasive blasting contain sodium nitrite (0.32% by weight) and diammonium phosphate (1.28% by weight). In seawater the sodium nitrate will add to the existing salt concentration, the diammonium phosphate will dissociate. The ammonium component will react with chloride in the seawater to become a salt, and the phosphate will dissolve, adding to the existing phosphate concentrations.

The concentration of phosphate in the inhibitor is very small (0.32%). Once diluted in seawater, this concentration would be further reduced, and would not have an adverse effect on the receiving water.

The other additive used on an 'as-required' basis is 'Chlor*Rid'. Chlor*Rid is an organic bonding chemical blend which aids in the removal of chlorides, sulphates and most other soluble salts. It contains no volatile organic compounds and is biodegradable. The effects of Chlor*Rid on seawater are negligible, and transient in nature due to dispersion and tidal flushing.

Debris from Original Paint System

Prior to 1994 the protective coatings system on the Harbour Bridge comprised a five coat system consisting of a zinc chromate primer followed by two phenolic zinc primer coats and two phenolic micaceous iron oxide (MIO) coats. This system was continued from the time of construction in 1959 until 1994. The entire bridge (150,000 m^2) was originally treated with the five coat system until 1994.

In 1994 the phenolic/zinc chromate system was changed to a four coat system consisting of two coats of zinc phosphate primer and two coats of micaceous iron oxide. This system was a modified alkyd system.

Between 1994 and 1998 approximately 40,000 m^2 was treated with the four coat modified alkyd system. A nominal 200 µm can be assumed for the zinc phosphate primer and a further 200 µm for the MIO topcoats.

In the absence of quantitative data, it is difficult to predict the amount of paint flake material that will be removed during the blasting process. An attempt has been made to try and quantify the volume of paint flakes removed per working year, based on the following assumptions:

- The total surface area of the Harbour Bridge (150,000m^2) is covered in a 200µm thick layer of 'old system' primer (zinc chromate primer, phenolic zinc primer) and 200um of MIO coating on top of the primer. This gives a total thickness for the entire Harbour Bridge surface area of 400µm.
- An area of approximately 60,000m^2 of the Harbour Bridge is covered in 400µm of the above coating plus a further 400µm comprising zinc phosphate primer and MIO coatings. This gives a total thickness for the 60,000m^2 of 800µm.
- A 'working year' comprises 650 hours per year of blasting in which the paint removal occurs, based on a 6 hour working day.
- During one year a total surface area of paint blasted totals 15,500 m^2 (being 4,500 dry blasting and 11,000 m^2 wet blasting). To determine the volume of paint debris discharged in one year, half of this surface area has been apportioned to the 400µm layer and half has been apportioned to the 800µm layer.
- To represent the worst case discharge scenario, the calculations assume that 100% of the old paint system material (flakes) is discharged into the sea; no paint flakes are retained on the Harbour Bridge structure.

The predicted volume of paint flakes discharged to the sea, based on these assumptions, is shown in the following table:

Table A- 6

Typical Volumes of Debris from the Old Paint System Discharged to Sea

Paint Removed During Blasting of Layer	S.A. (m^2)	Thickness (µm)	Total Debris Annual, based on blasting days only (m^3)	Typical Equivalent Daily Concentration of lost product to seawater (m^3)
Old Paint System Layer	7750	400	0.03	0.02
Old & New Paint System Layer	7750	800	0.06	0.03
Total			0.09	0.05

The volume of paint debris discharged into the Harbour each year via blasting has been calculated around 0.05m^3. The material is not soluble so it will not mix with seawater, however wave and tidal action in the Harbour will further disperse this volume. In addition, the discharged material will be spread over a very large surface area of seawater, so it is unlikely to result in any adverse effects on the receiving water.

Zinc Chromate in the Original Paint System

The effect of zinc chromate was assessed. As there was no data available on the quantities of zinc chromate in paint debris, it was not possible to quantitatively assess the effects of chromate on the Harbour water quality. Therefore a qualitative assessment was carried out.

In the previous resource consent application[16] it was noted that *'the amount of hexavalent chromium entering the Harbour did not significantly increase the existing levels because much of the blast product is removed from the Harbour due to its good flushing characteristics. Present concentrations of lead, zinc and chromium in bottom sediments around the harbour bridge generally fall within the moderate polluted classification of the USEPA Criteria for bottom sediments, although chromium and lead levels in St Mary's Bay and Bayswater indicate a heavily polluted environment for these heavy metals. Natural erosion of Waitemata Sandstone which forms the cliffs around the Harbour contributed significantly to the high levels of chromium; typically sandstone contains 35 ppm chromium'*. From this assessment it is unlikely that the chromate component of the original paint system debris will have a significant effect on the Harbour water quality.

Zinc chromate is insoluble in cold water and as such, upon entering the harbour, will dissociate. Zinc exists in natural waters in a dissolved state as solid precipitates, or adsorbed onto particulates. In marine environments however (pH>8), only a small fraction of the zinc exists as the free ion, with the majority being bound or precipitated. In this form, zinc is not readily available for uptake by biota as the free ion. The small quantity of zinc released into the Harbour as a result of blasting will not adversely affect the Harbour water quality or receiving environment.

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[16] Works Consultancy Services Ltd, Auckland Harbour Bridge – Assessment of Effects on the Environment of Steelwork Maintenance by Abrasive Blasting Methods, Prepared for Transit NZ, March 1993.

The hexavalent form of chromium exists in solution in combination with oxygen, forming the chromate ion ($CrO4_{2-}$). Hexavalent chromium compounds are more soluble and toxic than trivalent compounds under most environmental conditions, however at the pH of seawater, they may undergo reduction by naturally occurring reductants such as iron (II) compounds, sulphur (II) compounds and organic matter to form the less toxic chromium (III) species. In this form, rather than exist in solution, chromium (III) would primarily be associated with particulates and be lost to sedimentation.

Given that the zinc chromate in paint flakes is likely to exist in seawater either precipitated or bound to particulates, and given the dispersive effect of dilution and tidal flushing in the Harbour, the contribution of zinc chromate will not have an adverse effect on the receiving water quality.

Summary – Discharges To Seawater

The typical annual concentrations of lost paint product in seawater are based on 880 hours per year of paint application and 650 hours of blasting per year, utilising a 6 hour working day. In reality painting and blasting do not occur for the entire 6 hours of the day due to the time involved in setting up equipment; painting or blasting would take place for only 2 to 3 hours per day. The discharge quantities presented here are therefore greater than in reality, and in cases where the ANZECC Guidelines are exceeded, the true effect on the Harbour will be reduced.

Due to its density, the blast media, once in seawater, will contribute to the volume of sediment on the Harbour floor, rather than the suspended solids load in the long term. The typical contribution of spent blast media to the Harbour is negligible, and would not have an adverse effect on the receiving environment.

Discharges of paint from the old paint system to the sea will occur at a rate of around 0.05 m^3 per year. Again this quantity is a maximum, as blasting does not occur for the full 6 hours per day as used in the calculation methodology. The paint flakes discharged will float over a large surface area of water, and will be further dispersed by wave and tidal activity. Due to the volume discharged per year, there will not be an adverse effect on the receiving water quality. The zinc chromate component of the paint flakes is not discharged in sufficient quantities to have an adverse environmental effect.

DISCHARGES TO LAND

The following predicted concentrations of spent blast product and paint debris during the paint maintenance programme are again based on a ‘worst case scenario’ where the entire quantity falls onto land in the vicinity of the Harbour Bridge at one time. In reality the quantity discharged (hence concentration on the land or in the soil) would be spread over the duration of the activity and the portion of the year that the activity was carried out. Thus the concentrations predicted and the effects of the discharge to land would be lower than the concentrations reported here. Typical concentrations are used in this report for assessment purposes, in the absence of real data.

The assessment of effects of the blast media and paint debris on land has been carried out based on the similar assumptions to the discharges to seawater:

- When any of the paint coats are sprayed onto the surface of the Harbour Bridge, there is a maximum of 15 % loss of product.

- The entire 15 % lost product falls onto the land below the area being painted. This is an overestimate, as it would not be cost effective to lose this much product.
- The volume of soil available for mixing equates to 2 m^3, based on a surface area affected by the product loss of $100m^2$ and an estimated mixing depth of 0.02m (2cm) of soil.
- The assessment is instantaneous (i.e. no further reactions once deposition has occurred are taken into account).
- Any volatile components of the paint coatings are expected to be volatilized before reaching the ground.
- The predicted daily concentrations used in this assessment assume that the paint coating application typically takes place for a maximum period of 880 hours per year (with 6 hours per day of paint application). This applies for the original, existing, and future paint system applications, and is a typical period of application only, which may vary from year to year, and depend on the part of the Harbour Bridge being maintained. Typical concentrations are used in this report for assessment purposes in the absence of real data.
- The predicted daily concentrations used in this assessment assume that blasting takes place for a maximum of 650 hours per year. Again this is a typical period of application only, that may vary from year to year, and depend on the part of the Harbour Bridge being maintained. In any one day, no more than 6 hours of blasting would take place, and generally this time is around 2 to 3 hours, allowing for set up of equipment.
- The value for the density of soil used in this assessment was taken as 1.4 kg/m^3.

To enable an assessment of effects, the concentrations of each component of the paint maintenance system and the spent blast products once mixed with soil were compared with the 'Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites[17]'.

Current Paint System - Primer Coat (MC Miozinc) Application

The parameters used to assess the effects on land of the intermediate coats are detailed in Section 5.2.1 of this report. Table A-6 shows the predicted concentrations of the aromatic and zinc components of the primer coat.

Table A- 7

Typical Concentrations of MC Miozinc Constituents in Soil

Contaminant	Concentration in primer (% by weight)	Annual Mass of Lost Product @ 15% Loss, Total[18] (kg)	Typical Equivalent Daily Concentration of lost product in soil (mg/kg)	ANZECC Guideline (mg/kg)
Aromatic 100	7	0.003	0.000003	0.95 - 5

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[17] Australian And New Zealand Environment And Conservation Council, National Health And Medical Research Council Guidelines For The Assessment And Management Of Contaminated Sites January 1992.

[18] 'Total' means the total amount of product lost; since 40% of the Bridge spans over land this will be further reduced (i.e. x 0.4) in the calculation of the total amount that falls onto land and then mixes with soil.

Zinc powder	62	0.023	0.00002	2 - 180

As can be seen from the above table, both the typical annual and the equivalent daily concentrations of the aromatic and zinc components of the primer coat in soil are insignificant when compared to the guidelines. They will have a minimal effect on the receiving environment, and will not contribute to adverse environmental effects.

Current Paint System - Intermediate Coats (MC Miomastic) Application

The parameters used to assess the effects on land of the intermediate coats are detailed in Section 5.2 of this report.

Due to their volatility, polyurethane prepolymer, MEK and xylene were not assessed. Again the NHPI were assumed to be innocuous, and were not included in the assessment.

The predicted concentrations of high flash naptha and MIO are shown in Table A-8.

The typical equivalent daily concentration of high flash naptha is well below the ANZECC level, and it will not have an adverse effect on the receiving environment. There is no guideline level for MIO, however as soils are naturally high in iron oxides, it will only add to the existing concentrations and the small quantities discharged will not have any adverse effects.

As Table A-8 shows, the concentrations of the components of MC Miomastic in soil are again insignificant when compared to the ANZECC Guidelines. On this basis there will be no adverse environmental effect from the discharge of MC Miomastic components to land.

Table A- 8

Typical Concentrations of MC Miomastic Constituents in Soil

Contaminant	Concentration in primer (% by weight)	Annual Mass of Lost Product @ 15% Loss, Total[19] (kg)	Typical Equivalent Daily Concentration of lost product in soil (mg/kg)	ANZECC Guideline (mg/kg)
High flash naptha	6	0.003	0.000003	0.95 - 5[20]
Micaceous Iron Oxide	42	0.021	0.00002	No guideline level

As can be seen from the above table, the concentrations of high flash naptha and MIO in soil are insignificant when compared to the ANZECC Guidelines.

Current Paint System - Topcoat (MC Ferrox A) Application

The topcoat is made up of the components in Table A-9. The total surface area of the Harbour Bridge covered by the top coat is 72,720 m^2. The average coat thickness is 0.075

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[19] 'Total' means the total amount of product lost; since 40% of the Bridge spans over land this will be further reduced (i.e. x 0.4) in the calculation of the total amount that falls onto land and then mixes with soil.

[20] ANZECC Guideline for PAH

mm (75 μm). The total volume of paint used per annum is 5,540 litres over areas affected by land is 2,666.

Due to their volatility, polyurethane prepolymer, MEK and xylene were not assessed.

Table A-9 compares the typical concentrations of methyloxypropylacetate, aromatic 100 and the monocyclic aromatic hydrocarbon components of the topcoat material to the guideline values.

Table A- 9

Typical Concentrations of MC Ferrox-A Constituents In Soil

Contaminant	Concentration in paint (% by weight)	Annual Mass of Lost Product @ 15% Loss, Total[21] (g)	Typical Equivalent Daily Concentration of lost product in soil (mg/kg)	ANZECC Guideline (mg/kg)
Methyl oxypropylacetate	12	0.04	0.000005	No guideline value
Aromatic 100	4	0.01	0.000002	0.95 - 5
Ethylbenzene	2	0.01	0.0000008	0.05 - 1
1,2,4 Trimethyl benzene	1	0.003	0.0000004	0.05 - 1

The typical equivalent daily concentrations of each of the components of MC Ferrox-A in soil are all well within the ANZECC guideline levels. No guideline level exists for methyloxypropylacetate, therefore this component cannot be assessed. However, as the concentration is very low, and the chemical structure is one that can be degraded quickly relative to an aromatic compound, it is not expected to have an adverse effect on the receiving environment.

Current Paint System - Alkyd Zinc Phosphate & Alkyd MIO Application

The components of the Alkyd MIO paint coatings have been discussed earlier. The predicted concentrations on land are shown in Table A-10.

Table A- 10

Typical Concentrations of Alkyd Paint System Constituents on Land (Annually)

Components of Alkyd zinc phosphate	Concentration in paint (% by weight)	Annual Mass of Lost Product @ 15% Loss, Total in working year (g)	Typical Equivalent Daily Concentration of lost product in soil (mg/kg)	ANZECC Guideline (mg/kg)
Zinc phosphate	30	0.01	0.000001	2-180 for Zinc
Aromatic hydrocarbon	30	0.01	0.000001	0.95 - 5

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[21] 'Total' means the total amount of product lost; since 40% of the Bridge spans over land this will be further reduced (i.e. x 0.4) in the calculation of the total amount that falls onto land and then mixes with soil.

mixture

Components of Alkyd zinc phosphate	Concentration in paint (% by weight)	Annual Mass of Lost Product @ 15% Loss, Total in working year[22] (g)	Typical Equivalent Daily Concentration of lost product in soil (mg/kg)	ANZECC Guideline (mg/kg)
Aromatic hydrocarbon mixture	20	0.01	0.000001	0.95 - 5

As can be seen from the above table, the concentrations of the products of Alkyd MIO and Alkyd Zinc Phosphate once deposited on and mixed with land, are insignificant. This is especially true given that the modified alkyd system is spot coated.

Blast Media

The quantity of wet and dry abrasive used per year, the surface areas blasted and the components of the blast material have already been discussed in this section of the report under discharges to water. Table A-11 shows the predicted concentrations of blast media on land, taking into account that approximately 40% of the Harbour Bridge surface area spans over land.

Table A- 11

Typical Concentrations of Spent Blast Media on Land (Annually)

Dry Abrasive Blasting	Total Mass Of Media (kg)	Mass Of Lost Product 90% (kg)	Typical Equivalent Daily Concentration Of Lost Product on land (mg blast media/kg soil)
Garnet sand (97%)	17,460	15,714	20,000
Free silica (< 0.5%)	90	81	100
Limonite (< 2.5%)	450	405	500
Wet Abrasive Blasting	**Total Mass Of Media (kg)**	**Mass Of Lost Product (kg)**	**Equivalent Daily Concentration Of Lost Product In Seawater (mg blast media/kg soil)**
Crushed basalt	43,000	38,700	50,000

There are no guidelines for the components of blast media on land. The quantities discharged, once mixed with soil, are small and consist of naturally occurring minerals. In this respect the effects on land will be minimal.

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[22] 'Total' means the total amount of product lost; since 40% of the Bridge spans over land this will be further reduced (i.e. x 0.4) in the calculation of the total amount that falls onto land and then mixes with soil.

Discharges From the Old Paint System

The volume of old paint discharged to land as a result of blasting is shown in the table below. As with the discharges from the old paint system to seawater, a 100% loss has been assumed (i.e. no paint flakes have been retained on the Harbour Bridge structure itself during the removal process).

Table A- 12

Typical Concentrations of Debris from the Old Paint System on Land

Paint Removed During Blasting of Layer	S.A. (m^2)	Thickness (µm)	Total Debris Annual, based on blasting days only (m^3)	Typical Equivalent Daily Concentration of lost product to land (m^3)
Old Paint System Layer	7750	400	0.03	0.01
Old & New Paint System Layer	7750	800	0.06	0.02
Total			0.09	0.03

Discharges of paint flakes from the old paint system as a result of blasting are minimal; with a predicted volume of less than 0.03 m^3 per year falling onto land at the north and south abutments of the Harbour Bridge. This volume is not expected to result in any adverse environmental effects, and a portion will be caught in screens deployed whilst blasting over land.

Summary - Discharges To Land

The concentrations of lost product from the current paint system that have been assessed here, once mixed with the top surface layer of soil, are in significant when compared to the ANZECC Guidelines. The quantities of spent blast media and paint flakes from the original paint system are minor and would not have an adverse effect on the receiving environment.

DISCHARGES TO AIR

The components of the blast products and paint debris have already been identified and discussed in the preceding sections of this Appendix. The discharges to air from the paint maintenance programme include particulate matter (dust), metal debris (from the original paint system) and other paint debris. Typical periods of application are used in this report for assessment purposes, in the absence of real data.

The assessment of effects of the blast media and paint debris in air has been carried out based on the following assumptions:

- When any of the paint coats are sprayed onto the surface of the Harbour Bridge, there is a maximum of 15 % loss of product into the atmosphere, which is conservative.
- The entire 15 % lost product mixes with the surrounding air. Again this is very conservative.
- The volume of air available for dilution equates to 1000 m^3, based on mixing occurring in a cone-shaped area with a radius equal to 15 m and a height of 5 m. In reality it is likely

that the mixing zone will be much larger than 1000 m^3, however for conservatism a smaller volume was used.

- The assessment is instantaneous and does not take atmospheric dispersion into account.
- Any volatile components of the coatings are expected to be volatilized before reaching ground level.
- The predicted daily concentrations used in this assessment assume that paint coating application takes place for a maximum period of 880 hours per year (with a 6 hour working day). This applies for existing, future and original paint applications. This is a typical period of application only, which may vary from year to year, and depend on the part of the Harbour Bridge being maintained and the maintenance programme itself.
- The predicted daily concentrations used in this assessment assume that blasting takes place for a maximum of 650 hours per year, and a 6 hour working day. Again this is a typical application rate used for assessment purposes.
- It has been assumed that the non-hazardous proprietary ingredient (NHPI) content of the all the paints is inert, and, in the absence of further information on this constituent was not assessed.

To assess the environmental effects of the paint maintenance programme on the surrounding air, the predicted concentration of each component was compared to the National Institute for Occupational Safety and Health (NIOSH) workplace exposure standard- time weighted average (WES-TWA[23]) concentration divided by thirty. The WES-TWA concentration is the concentration for a normal 8-hour workday and a 40 hour week, to which a healthy worker can be repeatably exposed without adverse effect.

The rationale behind using the WES/30 is that the WES is for an eight hour exposure and one third of this will equate to the same exposure averaged over a whole day (24 hours). A further safety factor of ten is then applied to give a value of one thirtieth of the WES.

However, the main discharge to air from the maintenance painting programme can be collectively referred to as particulate matter, or dust (rather than the individual concentrations of the paint coating and abrasive media, which have very small concentrations once mixed in air). The concentrations of each component in air have been calculated to show how minor each component is on an individual basis. In the absence of quantitative data on the particulate content of the blast debris, a qualitative assessment of effects has been made.

Current Paint System - Primer Coat (MC Miozinc) Application

The primer coat is made up of the components in Table A-13. The components of the primer coat assessed here are Aromatic 100 (a naptha-derivative), and zinc powder. Polyurethane prepolymer, xylene, and MEK were not assessed due to their high evaporative degradation rate.

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[23] National Institute for Occupational Safety and Health (NIOSH) Guide to Chemical Hazards, United States Department Of Health and Human Services, June 1994.

Table A- 13

Typical Concentrations of MC Miozinc Constituents in Air

Contaminant	Concentration in primer (% by weight)	Mass of lost product (as 15% of total) (g)	Typical Equivalent Daily Concentration of lost product in air (g /m^3)	Guideline (g/m^3)
Aromatic 100	7	8865	0.05	No guideline level
Zinc powder	62	78516	0.45	No guideline level

The typical concentrations shown Table A-13, the maximum daily concentration of blast product was determined. There are no NIOSH guidelines for zinc powder or for aromatic 100, therefore it was not possible to compare these components with a guideline. Due to the small concentrations of aromatic 100 and zinc powder after mixing with air, the effects on the environment will be minor. In addition, both of these components will be further diluted and dispersed before reaching ground level.

Current Paint System - Intermediate Coats (MC Miomastic) Application

The intermediate coats are made up of the components in Table A-14. The components of the intermediate coat assessed are high flash naptha, and MIO. Due to their volatility and high evaporative degradation rate MEK, polyurethane prepolymer and xylene were not assessed.

The equivalent daily concentrations of high flash naptha are well below the NIOSH WES-TWA guideline. The equivalent daily concentration of MIO approximates the NIOSH guideline, however due to rapid dispersion in the air before reaching ground level, this constituent will not have an adverse environmental effect on the receiving environments. In addition, as a conservative volume of dilution air was used in the calculation of the equivalent daily MIO concentration in air, the concentration in reality will be a lot less than shown in Table A-14.

Table A- 14

Typical Concentrations of MC Miomastic Constituents in Air

Contaminant	Concentration in primer (% by weight)	Mass of lost product (as 15% of total) (g)	Typical Equivalent Daily Concentration of lost product in air (g /m^3)	NIOSH Guideline/30 (g/m^3)
High flash naptha	6	62322	0.36	0.015
Micaceous Iron Oxide	42	436254	2.52	0.0001[24] 0.0002[25]

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[24] NIOSH concentration for mica containing less than 1% quartz

[25] NIOSH concentration for iron oxide dust and fume, as iron

The concentrations of high flash naptha and MIO exceed the NIOSH/30 guideline levels. The volume of air used in the calculation methodology and the hours per day of painting were conservative, so in reality the calculated concentrations in air would be less. In addition, further dispersion in air would occur. Taking these points into account, the discharge of lost product from application of the intermediate coats would not have an adverse effect on the receiving environment.

Current Paint System - Topcoat (MC Ferrox A) Application

The topcoat is made up of the components in Table A-15. The components of the primer coat assessed are high flash naptha, and MIO. Due to their volatility and high evaporative degradation rate polyurethane prepolymer, MEK, methyloxypropylacetate and xylene were not assessed.

Table A- 15

Typical Concentrations of MC Ferrox-A Constituents in Air

Contaminant	Concentration in paint (% by weight)	Mass of lost product (as 15% of total) (g)	Typical Equivalent Daily Concentration of lost product in air (g /m^3)	NIOSH Guideline /30 (g/m^3)
Ethylbenzene	2	12945	0.08	0.00011
1,2,4 Trimethyl benzene	1	6473	0.04	0.00011
Aromatic 100	4	25890	0.15	No guideline level

The typical equivalent daily concentrations of ethylbenzene, 1,2,4 trimethylbenzene and aromatic 100 exceed in air the NIOSH guideline/30. None of these components will have an adverse effect on the receiving air quality, and will be rapidly mixed due to air currents before reaching ground level.

Current Paint System - Alkyd Zinc Phosphate & Alkyd MIO Application

The predicted annual and equivalent daily concentrations of the debris from the zinc alkyd phosphate and alkyd MIO coatings are shown in Table A-16.

Table A- 16

Typical Concentrations of Alkyd MIO & Alkyd Zinc Phosphate in Air

Components of Alkyd zinc phosphate assessed	Content (%)	Mass of lost product (as 15% of total) (g)	Typical Equivalent Daily Concentration of lost product in air (g /m^3)	NIOSH Guideline /30 (g/m^3)
Zinc Phosphate	30	19602	0.11	No guideline level
Aromatic hydrocarbon mixture	30	19602	0.11	

Components of Alkyd MIO assessed	Content (%)	Mass of lost product (as 15% of total) (g)	Typical Equivalent Daily Concentration of lost product in air (g /m^3)	NIOSH Guideline /30 (g/m^3)
Aromatic hydrocarbon mixture	20	32127	0.19	No guideline level

The main components of the alkyd zinc phosphate are alkyd polymers, talc, potassium aluminium silicate, zinc phosphate, and an aromatic hydrocarbon mixture. Of these, the effects in air of the zinc phosphate and aromatic hydrocarbon constituents have been assessed.

There are no NIOSH guidelines for these compounds, however, due to the small concentration in air and further dilution and dispersion, these compounds will not have an adverse effect on the receiving environments. There are no guidelines for zinc phosphate or aromatic 100, however the concentration in air is so minor that the effects would not be at all significant. In addition, the modified alkyd system is spot coated, so the concentrations reported here would be less in reality.

Blast Media

The same assumptions used in assessing the effects of the paint system are used for the assessment of the blast media, with the exception that:

- In order to determine a worst case scenario, it was assumed in this assessment that abrasive blasting takes place for 650 hours per year, for 6 hours per working day. This application rate is a typical rate only, used for assessment purposes, and may vary annually according to the maintenance programme.

Table A-17 shows the typical concentrations of the components of spent abrasive once mixed with the surrounding air.

Table A- 17

Typical Concentrations of Spent Blast Media in Air

Dry abrasive blasting component	Total Mass (% by weight)	Mass of lost product (as 90%) (g)	Typical Equivalent Daily Concentration of lost product in air (g /m^3)	NIOSH Guideline /30 (g/m^3)
Garnet sand (97%)	11,640	15714	124	No guideline level
Free silica (< 0.5%)	60	81	0.64	0.002[26]
Limonite (< 2.5%)	300	405	3.18	No guideline level

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[26] NIOSH concentration for silica as respirable dust

Wet abrasive blasting component	Total Mass (% by weight)	Mass of lost product (as 90%) (g)	Typical Equivalent Daily Concentration of lost product in air (g /m^3)	NIOSH Guideline /30 (g/m^3)
Crushed basalt	48,000	38700	304	No guideline level

A particle size analysis for the abrasive blast product[27] showed that 99.99% of the particles were greater than 150 μm in diameter and 22 % were less than 150 μm in diameter. A particle size analysis for less than 150 μm was not provided; however a particle size distribution curve drawn from the analysis shows that about 4 to 5 % of the debris will have a particle diameter of 10 μm or less (defined as PM_{10}). By definition this makes the abrasive media a combination of deposited and suspended particulate.

The Auckland Regional Council have adopted the UK Department of Environment (1995) guideline for PM10 of 50μg/m^3 particulate for a 24 hour averaging time, and the NZ Ministry for the Environment[28] guideline of 40 μg/m^3 as an annual maximum.

The former NZ Department of Health guideline for total suspended particulate of 60μg/m^3 on a 7 day average basis has also been adopted.

In the absence of quantitative data from the paint maintenance programme for discharges to air, it is not possible to assess the blast product and paint debris on the basis of particulate concentration. However, it is unlikely (due to conservatism in the calculation methodology) that the concentrations of blast media from the paint maintenance programme will reach these levels.

The typical concentrations of free silica and limonite (an iron oxide) can be compared to the NIOSH guidelines. The NIOSH guideline concentration divided by thirty for silica equates to 0.000002 g/m^3. The NIOSH guideline concentration for iron oxide dust and fume (as iron) equates to 0.0002 g/m^3 once divided by thirty. The concentrations of both limonite and silica in the garnet sand exceed the WES-TWA, however these concentrations are so small that they would have a negligible effect on the environment. Worker health and safety is addressed via the use of appropriate personnel protection equipment (PPE) during blasting.

Inhibitors

Refer to the discussion on the effects of inhibitors and Chlor*Rid on seawater in this Appendix. The same analogy and assessment of effects on seawater applies to the effects in air.

Debris from Original Paint System

The volume of debris discharged during blasting has been calculated and discussed earlier with respect to discharges into the Harbour and on to land at the north and south abutments of

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[27] Works Consultancy Services Ltd., Auckland Harbour Bridge - Assessment Of Effects On The Environment Of Steelwork Maintenance By Abrasive Blasting Methods, Prepared For Transit New Zealand, March 1993.

[28] New Zealand Ambient Air Quality Guidelines, Ministry For The Environment, July 1994

the Harbour Bridge. The total volume of debris from the old paint system discharged into air as a result of blasting has been calculated as less than 0.1 m^3 per year. This volume would be further diluted and dispersed before reaching ground level, and would not have an adverse effect on the receiving air quality.

Discharges To Air – Summary

The typical concentrations of the components of the paint coatings and the blast media in air are minimal, and will be further diluted and dispersed by air currents before reaching ground level. The receiving air quality will not be adversely affected as a result of discharges from the paint maintenance programme.

The only discharge to air from the paint maintenance programme that has the potential for environmental effects is particulate matter, or dust. There is no way to quantitatively compare the dust emissions to known guidelines, as no monitoring data has been collected. Due to the new operational practices and the mitigation measures in place, the dust emissions from the programme have significantly reduced, and will have only a minor effect on the environment.

Appendix B
Material Safety Data Sheets

WASSER
HIGH•TECH COATINGS

PRODUCT GUIDE

PRODUCT: MC-Miozinc™

DESCRIPTION

- Surface tolerant zinc primer
- Single component, moisture-cure urethane
- Zinc and Micaceous Iron Oxide (MIO) filled primer
- Color: Greenish Grey
- High solids, VOC compliant coating

USES

- Designed for use on blast-cleaned or power-tool cleaned surfaces.
- High performance zinc-filled primer or single protective coating in any use on steel where resistance to rust or corrosion undercutting is required
- Proven performance as primer in long life, high durability urethane systems for tanks, chemical and marine structures, and bridges
- Ideal for priming water assisted abrasive blasted surface where flash rusting or blooming limit use of zinc-rich coating
- Compatible with PURQuik™ Accelerator System

ADVANTAGES

- Single component
- Outstanding corrosion resistance
- Very surface tolerant
- Can be applied in cold, damp conditions - at humidities to 99%
- Can be applied at low temperatures - to below freezing
- Typical urethane abrasion resistance and all-around performance in harsh environments
- Best possible weathering of zinc type coatings when used as a stand alone coating
- Zinc stays in solution once stirred
- Extremely easy to apply and easy to recoat
- Very resistant to mud cracking
- Recommended for immersion applications when topcoated
- VOC compliant
- Meets United States Department of Agriculture requirements for incidental food contact

TECHNICAL DATA

- Solids by Volume: 61.0 ± 2.0%
- Weight per Gallon: 20.2 ± 0.6 lbs/gal
- Volatile Organic Content (VOC): Less than 2.8 lb/gal (340 g/l)
- Pigment Type: Zinc and Micaceous Iron Oxide (MIO)
- Flash Point: Above 103° F
- Theoretical Coverage: 994 sq ft per gal at 1 mil
- Recommended Dry Film Thickness: 3.0 - 4.0 mils DFT (5.0 - 6.5 mils wet)
- Temperature Resistance (Dry): 300° F continuous 350° F intermittent
- Chemical Resistance: See "Wasser Chemical Resistance Chart"
- Curing Time @ 75° F: Touch - 20 min; Handle - 8 hr; Recoat - 4 hrs; Stack - 12 hrs. Consult PURQuik™ data sheet for accelerated cure times
- Recoatability: No outer recoat window
- Color: Green
- Finish: Flat
- Shelf Life: 12 months from date of shipment in unopened original container

2/96 MC-MZ

URFACE PREPARATION

Atmospheric Service: SSPC-SP 6 Commercial Blast Cleaning

mmersion Service: SSPC-SP 10 Near White Blast

New Construction: SSPC-SP 10 Near White Blast with 1.0 - 2.0 mil angular profile

Spot Primer: Pressure wash at 2500 psi minimum. Supplement with SSPC-SP 1 Solvent Cleaning if necessary. Hand and Power Tool Clean SSPC-SP 2 and SP 3 on areas of corrosion or peeling paint.

Note 1: This product and most Wasser MC-Urethanes are designed to adhere to poorly prepared surfaces such as old paint, tightly adherent rust, and poorly cleaned surfaces; however, test patches should be made when good surface preparation is not possible.

APPLICATION

Consult "Wasser Application Guides" or a Technical Representative for specific system recommendations.

Consult "Wasser Application Instructions" and "Steel Structure Painting Council SSPCPA 1 - Good Painting Practices".

Thin only with Wasser MC-Thinner or MC-Thinner 100. Use MC-Thinner 100 in brush and roll applications. Improper thinners will cause gelation or improper cure! If VOC regulations restrict thinning, use Wasser MC-Thinner XMT.

Do not apply to wet surfaces or ice.

Excessive film will require longer cure times and may cause poor adhesion, blistering, pinholing, solvent entrapment and may require remedy. Consult Wasser Technical Representative for more information or if films exceed 100% of upper recommended Dry Film Thickness (DFT) or 8.0 mils DFT

Consult PURQuik™ data sheet for accelerated cure times

WARRANTY

WASSER HIGH-TECH COATINGS warrants its products to be free from efects in materials. Wasser High-Tech Coatings' sole obligation and Buyer's xclusive remedy in connection with the products shall be limited, at Wasser High-Tech Coating's option, to either replacement of products not conforming to this anty or credit to Buyer's account in the invoiced amount of the non-conforming products. Any claim under this Warranty must be made by Buyer to Wasser High-Tech Coatings in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life, or six months from the delivery date, whichever is earlier. Buyer's failure to notify Wasser High-Tech Coatings of such non-conformance as required herein shall bar Buyer from recovery under this Warranty.

Wasser High-Tech Coatings makes no other warranties concerning the products. No other warranties, whether express, implied, or statutory, such as warranties of merchantability or fitness for a particular purpose, shall apply. In no event shall Wasser High-Tech Coatings be liable for consequential or incidental damages.

Any recommendation or suggestion relating to the use of the products made by Wasser High-Tech Coatings, whether in its technical literature, or in response to specific inquiry, or otherwise, is based on data believed to be reliable; however, the products and information are intended for use by Buyers having requisite skill and know-how in the industry, and therefore it is for Buyer to satisfy itself of the suitability of the products for its own particular use and it shall be deemed that Buyer has done so, at its sole discretion and risk. Variation in environment, changes in procedures of use, or extrapolation of data may cause unsatisfactory results.

LIMIT OF LIABILITY Wasser's liability on any claim of any kind, including claims based upon Wasser's negligence or strict liability, for any loss or damage arising out of, connected with, or resulting from the use of the products, shall in no case exceed the purchase price allowable to the products or part thereof which give rise to the claim. In no event shall Wasser be liable for consequential or incidental damages. Published Product Data Sheets are subject to change without notice. Contact your Wasser Representative for current Product Data Sheets.

SAFETY PRECAUTIONS

This product is for industrial use only.

WARNING: Vapor and spray mist are harmful. Consult the Material Safety Data Sheet. Use an approved respirator when applying this product. Consult the MSDS sheet for recommendations. Protect skin and eyes from contact. This product contains organic solvents and polyisocyanates. Do not use if you have a chronic or allergic reaction to isocyanates or organic solvents.

MATERIAL SAFETY DATA SHEET

DATE OF PREPARATION: 12/22/95
MANUFACTURER'S CODE: **MC-MIOZINC 2.8**

SECTION I: GENERAL

MANUFACTURER'S NAME AND ADDRESS: WASSER HIGH-TECH COATINGS INC.
8041 S. 228TH STREET KENT WA 98032
INFORMATION PHONE NUMBER: 206-850-2967
EMERGENCY PHONE NUMBER: CHEMTREC 800-424-9300
CHEMICAL FAMILY: MOISTURE-CURE, POLYURETHANE PAINT
TRADE NAME: WASSER MC-MIOZINC
HMIS RATINGS: H-2,F-3,R-1

SECTION II: HAZARDOUS INGREDIENTS

INGREDIENTS	%WT	CAS NUMBER	EXPOSURE LIMITS TLV*
POLYURETHANE PREPOLYMER	8	NIA	NIA
XYLENE	6	1330-20-7	150ppm S, .02ppm-O
AROMATIC 100	7	64742-95-2	50ppm-M
ZINC POWDER	62	7440-66-6	5mg/CM-A,O,RD;10mg/CM-A,TD;15mg/CM-O,TD
Non Hazardous Propritary Ingredients	17	N/A	N/A

*A=ACGIH TLV; O=OSHA PEL; S=ACGIH STEL; M=MANUFACTURER'S SUGGESTED TLV; N=NIOSH TLV; RD= RESPIRABLE DUST; TD=TOTAL DUST; NIA=NO INFORMATION AVAILABLE

SECTION III: PHYSICAL DATA

BOILING POINT..........................280 DEGREES F
WEIGHT PER GALLON..............21 LBS. (APPRX)
EVAPORATION RATE................SLOWER THAN ETHER
VAPOR DENSITY........................HEAVIER THAN AIR
% VOLATILE(VOLUME)............38 (APPRX)
VOC..LESS THAN 2.8 LBS/GAL
APPEARANCE AND ODOR.......GREEN COLORED LIQUID WITH AROMATIC SOLVENT ODOR
SOLUBILITY IN WATER...........NONE

SECTION IV: FIRE AND EXPLOSION INFORMATION

FLASH POINT: 95 DEGREES F, CLOSED CUP
EXTINGUISHING MEDIA: DRY CHEMICAL, FOAM, CARBON DIOXIDE, WATER SPRAY

SPECIAL FIREFIGHTING PROCEDURES: Wear self-contained breathing apparatus (SCBA), with a full-facepiece, operated in the positive-pressure mode. Full protective clothing such as rubber gloves, boots, etc. should be worn by firefighters. No skin would be exposed. Clear fire area of unprotected personnel. Water from fog nozzles may be useful to cool closed containers to prevent pressure build-up.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapor is heavier than air. Under conditions of stagnant air, vapors can build up and travel a considerable distance along the ground to an ignition source, which may result in a flashback to the source of the vapors, or an explosion. Do not use or store near open flame, heat, sparks, electrical equipment or hot surfaces. Use only in well-ventilated areas. Closed containers may explode when exposed to extreme heat or burst when contaminated with water (CO2 evolved). During a fire, isocyanate vapors and other irritating, highly toxic gases may be generated by thermal decomposition or combustion.

SECTION V: FIRST AID AND HEALTH HAZARD INFORMATION:

EMERGENCY FIRST AID:

INGESTION: Gastro-intestinal distress. In the unlikely event of ingestion, call a physician immediately with a list of the ingredients.

SKIN: Remove heavily contaminated clothing. Wash affected skin thoroughly with soap and water.

EYE: Flush with water for at least 15 minutes and consult a physician. If irritation continues, consult a physician.

INHALATION: This is an industrial paint. The primary hazard is organic solvent. Inhalation of reactive polyurethane is unlikely unless spraying, then the hazard is inhalation of spray dust. Inhalation above the TLV can occure when painting or spraying in a confined space without respiratory protection. Remove exposed person to fresh air. Treat for exposure to organic solvent. Give mouth to mouth then oxygen if breathing has stopped. Contact a physician. Asthmatic type symptoms may develop and persist for 12-24 hours if exposed to excessive spray dust or fumes without respiratory protection. Treatment is symptomatic.

HEALTH HAZARD INFORMATION: SYMPTOMS OF OVER EXPOSURE:

INHALED: Nasal and respiratory tract irritation. Breathing solvent vapors at concentrations in air that exceed 80ppm can cause narcosis and central nervous system effects including dizziness, loss of coordination, drowsiness, headaches, confusion, fatigue, nausea, loss of appetite and/or loss of consciousness. Sensitized individuals may experience chest tightness, wheezing, coughing and/or shortness of breath. These symptoms may not appear for hours, and may persist for 4-24 hours.

CONTACT WITH SKIN: Overexposure may cause severe irritation. Skin irritation to isocyanates and organic solvents may cause allergic dermatitis in individuals with prior sensitization. Exposure to dry paint or dust is not hazardous.

CONTACT WITH EYES: May cause severe irritation.

SWALLOWED: Any ingestion is harmful resulting in burning sensation in the mouth and stomach accompanied by abdominal distress.

HEALTH EFFECTS OR RISKS FROM UNPROTECTED EXPOSURE:

ACUTE: Prolonged unprotected breathing of solvent vapor or spray may cause eye, nose, respiratory tract and/or skin irritation. Allergic skin or respiratory reaction may occur in some individuals. Narcotic in high concentrations. Headache, nausea, confusion, reversible eye damage, abdominal pain, fatigue and loss of consciousness may occur.

CHRONIC: Long term unprotected exposure may lead to muscular weakness, confusion, impaired coordination, liver damage, kidney damage, dermatitis, mucous membrane damage, pulmonary edema, anorexia and/or blood disorders. Large decreases in lung function may occur with chronic overexposure to isocyanates.

Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.

Prolonged overexposure to Xylene has been reported to be embryotoxic, teratogenic and to cause developmental disturbances in rats exposed in utero.

As a result of previous unprotected overexposure, certain individuals may develop isocyanate sensitization (chemical asthma) which will cause them to react to a later exposure to isocyanates well below the TLV. Sensatized individuals may show symptoms similar to individuals who show sensatization to specific dusts, animal fur, and other irritants if exposed to this product. This lung sensitivity can reappear in a sensatized person when reexposed. Skin sensitization can also result from

SECTION V, cont.
overexposure.

Laboratory studies with rats have shown that petroleum distillates cause kidney damage and kidney or liver tumors. Several studies evaluating petroleum workers have not shown significant increases of kidney damage nor kidney or liver tumors.

Prolonged and repeated unprotected breathing of spray mists and/or dusts over a period of years may cause lung disease.

This product contains no cancer agent found on any list.

SECTION VI: REACTIVITY DATA

CONDITIONS TO AVOID: Avoid heat, sparks, open flames and other sources of ignition.

INCOMPATIBILITY (MATERIALS TO AVOID): Mixing with water, alcohols, amines, strong acids and bases, oxidizing agents and surface active materials may cause reaction or gelling.

HAZARDOUS DECOMPOSITION PRODUCTS: Toxic gases and vapors including carbon monoxide, carbon dioxide, oxides of nitrogen, traces of HCN, isocyantes and other unidentified organic compounds.

CONDITIONS TO AVOID: Combining or mixing with water or other materials that reach with isocyanates may cause gellation or premature reaction in the container.

SECTION VII: SPILL, LEAK, AND DISPOSAL INFORMATION:

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: This material is a paint. Minor spills or leaks in well ventilated areas cause no hazard. Major spills in confined areas should be treated with care. Avoid all sources of ignition if solvent vapors are excessive or the spill is confined to a closed van or confined space. Persons not wearing protective equipment should avoid the area until solvent vapors have subsided. Avoid allowing spilled material to leak into any flowing water source. Material spilled on the ground can be contained and collected with absorbent. There is no danger of material penetrating into ground water if it is contained. Solvent evaporation will occur in spilled material if left in open ventilation leaving a solid stable non-hazardous residue. Dried material can be disposed of in land fill. Semi-dry and liquid should be collected and placed in sealed salvage containers or allowed to dry by evaporation in a well ventilated area.

WASTE DISPOSAL PROCEDURES: Spilled product that is not a thin film dried paint must be disposed of as a hazardous solid waste according to Resource Conservation and Recovery Act regulations. Preferred method of disposal is incineration.

SECTION VIII: EMPLOYEE PROTECTION INFORMATION:

Precautions must be taken so that persons handling this material do not breathe the vapors above the TLV, or have it contact the skin or eyes. In spray operations, protection must be afforded against exposure to both vapor and spray mist.

EYE PROTECTION: Liquid chemical goggles. Vapor resistant goggles should be worn when contact lenses are in use. In a splash hazard environment: goggles, or a full face shield should be used.

SKIN PROTECTION: Permeation resistant gloves (butyl rubber, nitrile rubber, polyvinyl alcohol). Cover as much of the exposed skin area as possible with appropriate clothing. If skin creams are used, keep the area covered by the cream to a minimum.

RESPIRATOR: This product contains polymeric reactive polyurethane prepolymers. Due to the large molecular weight and high vapor pressure it is extremely unlikely that measurable reactive polymer can get into the vapor phase during normal mixing, stirring, brushing, or rolling applications; however, during spraying in confined spaces the spray mist particles may reach a hazardous level, even if the vapor phase does not contain hazardous levels. **Since this product contains organic solvents it will automatically be required that the applicator wear an organic vapor cartridge respirator equipped with a proper dust prefilter. If this respirator is properly fit and changed when solvent breakthrough occurs, there will be adequate protection against reactive spray dust. In the unlikely event that there is measurable reactive prepolymer or trace isocyanate monomer in the vapor phase, the organic vapor filters will remove the reactive material.** Canister studies show that even four times the length of time after canisters lose their ability to remove organic solvents, they still adequately remove monomeric isocyanates.

GLOVES: Skin contact should be minimized by wearing solvent impermeable gloves made of neoprene or nitrile rubber.

OTHER PROTECTIVE CLOTHING AND EQUIPMENT: Appropriate protective clothing necessary to prevent repeated or prolonged skin contact should be worn. Solvent resistant boots should be worn where spill or splashing can occur. If barrier creams are used, keep the area which is protected only by the cream, to a minimum.

HYGIENIC WORK PRACTICES: Wash hands thoroughly with soap and water after handling this product, and before eating or smoking. Wash contaminated clothing thoroughly before reuse. Safety showers and eye stations should be available to employees.

OTHER STORAGE AND HANDLING REQUIREMENTS: Observe label precautions. Store in a cool, well-ventilated liquid storage area. Keep away from moisture, heat, sparks, and open flames. Use non-sparking tools. Use only with adequate ventilation. Avoid contact with eyes, skin and clothes. Avoid breathing vapor. At storage temperatures above 100 degrees F, this product may slowly polymerize.

PROTECTIVE MEASURES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Do not weld, heat or drill on or near containers. Wear appropriate personal protective equipment when working on contaminated equipment if the ingredients exceed the TLV. Do not sand, flame cut, braze or weld dry coating without a NIOSH/MSHS approved respirator, as welding fumes may be harmful.

WASSER®
GH•TECH COATINGS

PRODUCT GUIDE

PRODUCT: MC-Miomastic™

DESCRIPTION

- Single component, moisture-cure urethane
- Proprietary blend of corrosion inhibitor and micaceousiron oxide
- Color: Grey
- Designed specifically to solve the peeling and delamination problems found in epoxy mastics when used to overcoat old coatings

USES

- This product is designed to overcoat old coatings, including oil based red lead, vinyl red lead, alkyd, phenolic, and most old coatings.
- Spot prime bar steel with MC-Miozinc. This produst is not recommended direct to metal.
- Spot prim bar steel with MC-Miozinc. This product is not recommended direct to metal.
- Use to overcoat old red lead vinyl on gates and other hydro project
- Compatible with PURQuik™ Accelerator System

ADVANTAGES

- Single component - no catalyst mixing errors
- Can be applied in cold, damp conditions - at humidities to 99%
- Can be applied at low temperatures - to below freezing. Avoid frozen surfaces
- Can be immersed within 1-2 hours
- Does not weaken the adhesion of old coatings
- Does not tend to peel or delaminate old lead based coatings
- Very resistant to thermal shock. Reccommended for extremely cold environments, down to -60° F

TECHNICAL DATA

- Solids by Volume: 61.0 ± 2.0%
- Weight per Gallon: 17.5 ± 1.0 lbs/gal
- Volitile Organic Content (VOC): Less than 2.8 lbs/gal (340 g/l)
- Pigment Type: Micaceous Iron Oxide, 6 lbs/gal
- Flash Point: Above 104° F
- Theoretical Coverage: 978 sq ft per gallon at 1 mil DFT
- Recommended Dry Film Thickness: 3 mils DFT (5-6 mils wet). Avoid excessive films. Dry films over 6 mils may show bubbling
- Temperature Resistance (Dry): 300° F continuous 350° F Intermittent
- Chemical Resistance: See "Wasser Chemical Resistance Chart"
- Performance Specifications: See "Wasser Product Performance Specifications"
- Curing Time @ 75° F: Touch - 30 min; Handle - 18 hr; Recoat - 4 hrs; Stack - 23 hrs
- Recoatability: No outer recoat window
- Color: Grey
- Finish: Flat
- Shelf Life: 12 months from date of shipment in unopened original container

SURFACE PREPARATION

As an overcoat primer for old lead based paint on steel bridges, dam gates, penstocks, etc. Do a power wash followed by SSPC-SP 2, SP 3 or SSPC-SP 11 cleaning of all corrosion. Spot prime all base steel with MC-Miozinc. MC-Miomastic is not to be used direct to metal.

- Immersion Service: Do not use direct to metal. Use only over primed surface. Spot clean with SSPC-SP 11 or SSPC-SP 6. Spot prime with MC-Miozinc.

Note 1: This product and most Wasser MC-Urethanes are designed to adhere to poorly prepared surfaces such as old paint, and poorly cleaned surfaces; however, test patches should be made when good surface preparation is not possible. Always do a test patch when coating over old oil based coatings.

APPLICATION

Consult "Wasser Application Guides" or a Technical Representative for specific system recommendations

Consult "Wasser Application Instructions" and "Steel Structure Painting Council SSPC -PA1 - Good Painting Practices".

Thin only with Wasser MC-Thinner or MC-Thinner 100. Use MC-Thinner 100 in brush and roll applications. Improper thinners will cause gelation or improper cure! If VOC regulations restrict thinning, use Wasser MC-Thinner XMT.

Do not apply to wet surfaces or ice.

Excessive film will require longer cure times and may cause poor adhesion, blistering, pinholing, solvent entrapment and may require remedy. Consult Wasser Technical Representative for more information or if films exceed 100% of upper recommended Dry Film Thickness.

This product may be accelerated for faster cure with PURQuik. Consult the PURQuik data sheet for cure times.

WARRANTY

WASSER HIGH-TECH COATINGS warrants its products to be free from defects in materiaLs. Wasser High-Tech Coatings' sole obligation and Buyer's exclusive remedy in connection with the products shall be limited, at Wasser High-Tech Coating's option, to either replacement of products not conforming to this Warranty or credit to Buyer's account in the invoiced amount of the non-conforming products. Any claim under this Warranty must be made by Buyer to Wasser High-Tech Coatings in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life, or six months from the delivery date, whichever is earlier. Buyer's failure to notify Wasser High-Tech Coatings of such non-conformance as required herein shall bar Buyer from recovery under this Warranty.

Wasser High-Tech Coatings makes no other warranties concerning the products. No other warranties, whether express, implied, or statutory, such as warranties of merchantability or fitness for a particular purpose, shall apply. In no event shall Wasser High-Tech Coatings be liable for consequential or incidental damages.

Any recommendation or suggestion relating to the use of the products made by Wasser High-Tech Coatings, whether in its technical literature, or in response to specific inquiry, or otherwise, is based on data believed to be reliable; however, the products and information are intended for use by Buyers having requisite skill and know-how in the industry, and therefore it is for Buyer to satisfy itself of the suitability of the products for its own particular use and it shall be deemed that Buyer has done so, at its sole discretion and risk. Variation in environment, changes in procedures of use, or extrapolation of data may cause unsatisfactory results.

SAFETY PRECAUTIONS

This product is for industrial use only.

WARNING: Vapor and spray mist are harmful. Consult the Material Safety Data Sheet. Use an approved respirator when applying this product. Consult the MSDS sheet for recommendations. Protect skin and eyes from contact. This product contains organic solvents and polyisocyanates. Do not use if you have a chronic or allergic reaction to isocyanates or organic solvents.

LIMIT OF LIABILITY Wasser's liability on any claim of any kind, including claims based upon Wasser's negligence or strict liability, for any loss or damage arising out of, connected with, or resulting from the use of the products, shall in n case exceed the purchase price allowable to the products or part thereof which gi rise to the claim. In no event shall Wasser be liable for consequential or incidental damages. Published Product Data Sheets are subject to change without notice. Contact your Wasser Representative for current Product Data Sheets.

2/96 MC-MM

MATERIAL SAFETY DATA SHEET

DATE OF PREPARATION: 12/22/95

MANUFACTURER'S CODE: **MC-MIOMASTIC 2.8**

SECTION I: GENERAL

MANUFACTURER'S NAME AND ADDRESS: WASSER HIGH-TECH COATINGS INC.
8041 S. 228TH STREET KENT WA 98032
INFORMATION PHONE NUMBER: 206-850-2967
EMERGENCY PHONE NUMBER: CHEMTREC 800-424-9300
CHEMICAL FAMILY: MOISTURE-CURE, POLYURETHANE PAINT
TRADE NAME: WASSER MC-MIOMASTIC
HMIS RATINGS: H-2,F-3,R-1

SECTION II: HAZARDOUS INGREDIENTS

INGREDIENTS	%WT	CAS NUMBER	EXPOSURE LIMITS TLV*
POLYURETHANE PREPOLYMER	12	NIA	NIA
HIGH FLASH NAPTHA	6	64742-95-2	50ppm-M
XYLENE	6	1330-20-7	150ppm S, .02ppm-O
METHYLAMYLKETONE	4	10-43-0	50ppm-M
Non Hazardous Propritary Ingredients Including 42% Micaceous Iron Oxide	72	N/A	N/A

*A=ACGIH TLV; O=OSHA PEL; S=ACGIH STEL; M=MANUFACTURER'S SUGGESTED TLV;
N=NIOSH TLV; RD= RESPIRABLE DUST; TD=TOTAL DUST; NIA=NO INFORMATION AVAILABLE

SECTION III: PHYSICAL DATA

BOILING POINT..........................280 DEGREES F
WEIGHT PER GALLON.............17.1 LBS. (APPRX)
EVAPORATION RATE...............SLOWER THAN ETHER
VAPOR DENSITY.......................HEAVIER THAN AIR
% VOLATILE(VOLUME)...........38 (APPRX)
VOC...LESS THAN 2.8 LBS/GAL
APPEARANCE AND ODOR......RED COLORED LIQUID WITH AROMATIC SOLVENT ODOR
SOLUBILITY IN WATER...........NONE

SECTION IV: FIRE AND EXPLOSION INFORMATION

FLASH POINT: 95 DEGREES F, CLOSED CUP

EXTINGUISHING MEDIA: DRY CHEMICAL, FOAM, CARBON DIOXIDE, WATER SPRAY

SPECIAL FIREFIGHTING PROCEDURES: Wear self-contained breathing apparatus (SCBA), with a full-facepiece, operated in the positive-pressure mode. Full protective clothing such as rubber gloves, boots, etc. should be worn by firefighters. No skin would be exposed. Clear fire area of unprotected personnel. Water from fog nozzles may be useful to cool closed containers to prevent pressure build-up.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapor is heavier than air. Under conditions of stagnant air, vapors can build up and travel a considerable distance along the ground to an ignition source, which may result in a flashback to the source of the vapors, or an explosion. Do not use or store near open flame, heat, sparks, electrical equipment or hot surfaces. Use only in well-ventilated areas. Closed containers may explode when exposed to extreme heat or burst when contaminated with water (CO2 evolved). During a fire, isocyanate vapors and other irritating, highly toxic gases may be generated by thermal decomposition or combustion.

SECTION V: FIRST AID AND HEALTH HAZARD INFORMATION:

EMERGENCY FIRST AID:

INGESTION: Gastro-intestinal distress. In the unlikely event of ingestion, call a physician immediately with a list of the ingredients.

SKIN: Remove heavily contaminated clothing. Wash affected skin thoroughly with soap and water. Wash contaminated clothing thoroughly before reuse.

EYE: Flush with water for at least 15 minutes and consult a physician. If irritation continues, consult a physician.

INHALATION: This is an industrial paint. The primary hazard is organic solvent. Inhalation of reactive polyurethane is unlikely unless spraying, then the hazard is inhalation of spray dust. Inhalation above TLV can occure when painting or spraying in a confined space without respiratory protection. Remove exposed person to fresh air. Treat for exposure to organic solvent. Give mouth to mouth then oxygen if breathing has stopped. Contact a physician. Asthmatic type symptoms may develop and persist for 12-24 hours if exposed to excessive spray dust or fumes without respiratory protection. Treatment is symptomatic.

HEALTH HAZARD INFORMATION: SYMPTOMS OF OVER EXPOSURE:

INHALED: Nasal and respiratory tract irritation. Breathing solvent vapors at concentrations in air that exceed 80ppm can cause narcosis and central nervous system effects including dizziness, loss of coordination, drowsiness, headaches, confusion, fatigue, nausea, loss of appetite and/or loss of consciousness. Sensitized individuals may experience chest tightness, wheezing, coughing and/or shortness of breath. These symptoms may not appear for hours and may persist for 4-24 hours.

CONTACT WITH SKIN: Overexposure may cause severe irritation. Skin irritation to isocyanates and organic solvents may cause allergic dermatitis in individuals with prior sensitization. Exposure to dried paint or dust is not hazradous

CONTACT WITH EYES: May cause severe irritation.

SWALLOWED: Any ingestion is harmful resulting in burning sensation in the mouth and stomach accompanied by abdominal distress.

HEALTH EFFECTS OR RISKS FROM UNPROTECTED EXPOSURE:

ACUTE: Prolonged unprotected breathing of solvent vapor or spray may cause eye, nose, respiratory tract and/or skin irritation. Allergic skin or respiratory reaction may occur in some individuals. Narcotic in high concentrations. Headache, nausea, confusion, reversible eye damage, abdominal pain, fatigue and loss of consciousness may occur.

CHRONIC: Long term unprotected exposure may lead to muscular weakness, confusion, impaired coordination, liver damage, kidney damage, dermatitis, mucous membrane damage, pulmonary edema, anorexia and/or blood disorders. Large decreases in lung function may occur with chronic overexposure to isocyanates.

Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage.

Prolonged overexposure to Xylene has been reported to be embryotoxic, teratogenic and to cause developmental disturbances in rats exposed in utero.

As a result of previous unprotected overexposure, certain individuals may develop isocyanate sensitization (chemical asthma) which will cause them to react to a later exposure to isocyanates well below the TLV. Sensitized individuals may show

SECTION V, cont.

symptoms similar to individuals who show sensitization to specific dusts, animal furs, and other irritants if exposed to this product. This lung sensitivity can reappear in a sensitized individual when reexposed. Skin sensitization can also result from overexposure.

Laboratory studies with rats have shown that petroleum distillates cause kidney damage and kidney or liver tumors. Several studies evaluating petroleum workers have not shown significant increases of kidney damage nor kidney or liver tumors.

Prolonged and repeated unprotected breathing of spray mists and/or dusts over a period of years may cause lung disease.

This product contains no cancer agent found on any list.

SECTION VI: REACTIVITY DATA

CONDITIONS TO AVOID: Avoid heat, sparks, open flames and other sources of ignition.

INCOMPATIBILITY (MATERIALS TO AVOID): Mixing with water, alcohols, amines, strong acids and bases, oxidizing agents and surface active materials may cause reaction or gelling.

HAZARDOUS DECOMPOSITION PRODUCTS: Toxic gases and vapors including carbon monoxide, carbon dioxide, oxides of nitrogen, traces of HCN, isocyantes and other unidentified organic compounds.

CONDITIONS TO AVOID: Combining or mixing with water or other materials that reach with isocyanates may cause gellation or premature reaction in the container.

SECTION VII: SPILL, LEAK, AND DISPOSAL INFORMATION:

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: This material is a paint. Minor spills or leaks in well ventilated areas cause no hazard. Major spills in confined areas should be treated with care. Avoid all sources of ignition if solvent vapors are excessive or the spill is confined to a closed van or confined space. Persons not wearing protective equipment should avoid the area until solvent vapors have subsided. Avoid allowing spilled material to leak into any flowing water source. Material spilled on the ground can be contained and collected with absorbent. There is no danger of material penetrating into ground water if it is contained. Solvent evaporation will occur in spilled material if left in open ventilation leaving a solid stable non-hazardous residue. Dried material can be disposed of in land fill. Semi-dry and liquid should be collected and placed in sealed salvage containers or allowed to dry by evaporation in a well ventilated area.

WASTE DISPOSAL PROCEDURES: Spilled product that is not a thin film dried paint must be disposed of as a hazardous solid waste according to Resource Conservation and Recovery Act regulations. Preferred method of disposal is incineration.

SECTION VIII: EMPLOYEE PROTECTION INFORMATION:

Precautions must be taken so that persons handling this material do not breathe the vapors above the TLV, or have it contact the skin or eyes. In spray operations, protection must be afforded against exposure to both vapor and spray mist.

EYE PROTECTION: Liquid chemical goggles. Vapor resistant goggles should be worn when contact lenses are in use. In a splash hazard environment: goggles, or full face shield should be used.

SKIN PROTECTION: Permeation resistant gloves (butyl rubber, nitrile rubber, polyvinyl alcohol). Cover as much of the exposed skin area as possible with appropriate clothing. If skin creams are used, keep the area covered by the cream to a minimum.

RESPIRATOR: This product contains polymeric reactive polyurethane prepolymers. Due to the large molecular weight and high vapor pressure it is extremely unlikely that measurable reactive polymer can get into the vapor phase during normal mixing, stirring, brushing, or rolling applications; however, during spraying in confined spaces the spray mist particles may reach a hazardous level, even if the vapor phase does not contain hazardous levels. **Since this product contains organic solvents it will automatically be required that the applicator wear an organic vapor cartridge respirator equipped with a proper dust prefilter. If this respirator is properly fit and changed when solvent breakthrough occurs, there will be adequate protection against reactive spray dust. In the unlikely event that there is measurable reactive prepolymer or trace isocyanate monomer in the vapor phase, the organic vapor filters will remove the reactive material.** Canister studies show that even four times the length of time after canisters lose their ability to remove organic solvents, they still adequately remove monomeric isocyanates.

GLOVES: Skin contact should be minimized by wearing solvent impermeable gloves made of neoprene or nitrile rubber.

OTHER PROTECTIVE CLOTHING AND EQUIPMENT: Appropriate protective clothing necessary to prevent repeated or prolonged skin contact should be worn. Solvent resistant boots should be worn where spill or splashing can occur. If barrier creams are used, keep the area which is protected only by the cream, to a minimum.

HYGIENIC WORK PRACTICES: Wash hands thoroughly with soap and water after handling this product, and before eating or smoking. Wash contaminated clothing thoroughly before reuse. Safety showers and eye stations should be available to employees.

OTHER STORAGE AND HANDLING REQUIREMENTS: Observe label precautions. Store in a cool, well-ventilated liquid storage area. Keep away from moisture, heat, sparks, and open flames. Use non-sparking tools. Use only with adequate ventilation. Avoid contact with eyes, skin and clothes. Avoid breathing vapor. At storage temperatures above 100 degrees F, this product may slowly polymerize.

PROTECTIVE MEASURES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Do not weld, heat or drill on or near containers. Wear appropriate personal protective equipment when working on contaminated equipment if the ingredients exceed the TLV. Do not sand, flame cut, braze or weld dry coating without a NIOSH/MSHS approved respirator, as welding fumes may be harmful.

WASSER
IGH•TECH COATINGS

PRODUCT GUIDE

PRODUCT: MC-Ferrox A™

DESCRIPTION

- High Performance Topcoat based on Micaceous Iron Oxide*
- Single component, moisture-cure aliphatic urethane
- Enhanced chemical resistant colored topcoat
- Best possible resistance to UV, abrasion and weathering
- High solids, VOC compliant coating

*MIO

- Best possible resistance to yellowing, chalking or degradation by sunlight, chemical fumes and abrasion, enhanced by the micaceous iron oxide.
- Broadest range of wet chemical resistance
- Unique coverage on edges, threads, cracks due to the micaceous iron oxide
- Superior adhesion to most surfaces as a single coating
- Can be recoated easily
- Meets United States Department of Agriculture requirements for incidental food contact

USES

- Colored topcoat for any painted surface where maximum weather resistance, color retention and chemical resistance are required
- Rejuvenating color coat for any previously painted surface
- Extremely long life topcoat for bridges, railcars, tanks, ships or any steel structure in harsh environments
- Chemical resistant coating for metallized surfaces
- Colored coating for immersed surfaces or chemical fume exposures
- Compatible with PURQuik™ Accelerator System
- Recommended topcoat for lead overcoat system

ADVANTAGES

- Single component - no catalyst mixing errors
- Can be applied in cold, damp conditions - at humidities to 99%
- Can be applied at low temperatures - to below freezing. Avoid frozen surfaces
- Can be immersed or wetted in 1 hour

TECHNICAL DATA

• VOC Content:	3.5 lb/gal	2.8 lb/gal
• Solids by Volume:	52.0 ± 1.0%	61.0 ± 1.0%
• Weight per Gallon:	12.5 ± 1.0 lb/gal	13.0 ± 1.0 lb/gal
• Volatile Organic Content (VOC):	< 3.5 lb/gal (<420 g/l)	< 2.8 lb/gal (<340 g/l)
• Pigment Type:	Micaceous Iron Oxide	
• Flash Point:*	Above 90° F	Above 96° F
• Theoretical Coverage:	834 sq ft/ gal at 1 mil/DFT	978 sq ft/ gal at 1 mil/DFT

- Dry Film Thickness: 2.5 - 3.5 mils DFT. Avoid excessive films. Dry films over 5 mils may show bubbling.
- Temperature Resistance (Dry): 285° F continuous
- Chemical Resistance: See "Wasser Chemical Resistance Chart"
- Curing Time @ 75° F: Touch - 30 min; Handle - 18 hr; Recoat - 4 hrs; Stack time - 24 hrs
- Recoatability: No outer recoat window
- Color: Not available in primary, safety, or off whites due to the greying effect of the MIO
- Finish: Low gloss
- Shelf Life: 12 months from date of shipment in unopened original container

* Available in flash point 103° F

2/96 MC-FA

URFACE PREPARATION

Carbon Steel: Not recommended direct to metal without an appropriate Wasser primer.

Metalized Surfaces (zinc, aluminum): Apply directly to a clean surface. Abrade surface if there is no profile.

Galvanized Surfaces: Generally apply directly to clean galvanzied surface. Always do a solvent clean on new galvanized surfaces. Abrade surface when possible.

Other Metals: Aluminum, Brass, Bronze, Copper, Stainless, and any other corrosion resistant metals or alloys, the surface must be roughened. Supplement with SSPC-SP1 Solvent Cleaning if necessary to remove any grease, oils, or any other surface contamination. Always do a test patch.

Plastics: Fiberglass, gel coat, acrylic, and other plastic surfaces should be abraded.

Existing Coatings: All surfaces must be clean and free of any surface contamination. Pressure wash, supplemented with SSPC-SP1 Solvent Cleaning if necessary. Perform a test patch to check adhesion if recoatability data is not available. Abrade surface if necessary.

Concrete: Consult Wasser's "Application Instructions For Painting Concrete Surfaces". Blast Track all concrete surfaces with curing or form release agents. Over existing coatings perform a test patch. Abrade surface if necessary.

WARRANTY

WASSER HIGH-TECH COATINGS warrants its products to be free from efects in materiaLs. Wasser High-Tech Coatings' sole obligation and Buyer's xclusive remedy in connection with the products shall be limited, at Wasser High-Tech Coating's option, to either replacement of products not conforming to this Warranty or credit to Buyer's account in the invoiced amount of the non-conforming products. Any claim under this Warranty must be made by Buyer to Wasser High-Tech Coatings in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life, or six months from the delivery date, whichever is earlier. Buyer's failure to notify Wasser High-Tech Coatings of such non-conformance as required herein shall bar Buyer from recovery under this Warranty.

Wasser High-Tech Coatings makes no other warranties concerning the products. No other warranties, whether express, implied, or statutory, such as warranties of merchantability or fitness for a particular purpose, shall apply. In no event shall Wasser High-Tech Coatings be liable for consequential or incidental damages.

Any recommendation or suggestion relating to the use of the products made by Wasser High-Tech Coatings, whether in its technical literature, or in response to specific inquiry, or otherwise, is based on data believed to be reliable; however, the products and information are intended for use by Buyers having requisite skill and know-how in the industry, and therefore it is for Buyer to satisfy itself of the suitability of the products for its own particular use and it shall be deemed that Buyer has done so, at its sole discretion and risk. Variation in environment, changes in procedures of use, or extrapolation of data may cause unsatisfactory results.

APPLICATION

Consult "Wasser Application Guides" or a Technical Representative for specific system recommendations.

Consult "Wasser Application Instructions" and "Steel Structure Painting Council SSPC-PA 1 - Good Painting Practices".

Due to the large particle size of the MIO, there may be gloss variations at the application overlaps when applying MC-Ferrox A on large flat areas.

Consult Wasser's "Application Instructions For Painting Concrete Surfaces" when applying on concrete.

Thin only with Wasser MC-Thinner or MC-Thinner 100. Use MC-Thinner 100 in brush and roll applications. Improper thinners will cause gelation or improper cure! If VOC regulations restrict thinning, use Wasser MC-Thinner XMT.

Do not apply to wet surfaces or ice.

Excessive films will require longer cure times and may cause poor adhesion, blistering, pinholing, solvent entrapment and may require remedy.

Consult Wasser Technical Representative for more information or if films exceed 100% of upper recommended Dry Film Thickness.

SAFETY PRECAUTIONS

This product is for industrial use only.

WARNING: Vapor and spray mist are harmful. Consult the Material Safety Data Sheet. Use an approved respirator when applying this product. Consult the MSDS sheet for recommendations. Protect skin and eyes from contact. This product contains organic solvents and polyisocyanates. Do not use if you have a chronic or allergic reaction to isocyanates or organic solvents.

LIMIT OF LIABILITY Wasser's liability on any claim of any kind, including claims based upon Wasser's negligence or strict liability, for any loss or damage arising out of, connected with, or resulting from the use of the products, shall in no case exceed the purchase price allowable to the products or part thereof which give rise to the claim. In no event shall Wasser be liable for consequential or incidental damages. Published Product Data Sheets are subject to change without notice. Contact your Wasser Representative for current Product Data Sheets.

MATERIAL SAFETY DATA SHEET

DATE OF PREPARATION: 09/22/95
MANUFACTURER'S CODE: **MC-FERROX-A 3.5**

SECTION I: GENERAL

MANUFACTURER'S NAME AND ADDRESS: WASSER HIGH-TECH COATINGS INC.
8041 S. 228TH STREET KENT WA 98032
INFORMATION PHONE NUMBER: 206-850-2967
EMERGENCY PHONE NUMBER: CHEMTREC 800-424-9300
CHEMICAL FAMILY: MOISTURE-CURE, POLYURETHANE PAINT
TRADE NAME: WASSER MC-FERROX-A
HMIS RATINGS: H-2,F-3,R-1

SECTION II: HAZARDOUS INGREDIENTS

INGREDIENT	%WT	CAS NUMBER	EXPOSURE LIMITS TLV
POLYURETHANE PREPOLYMER	38	NIA	NIA
METHOXYPROPYLACETATE	12	108-65-6	100ppm-M
*XYLENE	8	1330-20-7	150ppm-S,100ppm-A,100ppm-O
METHYLAMYLKETONE	5	110-43-0	50ppm-M
AROMATIC 100	4	64742-95-2	50ppm-M
*ETHYLBENZENE	2	100-41-4	545mg/m3-O,125ppm-A
*1,2,4 TRIMETHYLBENZENE	1	95-63-6	125mg/m3-O.25ppm-A

A=ACGIH TLV; O=OSHA PEL; S=ACGIH STEL; M=MANUFACTURER'S SUGGESTED TLV;
N=NIOSH TLV; NIA=NO INFORMATION AVAILABLE

*SARA 313 reportable ingredients

SECTION III: PHYSICAL DATA

BOILING POINT......................230 DEGREES F
WEIGHT PER GALLON..........12.5 LBS (APPX)
EVAPORATION RATE............SLOWER THAN ETHER
VAPOR DENSITY....................HEAVIER THAN AIR
% VOLATILE(VOLUME)........47 (APPX)
VOC...LESS THAN 3.5 LBS/GAL
APPEARANCE AND ODOR...COLORED LIQUID WITH AROMATIC SOLVENT ODOR
SOLUBILITY IN WATER........SLIGHT

SECTION IV: FIRE AND EXPLOSION INFORMATION

FLASH POINT: 90 DEGREES F, CLOSED CUP
EXTINGUISHING MEDIA: DRY CHEMICAL, FOAM, CARBON DIOXIDE, WATER SPRAY

SPECIAL FIREFIGHTING PROCEDURES: Wear self-contained breathing apparatus (SCBA), with a full-facepiece, operated in the positive-pressure mode. Full protective clothing such as rubber gloves, boots, etc. should be worn by firefighters. No skin would be exposed. Clear fire area of unprotected personnel. Water from fog nozzles may be useful to cool closed containers to prevent pressure build-up.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapor is heavier than air. Under conditions of stagnant air, vapors can build up and travel a considerable distance along the ground to an ignition source, which may result in a flashback to the source of the vapors, or an explosion. Do not use or store near open flame, heat, sparks, electrical equipment or hot surfaces. Use only in well-ventilated areas. Closed containers may explode when exposed to extreme heat or burst when contaminated with water (CO2 evolved). During a fire, isocyanate vapors and other irritating, highly toxic gases may be generated by thermal decomposition or combustion.

SECTION V: FIRST AID AND HEALTH HAZARD INFORMATION:

EMERGENCY FIRST AID:

INGESTION: Gastro-intestinal distress. In the unlikely event of ingestion, call a physician immediately with a list of the ingredients.

SKIN: Remove heavily contaminated clothing. Wash affected skin thoroughly with soap and water. Wash contaminated clothing thoroughly before reuse.

EYE: Flush with water for at least 15 minutes and consult a physician. If irritation continues, consult a physician.

INHALATION: This is an industrial paint. The primary hazard is organic solvent. The inhalation of reactive polyurethane is unlikely unless spraying, then the hazard is inhalation of spray dust. An inhalation above the TLV can occure when painting or spraying in a confined space without respiratory protection. Remove exposed person to fresh air. Treat for exposure to organic solvent. Give mouth to mouth then oxygen if breathing has stopped. Contact a physician. Asthmatic type symptoms may develop and persist for 12-24 hours if exposed to excessive spray dust or fumes without respiratory protection. Treatment is symptomatic.

HEALTH HAZARD INFORMATION; SYMPTOMS OF OVER EXPOSURE:

INHALED: Nasal and respiratory tract irritation. Breathing solvent vapors at concentrations in air that exceed 80ppm can cause narcosis and central nervous system effects including dizziness, loss of coordination, drowsiness, headaches, confusion, fatigue, nausea, loss of appetite and/or loss of consciousness. Sensitized individuals may experience chest tightness, wheezing, coughing and/or shortness of breath. These symptoms may not appear for hours and may persist for 4-24 hours.

CONTACT WITH SKIN: Overexposure may cause severe irritation. Skin irritation to isocyanates and organic solvents may cause allergic dermatitis in individuals with prior sensatization. Exposure to dried paint or dust is not hazardous.

CONTACT WITH EYES: May cause severe irritation.

SWALLOWED: Any ingestion is harmful resulting in burning sensation in the mouth and stomach accompanied by abdominal distress.

HEALTH EFFECTS OR RISKS FROM UNPROTECTED EXPOSURE:

ACUTE: Prolonged unprotected breathing of solvent vapor or spray may cause eye, nose, respiratory tract and/or skin irritation. Allergic skin or respiratory reaction may occur in some individuals. Narcotic in high concentrations. Headache, nausea, confusion, reversible eye damage, abdominal pain, fatigue and loss of consciousness may occur.

CHRONIC: Long term unprotected exposure may lead to muscular weakness, confusion, impaired coordination, liver damage, kidney damage, dermatitis, mucous membrane damage, pulmonary edema, anorexia and/or blood disorders. Large decreases in lung function may occur with chronic overexposure to isocyanates.

Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system

SECTION V, cont.

damage.

Prolonged overexposure to Xylene has been reported to be embryotoxic, teratogenic and to cause developmental disturbances in rats exposed in utero.

As a result of previous unprotected overexposure, certain individuals may develop isocyanate sensitization (chemical asthma) which will cause them to react to a later exposure to isocyanates well below the TLV. Sensitized individuals may show symptoms similar to individuals who show sensitization to specific dusts, animal fur, and other irritants if reexposed to this product. This lung sensitivity can reappear in a sensitized individual when reexposed. Skin sensitization can also result from overexposure.

Laboratory studies with rats have shown that petroleum distillates cause kidney damage and kidney or liver tumors. Several studies evaluating petroleum workers have not shown significant increases of kidney damage nor kidney or liver tumors.

Prolonged and repeated unprotected breathing of spray mists and/or dusts over a period of years may cause lung disease.

This product contains no cancer agent found on any list.

SECTION VI: REACTIVITY DATA

CONDITIONS TO AVOID: Avoid heat, sparks, open flames and other sources of ignition.

INCOMPATIBILITY (MATERIALS TO AVOID): Mixing with water, alcohols, amines, strong acids and bases, oxidizing agents and surface active materials may cause reaction or gelling.

HAZARDOUS DECOMPOSITION PRODUCTS: Toxic gases and vapors including carbon monoxide, carbon dioxide, oxides of nitrogen, traces of HCN, isocyantes and other unidentified organic compounds.

CONDITIONS TO AVOID: Combining or mixing with water or other materials that reach with isocyanates.

SECTION VII: SPILL, LEAK, AND DISPOSAL INFORMATION:

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: This material is a paint. Minor spills or leaks in well ventilated areas cause no hazard. Major spills in confined areas should be treated with care. Avoid all sources of ignition if solvent vapors are excessive or the spill is confined to a closed van or confined space. Persons not wearing protective equipment should avoid the area until solvent vapors have subsided. Avoid allowing spilled material to leak into any flowing water source. Material spilled on the ground can be contained and collected with absorbent. There is no danger of material penetrating into ground water if it is contained. Solvent evaporation will occur in spilled material if left in open ventilation leaving a solid stable non-hazardous residue. Dried material can be disposed of in land fill. Semi-dry and liquid should be collected and placed in sealed salvage containers.

WASTE DISPOSAL PROCEDURES: Spilled product that is not a thin film dried paint must be disposed of as a hazardous solid waste according to Resource Conservation and Recovery Act regulations. Preferred method of disposal is incineration.

SECTION VIII: EMPLOYEE PROTECTION INFORMATION:

Precautions must be taken so that persons handling this material do not breathe the vapors above the TLV, or have it contact the skin or eyes. In spray operations, protection must be afforded against exposure to both vapor and spray mist.

EYE PROTECTION: Liquid chemical goggles. Vapor resistant goggles should be worn when contact lenses are in use. In a splash hazard environment: goggles should be used in combination with a full face-shield.

SKIN PROTECTION: Permeation resistant gloves (butyl rubber, nitrile rubber, polyvinyl alcohol). However, please note that PVA degrades in water. Cover as much of the exposed skin area as possible with appropriate clothing. If skin creams are used, keep the area covered by the cream to a minimum.

RESPIRATOR: This product contains polymeric reactive polyurethane prepolymers. Due to the large molecular weight and high vapor pressure it is extremely unlikely that measurable reactive polymer can get into the vapor phase during normal mixing, stirring, brushing, or rolling applications; however, during spraying in confined spaces the spray mist particles may reach a hazardous level, even if the vapor phase does not contain hazardous levels. **Since this product contains organic solvents it will automatically be required that the applicator wear an organic vapor cartridge respirator equipped with a proper dust prefilter. If this respirator is properly fit and changed when solvent breakthrough occurs, there will be adequate protection against reactive spray dust. In the unlikely event that there is measurable reactive prepolymer or trace isocyanate monomer in the vapor phase, the organic vapor filters will remove the reactive material.** Canister studies show that even four times the length of time after canisters lose their ability to remove organic solvents, they still adequately remove monomeric isocyanates.

GLOVES: Skin contact should be minimized by wearing solvent impermeable gloves made of neoprene or nitrile rubber.

OTHER PROTECTIVE CLOTHING AND EQUIPMENT: Appropriate protective clothing necessary to prevent repeated or prolonged skin contact should be worn. Solvent resistant boots should be worn where spill or splashing can occur. If barrier creams are used, keep the area which is protected only by the cream, to a minimum.

HYGIENIC WORK PRACTICES: Wash hands thoroughly with soap and water after handling this product, and before eating or smoking. Wash contaminated clothing thoroughly before reuse. Safety showers and eye stations should be available to employees.

OTHER STORAGE AND HANDLING REQUIREMENTS: Observe label precautions. Store in a cool, well-ventilated flammable liquid storage area. Keep away from moisture, heat, sparks, and open flames. Use non-sparking tools. Use only with adequate ventilation. Avoid contact with eyes, skin and clothes. Avoid breathing vapor. At storage temperatures above 100 degrees F, this product may slowly polymerize. Warning properties (irritation of the eyes, nose and throat or odor) are not adequate to prevent chronic overexposure from inhalation.

PROTECTIVE MEASURES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Do not weld, heat or drill on or near containers. Wear appropriate personal protective equipment when working on contaminated equipment. Do not sand, flame cut, braze or weld dry coating without a NIOSH/MSHS approved respirator, as welding fumes may be harmful.

CONFIDENTIAL

MATERIAL SAFETY DATA SHEET

PRODUCT NAME :HB Rust Barrier Grey Green 4 Ltr
PRODUCT CODE :510SGG040

SECTION I - MANUFACTURER IDENTIFICATION

MANUFACTURER'S NAME:
ADDRESS :

EMERGENCY PHONE :
INFORMATION PHONE :

DATE PRINTED : 17/07/95

SECTION II - HAZARDOUS INGREDIENTS

REPORTABLE COMPONENTS	CAS NUMBER	WEIGHT PERCENT
+ Alkyd Polymer	Mixture	10-30
+ Alkyd Polymer	Mixture	10-30
+ Talc	14807-96-6	10-30
WES-TWA 2 mg/m3 Respirable Dust		
WES-STEL - mg/m3		
+ Zinc Phosphate	7543-51-3	10-30
+ Aromatic Hydrocabon Mixture	64742-95-6	10-30
+ Potassium Aluminium Silicate	12001-26-2	<10
+ Iron Oxide	N/Available	<10
WES-TWA 5 mg/m3 as Fe		
WES-STEL - mg/m3 as Fe		
+ Metal Soaps Blend	Mixture	<10

WES - Workplace Exposure Standards
TWA - Time Weighted Average
STEL - Short-Term Exposure Limit

SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

SPECIFIC GRAVITY : 1.32
VAPOUR DENSITY : Heavier Than Air
EVAPORATION RATE : Slower Than Ether
SOLUBILITY IN WATER : Not Water Soluble
APPEARANCE AND ODOUR : Liquid with Solvent Odour.

SECTION IV - TRANSPORTATION DATA

UN NUMBER: 1263
UN CLASS : 3
HAZCHEM ID: 3YE
PACKAGING GROUP : III
PROPER SHIPPING NAME : Paint and Related Materials.

================ SECTION V - FIRE AND EXPLOSION HAZARD DATA ============

FLASH POINT (°C) : 34
FLASH POINT METHOD : Abel CC
FLAMMABLE LIMITS IN AIR BY VOLUME (%)- LOWER: 1.0 UPPER: 7.5

EXTINGUISHING MEDIA:

CO2, Dry chemical, foam or other approved method for treating Class A/B fires.

SPECIAL FIREFIGHTING PROCEDURES

Self contained breathing apparatus with a full facepiece operated in pressure demand or other positive mode. In case of fire use Dry Chemical Foam, or approved method for treating a Class A/B fire. Summon professional firefighters. During a fire, toxic gase smoke are irritants present from decomposition/combustion. Closed containers may explode when exposed to extreme heat.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Keep away from heat, sparks and flame. Do not smoke. Estinguish all pilot lights and turn off all sources of ignition, including heaters, fans and other non-explosion proof electrical equipment, during use and until all vapours are gone. Vapours may ignite explosively. Vapour may spread long distances and beyond closed doors. Prevent build up of vapours by maintaining a continuous fl of fresh air.

======================= SECTION VI - REACTIVITY DATA ==================

STABILITY:

This product is stable.

CONDITIONS TO AVOID

Not Available

INCOMPATIBILITY (MATERIALS TO AVOID)

Avoid contact with strong oxidizing agents.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS

May decompose into fumes containing carbon monoxide and carbon dioxide.

HAZARDOUS POLYMERIZATION:

Hazadous polymerization will not occur.

==================== SECTION VII - HEALTH HAZARD DATA ==================

INHALATION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

Irritation of the resipiratory tract, headache, nausea, dizziness, weakness and fatigue. Extreme exposure can result in unconsiousness and even respiratory arrest. May also cause tightness in the chest.

SKIN AND EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE

Can cause severe irritation, redness, tearing, and blurred vision.

SKIN ABSORPTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

Prolonged or repeated contact can cause moderate irritation, defatting, and dermatitis.

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE

INGESTION IS HARMFUL and can cause a burning sensation, sore throat, abdominal pain, nausea, vomiting, and diarrhea.

HEALTH HAZARDS (ACUTE AND CHRONIC)

CHRONIC

- Prolonged and repeated breathing of spray mist and/or sanding dust over a period of years may cause diseases of the lungs.
- Can cause irritation to mucous membranes.
- Narcotic effects have been noted.
- May cause injury to kidneys, liver and lungs.
- Corneal effects have been noted.
- Coma may result from overexposure.
- A cumulative poison.
- High vapours may result in central nervous system depression.
- Hemorrhages into various vital organs have been noted.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

None, when used with safe handling procedures and use information (See section VIII).

EMERGENCY AND FIRST AID PROCEDURES

IN CASE OF SKIN CONTACT -
Wash area thoughly with soap and water. Remove soiled clothing. Get medical assistance if irritation persists. Wash clothing befo re-use.

IN CASE OF EYE CONTACT -
Flush with large amounts of water for at least 15 minutes. Get medical assistance.

IF SWALLOWED -
GET MEDICAL ATTENTION IMMEDIATELY. DO NOT induce vomiting. Aspiration of material into lung can cause chemical pneumontus which ma be fatal.

IF INHALED -
If you experience difficulty in breathing leave the area to obtain fresh air. If continued difficulty is experienced, summon medic assistance immediately. If breathing ceases, restore using approved CPR techniques and summon medical help immediately.

=========== SECTION VIII - PRECAUTIONS FOR SAFE HANDLING AND USE ========

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

SMALL SPILL -
Absorb liquid on inert material such as paper, vermiculite, floor absorbent.
LARGE SPILLS -
Eliminate all ignition sources (Flares, flames including pilot lights, electrical sparks). Persons not wearing protective clothin should be excluded from area of spill until clean-up has been completed. Stop spill at source, contain area of spill to prevent spreading , pump liquid to salvage tank. Remaining liquid may be absorbed with inert material such as sand, clay, earth or floor absorbent, and shovelled into containers with non-sparking tools. Prevent run-off to sewers, streams or other bodies of water. If run-off occurs, notify the proper authorities as required that a spill has occurred.

WASTE DISPOSAL METHOD

Allow volatile portion to evaporate, being sure to allow time for vapours to completely clear. Dispose of contaminated absorbent, container and unused contents in accordance with local regulations. Do not incinerate closed containers.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Do not store above 50°C or near fire or open flame. Store large quantities in buildings designed to comply with regulations. Clos containers after use. Do not reuse empty containers.

OTHER PRECAUTIONS

Do not smoke when using this material.

SECTION IX - CONTROL MEASURES

RESPIRATORY PROTECTION

When spray applied in outdoor or open areas, and during sanding or grinding operations, use approved mechanical respirators to re solid airborne particles of overspray and sanding dust. When used in restricted ventilation areas, wear approved chemical/mechani filters to remove a combination of particles and vapour. When used in confined areas, wear approved air supplied respirators or u hoods. Use approved respirators when flame cutting, welding, brazing and sanding this material.

VENTILATION

Provide general dilution or local exhaust ventilation in volume and pattern to keep air contaminant concentration below current safety and health standards in the mixing, application, and curing areas, and to remove sanding dusts of dried coating and decomposition products during welding and flame cutting on surfaces coated with this product. Vapour may spread long distances. Prevent build-up by removing heavy solvent vapour from lower levels of the work areas. Eliminate all ignition sources.

PROTECTIVE GLOVES

Solvent impermeable gloves are recommended to prevent skin contact.

EYE PROTECTION

Use solvent resistant safety eyewear with splash guards or side shield to prevent eye contact.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT

Use solvent impermeable clothing and boots to prevent skin contact.

WORK/HYGIENIC PRACTICES

Remove and wash soiled clothing before reuse. Wash hands before eating.

SECTION X - DISCLAIMER

The information contained herein is based on data believed to be accurate, but we do not assume any liability for the accuracy of this information. We neither suggest nor guarantee that the hazards mentioned are the only ones that exist. Final determination suitability of any material is the sole responsbility of the user.

CONFIDENTIAL

MATERIAL SAFETY DATA SHEET

PRODUCT NAME :Isotal Ferrox #4 Dark Grey 10 Ltr
PRODUCT CODE :582SDG100

SECTION I - MANUFACTURER IDENTIFICATION

MANUFACTURER'S NAME:
ADDRESS :

EMERGENCY PHONE :
INFORMATION PHONE :

DATE PRINTED : 17/07/95

SECTION II - HAZARDOUS INGREDIENTS

REPORTABLE COMPONENTS	CAS NUMBER	WEIGHT PERCENT
+ Alkyd Polymer	Mixture	10-30
+ Alkyd Polymer	Mixture	10-30
+ Aromatic Hydrocabon Mixture	64742-95-6	<10
+ Vegetable Oil	N/Available	<10
+ Aluminium Paste	Mixture	<10
+ Metal Soaps Blend	Mixture	<10

WES - Workplace Exposure Standards
TWA - Time Weighted Average
STEL - Short-Term Exposure Limit

SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

SPECIFIC GRAVITY : 1.63
VAPOUR DENSITY : Heavier Than Air
EVAPORATION RATE : Slower Than Ether
SOLUBILITY IN WATER : Not Water Soluble
APPEARANCE AND ODOUR : Liquid with Solvent Odour.

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UN CLASS : 3
HAZCHEM ID: 3YE
PACKAGING GROUP : III
PROPER SHIPPING NAME : Paint and Related Materials.

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Keep away from heat, sparks and flame. Do not smoke. Estinguish all pilot lights and turn off all sources of ignition, including heaters, fans and other non-explosion proof electrical equipment, during use and until all vapours are gone. Vapours may ignite explosively. Vapour may spread long distances and beyond closed doors. Prevent build up of vapours by maintaining a continuous f of fresh air.

SECTION VI - REACTIVITY DATA

STABILITY:
This product is stable.

CONDITIONS TO AVOID
Not Available

INCOMPATIBILITY (MATERIALS TO AVOID)
Avoid contact with strong oxidizing agents.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS
May decompose into fumes containing carbon monoxide and carbon dioxide.

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Hazadous polymerization will not occur.

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Irritation of the resipiratory tract, headache, nausea, dizziness, weakness and fatigue. Extreme exposure can result in unconsiousness and even respiratory arrest. May also cause tightness in the chest.

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Can cause severe irritation, redness, tearing, and blurred vision.

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INGESTION IS HARMFUL and can cause a burning sensation, sore throat, abdominal pain, nausea, vomiting, and diarrhea.

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CHRONIC
- Prolonged and repeated breathing of spray mist and/or sanding dust over a period of years may cause diseases of the lungs.
- Can cause irritation to mucous membranes.
- Narcotic effects have been noted.
- May cause injury to kidneys, liver and lungs.
- Corneal effects have been noted.

Coma may result from overexposure.
A cumulative poison.
- High vapours may result in central nervous system depression.
Hemorrhages into various vital organs have been noted.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

None, when used with safe handling procedures and use information (See section VIII).

EMERGENCY AND FIRST AID PROCEDURES

IN CASE OF SKIN CONTACT -
Wash area thoughly with soap and water. Remove soiled clothing. Get medical assistance if irritation persists. Wash clothing befo
re-use.

IN CASE OF EYE CONTACT -
Flush with large amounts of water for at least 15 minutes. Get medical assistance.

IF SWALLOWED -
GET MEDICAL ATTENTION IMMEDIATELY. DO NOT induce vomiting. Aspiration of material into lung can cause chemical pneumontus which ma
be fatal.

IF INHALED -
If you experience difficulty in breathing leave the area to obtain fresh air. If continued difficulty is experienced, summon medic
assistance immediately. If breathing ceases, restore using approved CPR techniques and summon medical help immediately.

============ SECTION VIII - PRECAUTIONS FOR SAFE HANDLING AND USE =========

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SMALL SPILL -
Absorb liquid on inert material such as paper, vermiculite, floor absorbent.
LARGE SPILLS -
Eliminate all ignition sources (Flares, flames including pilot lights, electrical sparks). Persons not wearing protective clothing should be excluded from area of spill until clean-up has been completed. Stop spill at source, contain area of spill to prevent spreading , pump liquid to salvage tank. Remaining liquid may be absorbed with inert material such as sand, clay, earth or floor absorbent, and shovelled into containers with non-sparking tools. Prevent run-off to sewers, streams or other bodies of water. If run-off occurs, notify the proper authorities as required that a spill has occurred.

WASTE DISPOSAL METHOD

Allow volatile portion to evaporate, being sure to allow time for vapours to completely clear. Dispose of contaminated absorbent, container and unused contents in accordance with local regulations. Do not incinerate closed containers.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Do not store above 50°C or near fire or open flame. Store large quantities in buildings designed to comply with regulations. Clos
containers after use. Do not reuse empty containers.

OTHER PRECAUTIONS

Do not smoke when using this material.

====================== SECTION IX - CONTROL MEASURES ======================

RESPIRATORY PROTECTION

When spray applied in outdoor or open areas, and during sanding or grinding operations, use approved mechanical respirators to r
solid airborne particles of overspray and sanding dust. When used in restricted ventilation areas, wear approved chemical/mechan
filters to remove a combination of particles and vapour. When used in confined areas, wear approved air supplied respirators or

hoods. Use approved respirators when flame cutting, welding, brazing and sanding this material.

VENTILATION

Provide general dilution or local exhaust ventilation in volume and pattern to keep air contaminant concentration below current safety and health standards in the mixing, application, and curing areas, and to remove sanding dusts of dried coating and decomposition products during welding and flame cutting on surfaces coated with this product. Vapour may spread long distances. Prevent build-up by removing heavy solvent vapour from lower levels of the work areas. Eliminate all ignition sources.

PROTECTIVE GLOVES

Solvent impermeable gloves are recommended to prevent skin contact.

EYE PROTECTION

Use solvent resistant safety eyewear with splash guards or side shield to prevent eye contact.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT

Use solvent impermeable clothing and boots to prevent skin contact.

WORK/HYGIENIC PRACTICES

Remove and wash soiled clothing before reuse. Wash hands before eating.

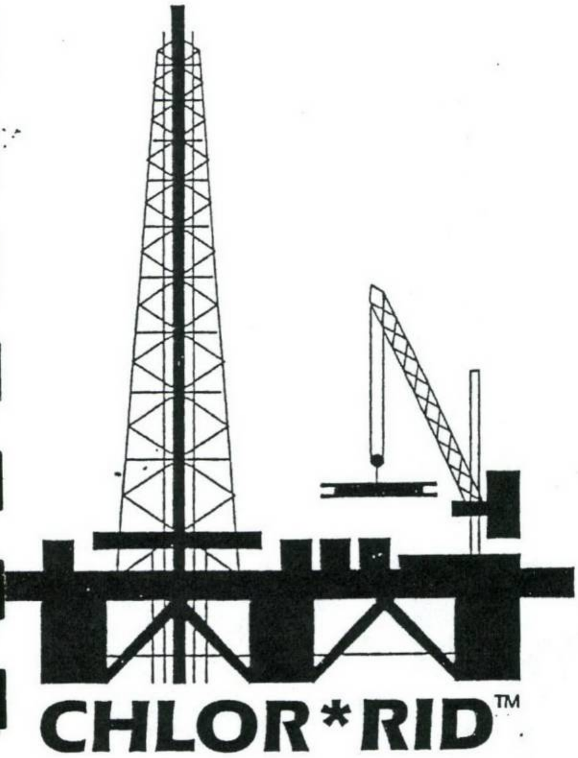
SECTION X - DISCLAIMER

The information contained herein is based on data believed to be accurate, but we do not assume any liability for the accuracy this information. We neither suggest nor guarantee that the hazards mentioned are the only ones that exist. Final determination suitability of any material is the sole responsbility of the user.

DATA SHEET

CHLOR*RID™ LIQUID SOLUBLE SALT REMOVER

ESCRIPTION: CHLOR*RID is an organic bonding chemical blend which aids in the removal of chlorides, ulfates and most other soluble salts. Contains no volatile organic compounds (VOCs), and is biodegradable.



CHLOR*RID is recommended as a wash solution prior to application of primers or coatings on a variety of surfaces, including ferrous and nonferrous metals, concrete, wood, plastics and others. For a full list, contact CHLOR*RID International Inc. at 800-422-3217.

SURFACE PREPARATION: Best surface preparation yields best results. However, when CHLOR*RID is used with high water pressure (3000 p.s.i. minimum recommended), the surface usually requires no other pre-cleaning. Hot water, along with high pressure, will speed chemical reaction times. Sufficient pressure to remove any barriers, such as corrosion by-products, must be used.

APPLICATION: CHLOR*RID can be introduced and applied by a variety of means. See directions for hand cleaning, pressure washing, and wet abrasive blasting methods. Contact CHLOR*RID International Inc. or an Authorized Distributor for other methods or technical support.

fter cleaning a small area (100 square feet), test known areas of contamination. Adjust travel speed, ncentration, pressure, water temperature, etc., as necessary, and retest to assure desired cleanliness level. It is not necessary to use entire contents. Partially filled containers should be closed tightly.

- Color: Blue-Green
- Typical coverage: 300 - 1000 square feet per U.S. gallon
- No VOCs
- pH 3.3 (+/– .2)
- Packaging: 1/5/55 U.S. gallon
- Single Component
- Shelf Life: 24 months
- Application Temperature: 33°F - 250°F
- Keep from freezing – If frozen, thaw before use.

WARRANTY: CHLOR*RID International Inc. warrants this product to be identical in chemical and physical operties from batch to batch within the specification limits of the raw materials used in their manufacture.

SAFETY PRECAUTIONS: KEEP OUT OF REACH OF CHILDREN. Do not mix with other chemicals. See S.D.S. or W.H.M.I.S. for full precautions prior to use. This product is intended for professional use only.

CHLOR*RID International Inc.
Toll Free 800-422-3217 • Fax 602-821-0364 • Office 602-821-0039
or write P.O. Box 908 • Chandler, Arizona 85244

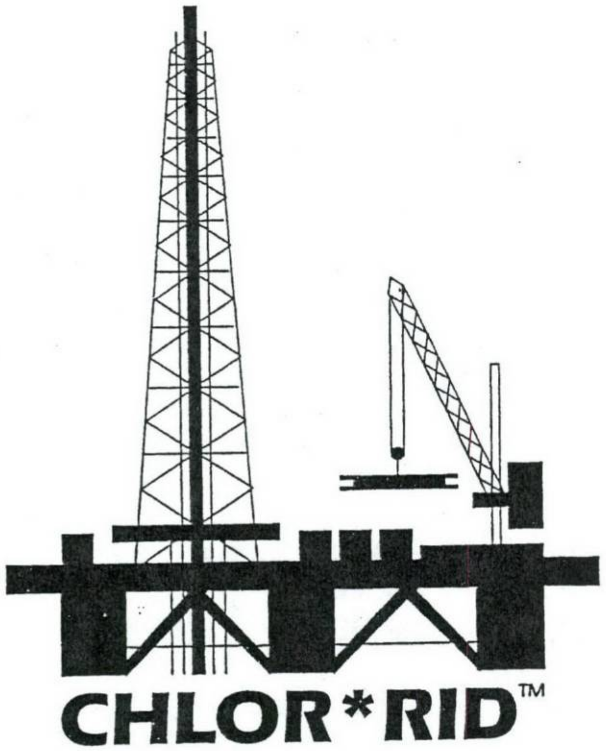
Pa t Pending

RECTIONS

ILOR*RID™ LIQUID SOLUBLE SALT REMOVER

SCRIPTION: CHLOR*RID is a unique organic bonding chemistry which aids in the removal of chlorides, ates and most other soluble salts.

GH PRESSURE WASHING: CHLOR*RID is added to the ter of the pressure washer, usually in a dilution ratio from 0 to 1:100. The application rate is dependent on the ntamination level and the water quality. Add CHLOR*RID a reservoir supply – or use a siphon tube or metering pump. ply 1 U.S. gallon of CHLOR*RID to 300 to 1000 square feet surface, depending on contamination level. Use potable ter or other approved source. A minimum 3000 p.s.i. ssure washer is recommended. Flush washer and lines prior application. Hold pressure nozzle close to the surface, ally 2 to 6 inches, to ensure all surfaces are washed with ect high pressure. Use hot water for best results. In areas of ep pitting, slow the wash speed to enable CHLOR*RID to netrate into corrosion cells. Do not rinse.



AND WASHING: Add 3 oz. CHLOR*RID to 1 gallon potable ater or other approved source. Use a hand brush and scrub rface in a circular motion, reversing direction periodically. and washing is intended for small areas only and is not commended for porous surfaces, such as concrete or pitted eel. Add CHLOR*RID to rinse water at 1 to 100 ratio.

ET ABRASIVE BLASTING: Add CHLOR*RID to the system at 1 U.S. gallon per 300 - 1000 square feet surface to be blasted using potable water or other approved source. (Dilution ratio from 1:50 to 1:100.) dd CHLOR*RID to rinse water at 1 to 100 ratio. Always use appropriate safety equipment.

to cleaning or blasting, test surface for contaminates. After cleaning or blasting a small area, retest to etermine if surface is free of contaminates. Adjust speed of travel, pressure, water temperature, etc., as ecessary and retest to achieve desired cleanliness level.

ue to a wide variety of surface conditions, work environments, weather conditions, etc., these directions re general and may require alterations to better suit individual conditions. Call CHLOR*RID International c. for recommendations for a specific project. CHLOR*RID International Inc. assumes no liability for use or isuse of the product inconsistent with its labeling.

VARRANTY: CHLOR*RID International Inc. warrants this product to be identical in chemical and physical roperties from batch to batch within the specification limits of the raw materials used in its manufacture.

AFETY PRECAUTIONS: KEEP OUT OF REACH OF CHILDREN. Do not mix with other chemicals. See M.S.D.S. or W.H.M.I.S. for full precautions prior to use. This product is intended for professional use only.

CHLOR*RID International Inc.
Toll Free 800-422-3217 • Fax 602-821-0364 • Office 602-821-0039
or write P.O. Box 908 • Chandler, Arizona 85244

03-96-16006

atent Pending

MATERIAL SAFETY DATA SHEET

SECTION I PRODUCT IDENTIFICATION

P DUCT NAME: CHLOR•RID™
C MICAL NAME: INDUSTRIAL CLEANING SOLUTION
M NUFACTURER: CHLOR•RID INTERNATIONAL, Inc.
2131 N. LONGMORE ST.
CHANDLER, AZ. 85224
E ECTIVE DATE: 03/7/96 EMERGENCY PHONE: 602-821-0039 Toll Free: 800-422-3217

SE TION II HAZARDOUS INGREDIENTS

M TERIAL AMOUNT PEL TLV

NONE OF THE INGREDIENTS USED IN THIS FORMULATION ARE KNOWN TO BE HAZARDOUS UNDER CURRENT DEPT. OF LABOR OSHA, A ERICAN CONFERENCE OF GOVERNMENT HYGENISTS. REGISTRY LIST OF TOXIC EFFECTS, NATIONAL TOXICOLOGICAL PROGRAM, I ERNATIONAL AGENCY FOR RESEARCH ON CANCER, DEFINITIONS. FURTHER, THERE ARE NO KNOWN RESTRICTIONS UNDER CURRENT TSCA NOR EPA GUIDELINES.
COMPONENTS NOT LISTED ARE NON-HAZARDOUS ACCORDING TO 29 CFR 1910.1200 CONTAINS NO PHOSPHATES.

PHYSICAL DATA

B LING POINT: 100 DEG. C. (APPROXIMATELY AS WATER)

pH. 3.3 (+/- 0.2)

ECIFIC GRAVITY: 1.01 (+/-.05) PERCENT VOLATILE: 95.53%

FLASH POINT. GREATER THAN 200 DEG. F.

POR PRESSURE: VAPOR IS WATER VAPOR DENSITY: VAPOR IS WATER

SOLUBILITY IN WATER: COMPLETE

PEARANCE AND ODOR: LIGHT BLUE GREEN / VERY MILD LIKE BURNT SUGAR

SECTION IV FIRE AND EXPLOSIVE HAZARDS

ASH POINT: NON-FLAMMABLE
EXTINGUISHING MEDIA: ANY APPROPRIATE MEDIA
AMMABILITY LIMITS: N/A

SUAL FIRE AND EXPLOSION HAZARDS: IN EXTREME CONCENTRATIONS CONTACT WITH SOME METALS FOR PROLONGED PERIODS O TIME MAY PRODUCE SMALL AMOUNTS OF HYDROGEN GAS IF CONTAINED.

ECTION V HEALTH HAZARD DATA

FFECTS OF OVEREXPOSURE-

EYE CONTACT: MODERATELY IRRITATING

KIN CONTACT: MAY CAUSE IRRITATION ON PROLONGED CONTACT

INGESTION: NONE CURRENTLY KNOWN

HALATION: NONE CURRENTLY KNOWN

IRST AID PROCEDURES- EYES: FLUSH WITH WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, CALL A PHYSICIAN.

KIN: REMOVE CONTAMINATED CLOTHING. FLUSH WITH WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, CALL A PHYSICIAN.

NGESTION: IF SWALLOWED, DRINK MILK, RAW EGG WHITE, MUCILAGE, MILK OF MAGNESIA OR GELATIN SOLUTION. IF THESE ARE NOT AVAILABLE DRINK LARGE QUANTITIES OF WATER. IF IRRITATION CONTINUES, CALL A PHYSICIAN.

CTION VI REACTIVITY DATA

ABILITY: STABLE

COMPATIBILITY: DO NOT MIX WITH OTHER CHEMICALS

ZARDOUS POLYMERIZATION: WILL NOT OCCUR

NDITIONS TO AVOID: N/A

ORAGE: STORE AT ROOM TEMPERATURE. AVOID EXTREME HEAT OR COLD. KEEP FROM FREEZING.

CTION VII SPILL OR LEAK PROCEDURES

EPS TO CONTAIN: WEAR APPROPRIATE PROTECTIVE CLOTHING AND OR EQUIPMENT. NEUTRALIZE WITH LIME OR SODA ASH, OR A ITABLE ABSORBENT MAY BE USED. REMOVE CONTAMINATED ABSORBENT, FLUSH SPILL AREA WITH WATER.

ASTE DISPOSAL: COMPLY WITH LOCAL, STATE AND FEDERAL REGULATIONS. IF PERMISSIBLE, FLUSH TO DRAIN; NEUTRALIZE WITH ME OR SODA ASH, IF REQUIRED, THEN FLUSH TO DRAIN.

ECTION VIII SPECIAL PROTECTION DATA

ESPIRATORY: IF USE CONDITIONS GENERATE MIST, INCREASE VENTILATION OR WEAR APPROPRIATE RESPIRATOR.

YES: SAFETY GLASSES WITH SIDE SHIELDS ARE RECOMMENDED WHEN WORKING WITH CHEMICALS.

KIN: RUBBER GLOVES AND APRON SHOULD BE WORN IF EXPOSURE IS EXPECTED.

DDITIONAL COMMENTS: EYE WASHES AND SAFETY SHOWERS SHOULD BE AVAILABLE WHEN HANDLING CHEMICALS. EDUCATE AND RAIN USERS AND EMPLOYEES IN THE SAFE AND PROPER USE OF THIS PRODUCT AND ALL PRODUCTS.

ECTION IX SPECIAL PRECAUTIONS

O NOT USE INCONSISTENT WITH LABELING. DO NOT MIX WITH OTHER CHEMICALS. KEEP OUT OF THE REACH OF CHILDREN AND NTRAINED USERS.

ECTION X USERS RESPONSIBILITY

USER SHOULD TAKE THOSE PRECAUTIONS REQUIRED IN AN INDIVIDUAL OPERATION TO DEVELOP PROTECTIVE WORK PROCEDURES OR A SAFE ENVIRONMENT.

SECTION XI MANUFACTURERS STATEMENT AND LIABILITY CLAUSE

THE INFORMATION CONTAINED HEREIN IS TO THE BEST OF OUR KNOWLEDGE AND BELIEF, ACCURATE, BASED ON DATA AVAILABLE AT THIS TIME. WE ACCEPT NO LIABILITY FOR DAMAGES INCURRED OUTSIDE THE SPECTRUM OF THE LABEL OF THE PRODUCT.

SECTION XII SHIPPING CLASSIFICATION

CLEANING COMPOUND ITEM 4580 - SUB 3 - CLASS 55

CHLOR*RID SPECIFICATION *WET ABRASIVE BLAST*

c. To the standard abrasive blast nozzle add a water ring intended for wet abrasive blasting or use a nozzle specifically designed for that purpose. Water is to be supplied to the water ring or comparable equipment as per the manufacturers recommendation. The blast water is to be of potable quality and CHLOR*RID is to be added by means of a siphon device or pressure pump capable of overcoming the inlet line pressure, or from a pre-mixed holding tank. This is necessary to assure the introduction of the CHLOR*RID chemistry. A backflow prevention device shall be installed in the supply line prior to the chemical introduction location (check local code). CHLOR*RID is to be introduced at the approximate dilution of 1 US gallon per 100 US gallons of blast water. The operator shall apply the blast solution at the rate of approximately 300 square feet of surface area per 100 US gallons of blast solution.

When an area of approximately 25 square feet has been blasted, the surface is to be tested for soluble salt contamination by means of (insert acceptable test method). If the contamination levels are below the required level, the square foot application rate may be increased with another test performed to ensure cleanliness at that application rate. This may be done several times to determine the necessary application rate needed to remove the soluble salts to the required level. Any test area that is confirmed to be in excess of the acceptable level of soluble salts is to be reblasted at a higher application rate to achieve a clean surface. The entire surface is to be abrasive blasted to (insert blast standard) standards for final surface preparation. It may be necessary to rinse the surface upon completion of wet abrasive blasting to remove excess abrasive left upon the surface. The rinse water is to have CHLOR*RID added at a dilution of 1:100. After rinsing, the surface is to be blown dry with clean compressed air (insert air quality specification) or fan.

CHLOR*RID is available from CHLOR RID International, Inc.
1-800-422-3217 / 1-602-821-0039, or any of their Authorized Distributors.

Inpro **INDUSTRIAL PROCESSORS LIMITED**
Phone 64-9-570 1793 Fax 64-9-570 1723
P.O. Box 62208, 4 Waipuna Road, Mt Wellington,
Auckland, New Zealand

MATERIAL SAFETY DATA SHEET

Page 1 of 2

IDENTIFICATION

NON HAZARDOUS

Product Name:	**Basalt Blasting Media**	**UN number:**	N/A
	Fineblast, Minblast, S.A.E. Rom	**DG Class:**	N/A
	Inpro General purpose	**Hazchem Code:**	N/A
	Inpro Heavy Duty	**Toxic Substances Sch:**	N/A

Chemical Name Basalt

Physical Description/Properties

Coloured grains. Odourless. Insoluble in water.

Decomposition Temp: N/A.

Melting Point: N/A

Specific Gravity: 3 g/cm^3

HEALTH HAZARD INFORMATION

Health Effects:

Swallowed:	Irritation
Eye:	Irritation or cornea
Skin:	None
Inhaled:	Irritation of lungs, coughing or choking may occur.

First Aid:

Swallowed:	Give small quantities of water.
Eye:	Flush out with a gentle stream of clean water for 15 minutes.
Skin:	
Inhaled:	Remove the patient from the affected area to an area of clean air.

Seek medical attention:

Continued over....

PRECAUTIONS FOR USE

Exposure Limits:	N/A
Ventilation:	Normal requirements
Personal Protection:	Wear a NIOSH/MSHA approved dust mask and eye protection.
Flammability:	Non-flammable

SAFE HANDLING INFORMATION

Storage & Transportation:	Store in multiwall paper bags in a dry, well ventilated environment under cover.
Spills and Disposal:	May be swept or shoveled and buried or spread on ground. Natural component of rocks.
Fire/Explosion Hazard:	Non-flammable.
Other information:	

CONTACT PERSON: Colin Humphrey ISSUE: 1 DATE: 26 Nov 1997

MATERIAL SAFETY DATA SHEET

Page 1 of 2

IDENTIFICATION

Product Name: GARNET SAND
Grades A to E

UN number:	N/A
DG Class:	N/A
Hazchem Code:	N/A
Toxic Substances Sch.:	N/A

Chemical Analysis: Garnet: 97% Ilminite: less than 2.5%
Quartz: Less than 0.5%

Physical Description/Properties

Dark red, irregular angular shaped grains. Insoluble in water.

Decomposition Temp:

Melting Point:

Specific Gravity: 4.3 - 4.7 g/cm^3

HEALTH HAZARD INFORMATION

Health Effects:

Swallowed:	Irritation.
Eye:	Irritation to cornea.
Skin:	None
Inhaled:	Irritation to lungs, coughing or choking may occur.

First Aid:

Swallowed:	Give small quantities of water or milk.
Eye:	Flush out with a gentle stream of clean water for about 5 minutes.
Skin:	Wash with water.
Inhaled:	Remove any obstruction to the air passages. Remove the patient from the affected area to an area of clean air.

Advice to Doctor:

PRECAUTIONS FOR USE

Exposure Limits (TWA):	10 mg/m^3 respirable dust.
Ventilation:	Normal requirements
Personal Protection:	Wear a NIOSH/MSHA approved dust mask and eye protection, skin protection.
Flammability:	Non-flammable

SAFE HANDLING INFORMATION

Storage & Transportation:	Store in original bags in a dry, well ventilated environment under cover.
Spills and Disposal:	May be swept or shovelled and buried. Naturally ocurring rock.
Fire/Explosion Hazard:	Non-flammable, non- explosive.
Other Information:	

CONTACT PERSON: DANNY O'NEILL ISSUE: 1 DATE: 29/09/95

C:\MSDS\GARNET.CHP

Appendix C
Most Recent Public Survey Results

A Joint Venture Company between
RoadTec Resources & TBS Group

TOTAL
BRIDGE
SERVICES

Our Ref: PSMC 003/15

11 June 1999

Dear Residents,

We wish to acknowledge your notification of excessive noise from the finger joint at TN6. The remedial work will be carried out this Sunday 13th June during an evening bridge closure, commencing about 8.30pm. The replacing of the teflon packers will rectify the problem.

We appreciate any communication from you and will endeavour to respond quickly to similar problems.

Yours faithfully,

George Wallace
Coatings Manager.

11 Princes Street, Northcote Point
PO Box 5848, Wellesley Street, Auckland
Phone: 481 0078 Fax: 481 0079

Total Bridge Services
(A Joint Venture between RoadTec Resources NZ Ltd & TBS Farnsworth Ltd)

11 Princes Street, Northcote Point
PO Box 56-416, Dominion Road, Mt Eden, Auckland
Phone: 0-9 481 0078 Fax: 0-9 481 0079

TOTAL
BRIDGE
SERVICES

Fax

To:	Woodward Clyde Ltd	**Date:**	05 November 1999
Fax:	355 1333	**File:**	PSMC 003/11
Attn:	[redacted] Bebelman	**Project/Task:**	
From:	Keith Stolberger	**Pages:**	8
Subject:	AHB Resource Consent Procurement		

Cathy

Refer Woodward Clyde fax ref: f039.doc dated 19th October 1999 from Paula Bradshaw.

Please find attached a copy of the letter sent to local residents and businesses in regard to the renewal of the AHB resource consent.

The attached letter has been sent to all residents in the immediate vicinity of the bridge on Princes Street, Northcote Point. All residents south of Alma Street have received the letter and given the opportunity to submit feedback on this issue. In addition, all the business premises at the southern end of the AHB situated in the Westhaven Marina area have received this letter. The businesses include:

Ports of Auckland – Marina Office

Sitting Duck Café

Royal NZ Yacht Squadron

Ponsonby Cruising Club

Richmond Cruising Club

Marine Brokers

Letters have also been sent to the Auckland City Council and North Shore City Council.

To date we have not received any feedback from any of the parties that have received letters. However, if we receive any prior to lodgement of our application I will pass it on to you.

As per our discussion on the phone this morning, I need to do some re-checks on the calculations/quantities. I will endeavour to have this all wrapped up by the middle of next week and we should hopefully be in a position to lodge the application in the week commencing Monday, 15th November.

Regards

KStolberger

A Joint Venture between RoadTec Resources NZ Ltd
& TBS Farnsworth Ltd

TOTAL BRIDGE SERVICES

Our Ref: PSMC 003/11/MISC.001

4th October 1999

Dear Sir/Madam

Auckland Harbour Bridge Maintenance Consultation

Transit New Zealand (Transit) is responsible for the maintenance and operation of the Auckland Harbour Bridge. Transit currently holds three resource consents from the Auckland Regional Council for the discharges resulting from maintenance activities carried out on the bridge. The three discharge consents are:

- To discharge abrasive blasting products into the Waitemata Harbour
- To discharge abrasive blasting products into the air
- To discharge abrasive blasting products onto land.

Transit, through its contractors, has been working under these resource consents since 1994 as part of the day to day maintenance works programme for the bridge. These consents expire on 31 December 2000. As such we are seeking to renew the resource consents to enable the maintenance works programme required for the Harbour Bridge to continue.

Total Bridge Services are the bridge maintenance contractors for Transit and have commissioned Woodward-Clyde (NZ) Ltd to prepare the supporting information for the resource consent renewals.

Abrasive blasting of the bridge is required for paint preparation works and general maintenance cleaning due to the salty coastal environment. As part of the renewal of consents Transit has considered how the works can be carried out better with less impact on the environment. Therefore Transit is proposing to change the abrasive blasting carried out from a generally dry blasting system to a wet (water based) blasting system. The main environmental advantage of this process change is that any dust nuisance will be significantly reduced.

We are seeking feedback from you on any problems that you may have experienced with the existing blasting maintenance works carried out on the bridge. We invite you to discuss any concerns you may have with the renewal of the discharge resource consents based mainly on a wet blasting system. Please note that there will be some dry blasting still required on small hard to reach places of the bridge where the wet blasting equipment will not be effective and where visibility restrictions make wet blasting dangerous, but this will be relatively minor.

To assist with your understanding of the activity carried out on the Harbour Bridge, a copy of the executive summary of the *Draft Assessment of Environmental Effects* is attached to this letter.

Please contact the following persons to discuss any issues or concerns:

Keith Stolberger - s9(2)(a) [redacted] (Total Bridge Services) or fax (09) 481 0079
Paula Bradshaw - (Woodward-Clyde) or fax (09) 355 1333
Stuart Bracey - (Opus International Consultants) or fax (09) 355 9584

Yours faithfully,
TOTAL BRIDGE SERVICES

Keith Stolberger
Project Manager
Auckland Harbour Bridge

Woodward-Clyde
Engineering & Environmental Consultants

Project No. AA27960013

24 August 1999

Ngati Whatua
c/ Bill Kapea
136 Manuka Road
Glenfield
Auckland

Attention: s9(2)(a)

Dear s9(2)(a)

Re: Auckland Harbour Bridge Resource Consent Renewals

Further to our telephone conversation last week, I have enclosed a summary of the Assessment of Effects for the resource consent renewals for the Auckland Harbour Bridge Paint Maintenance Programme. The existing consents were granted in May 1994, and are due to expire in December 2000. Woodward-Clyde is acting for Fulton Hogan Ltd, and we intend to lodge this application in September 1999.

As you will see from the attached summary, there are several control measures in place to prevent the contamination of the Harbour water and surrounding environments (especially via stormwater contamination).

As the nominated representative for Ngati Whatua, we would like to consult with you to discuss any issues you may have on the consent renewals. Could you please contact me to advise whether you would like to discuss the matter further? My direct line is 0s9(2)(a)

Yours faithfully
WOODWARD-CLYDE (NZ) LIMITED

Paula Bradshaw
Environmental Engineer

Enclosures – Consent Application Summary

S:\JOBS\2796\AA13\0003 - CONSULTATION\LETTER004.DOC\18-OCT-99\AUK\PAULA BRADSHAW:pcb

Woodward-Clyde (NZ) Ltd
A division of URS Corporation
Bank Direct Centre, 13-15 College Hill, P O Box 821, Auckland,
New Zealand, **Ph 0-9-355 1300** • Fax 0-9-355 1333

Te Hao O Ngati Whatua

Consultants for Tangata Whenua Resource Management Issues
Technical Director - William A. Kapea

136 Manuka Rd, Glenfield, Auckland 10 Ph 09-444-4079 ; Fax 09 -443-2820

Submission in Respect of a Resource Consent Application

To the Applicant: **Woodward-Clyde for Fulton Hogan Ltd**
Name: **Paula Bradshaw**
Address: **PO Box 821, Auckland**
Site Location: **Auckland Harbour Bridge**
File Reference(s): **AA27960013 Our ref: 521**
Brief Details: **Paint maintenance programme**

From: Full Name: Te Hao o Ngati Whatua **Contact:** s9(2)(a)

Postal Address: 136 Manuka Road, Glenfield, AUCKLAND 10

Phone Number: s9(2)(a) **Fax Number:** 443 2820

We do not oppose the application

On the following grounds:

* Te Hao's concerns relate to the following:
1) The discharge of contaminants into the Waitemata Harbour
2) The use of paints and cleaners containing contaminants - chemicals metals etc
3) The safety of workers during works
4) The safety of motorists and boat users below during works
5) The safe removal of contaminants to a recognised landfill
6) The discharge of stormwater runoff containing oils and contaminants into the Waitemata Harbour from the road surface of the bridge given the heavy vehicular traffic present on this stretch of motorway.

Date: 30 September 1999 **Signed:** s9(2)(a)

North Shore City Council
Area Office
Birkenhead

File Ref:

ED
9 NOV 1999
AUCKLAND OFFICE

8 November 1999

NORTH SHORE CITY

Cnr Rawene Roa
and Hinemoa Stre
Birkenhead

Postal Address
Private Bag 9350
Takapuna
North Shore City
New Zealand

Telephone
0-9-486 8400
Facsimile
0-9-486 8506

Opus International Consultants
P O Box 5848
AUCKLAND

Attention - Stuart Bracey

Dear Stuart

AUCKLAND HARBOUR BRIDGE - DISCHARAGE CONSENTS RENEWAL

I am writing in reply to correspondence regarding the above issue, which was received by Council on 27 October 1999.

As per our telephone conversation on Friday 5 November, I would like to confirm that Council has no issues of concern in relation to the work.

Please feel free to contact me o s9(2)(a) hould you wish to discuss any issues.

Yours faithfully

Wendy Baverstock
DEVELOPMENT PLANNER
BIRKENHEAD AREA OFFICE

Department of Conservation
Te Papa Atawhai

fax

Name: Stuart Bracey

Organisation: Opus

Address:

Fax Number: 355 9584

From: Marilyn Fullam

No. of Pages: 1
(including cover sheet)

Dear Stuart

Re: Auckland Harbour Bridge Discharge Consents Renewal.

Your letter of 26 October 1999 refers.

I advise that the Department supports the proposed use of a primer which is more sensitive to the environment and the continuation of the mitigation measures used to date.

Thank you for the opportunity to comment on the draft application.

Yours faithfully

M Fullam

Marilyn Fullam
Community Relations Officer
for Auckland Conservator

document2

AUCKLAND *CITY* ENVIRONMENTS

Environmental Health & Licensing

FACSIMILE

Please hand the following pages to:

Name :	Stuart Bracey
Company :	Opus Consultants
Fax number :	355~~-0500~~ 9584
Date :	2 November 1999
From :	Andrew Gordon
Subject :	**AUCKLAND HARBOUR BRIDGE - BRIDGE MAINTENANCE WORK - DISCHARGE PERMIT RENEWAL**

Total number of pages (1) including covering page.
If you do not receive all the pages, please call back as soon as possible.

In your letter dated 26 October 1999 you requested feedback on any complaints/problems with bridge maintenance work.

A search of Councils complaint management system, which holds information back to late 1995, has revealed no complaints in relation to the above work. Furthermore, I have made inquires with Council's enforcement/monitoring and environmental health staff who are also unaware of any problems/issues.

AGordon

Andrew Gordon
Environmental Health Co-Ordinator

FACSIMILE
FAX : 353 9068 TELEPHONE : 353 9065
Private Bag 92516 Wellesley Street Auckland New Zealand