File No: NA/933

November 2001

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

NEXGUARD/NGIT Polymer

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act* 1989 (the Act) and Regulations. This legislation is an Act of the Commonwealth of Australia. The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is administered by the National Occupational Health and Safety Commission which also conducts the occupational health & safety assessment. The assessment of environmental hazard is conducted by the Department of the Environment and the assessment of public health is conducted by the Department of Health and Aged Care.

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Copies of this full public report may also be requested, free of charge, by contacting the Administration Coordinator on the fax number below.

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Director
Chemicals Notification and Assessment

TABLE OF CONTENTS

FULL PUBLIC REPORT

NEXGUARD/NGIT Polymer

1. APPLICANT

Nalco Australia Pty Ltd of 2 Anderson Street, Botany NSW 2019 (ABN 41 000 424 788) has submitted a limited notification statement in support of their application for an assessment certificate for **NEXGUARD/NGIT Polymer.**

2. IDENTITY OF THE CHEMICAL

The chemical name, CAS number, molecular and structural formulae, molecular weight, spectral data, details of the polymer composition and details of exact import volume and customers have been exempted from publication in the Full Public Report and the Summary Report.

Marketing Name: **NEXGUARD/NGIT Polymer**

3. PHYSICAL AND CHEMICAL PROPERTIES

The following physicochemical properties refer to the notified polymer as a 12% aqueous solution.

Appearance at 20°C & 101.3 kPa:	Clear colourless liquid at 23°C.
Melting Point:	Not determined.
Specific Gravity:	1.1 – 1.2 x 10^3 kg/m^3 at 25°C.
Vapour Pressure:	Not determined. See comments below.
Water Solubility:	> 2480 g/L at 23°C. See comments below.
Partition Co-efficient (n-octanol/water):	log P_{ow} < -1.7 at 23°C.
Hydrolysis as a Function of pH:	Stable at pH 4 and 7; unstable at pH 9. See comments below.
Adsorption/Desorption:	Not determined. See comments below.

Dissociation Constant:	Not determined. The polymer is expected to fully dissociate in water in the environmental pH range.
Flash Point:	Not applicable as the polymer is in the form of an aqueous solution.
Flammability Limits:	Not flammable
Autoignition Temperature:	Not determined.
Explosive Properties:	Not determined. The polymer is not expected to be explosive.
Reactivity/Stability:	Stable

3.1 Comments on Physico-Chemical Properties

The solubility in water was determined by adding NGIT to vials containing different amounts of water (GlobalTox 2000). All solutions remained clear with an increasing viscosity from the most dilute sample (240 g/L), which was like water, to the most viscous (2,480 g/L), which did not flow after inverting for 10 s. Therefore the solubility in water was >2,480 g/L at 23°C.

The partition coefficient was determined using the OECD Test Guidelines 107 shake flask method (GlobalTox 2000) to be <0.02 at 23°C. This equates to a log K_{OW} of <-1.7 indicating that the notified polymer is hydrophilic and not likely to bioconcentrate or bioaccumulate in biota.

Changes in the concentration of the notified polymer in solutions at pH 4 and 7 were <10% after 5 d indicating that it was stable in the OECD hydrolysis test. However at pH 9, the concentration decreased by 17% and the polymer was considered unstable at this pH. The nature of the degradation could not be determined because the structure does not contain hydrolysable groups. The final product containing the polymer has a neat pH of 10.5.

The vapour pressure is expected to be low given the molecular structure of the polymer and its high molecular weight.

Once the polymer has been discharged from boiler systems, it is expected to be less soluble in water and have low mobility in soil due to complexing with Ca^{2+} and Mg^{3+} cations. If it reaches soil before complexation with these cations (eg. due to a spill), it is expected to be relatively mobile in soil.

Degradation by hydrolysis and photolysis is expected to be limited (Lyons and Vasconcellos 1997).

4. PURITY OF THE CHEMICAL

Degree of Purity: 100 %

Additives/Adjuvants: None

5. USE, VOLUME AND FORMULATION

The notified polymer will be used as a scale and rust inhibitor in industrial boiler systems. It will be imported as a finished aqueous product at approximately 12% in 200 L and 1000L returnable steel containers as well as in bulk and transported to Nalco's site in Botany. There it will be repackaged into 15 L plastic carboys, 200 L, 800 L and 1500 L proprietary returnable steel containers for transport to customers.

It will generally be diluted to a dispersion concentration specific to the boiler operating parameters by a continuous dose in a closed system. The polymer will be a permanent component in the boiler water.

Less than 20 tonnes of the notified polymer will be imported per year for the first 5 years.

6. OCCUPATIONAL EXPOSURE

Import, Transport and Storage (2-3 hours/day, 10-15 days/year)

The product containing the notified polymer will be imported and transported directly to Nalco's Botany site in New South Wales. Import containers will not be opened prior to repackaging at the Botany site and so exposure of approximately 8 dockside and transport workers and 6 receiving clerks and 2 forklift drivers at the Botany site will only occur as a result of accidental puncture of import containers.

Repackaging (2-5 hours/day, 30 days/year)

At the Botany site, the product will be repackaged prior to delivery to customers. Three repackaging operators will open the import containers and either insert a spear and transfer line or in the case of 1000L containers connect the transfer line directly to the decant valve. The imported chemical will then be pumped automatically directly into alternate containers or via a closed decanting vessel.

Dermal exposure may occur during the manipulation of spears, transfer lines and valves. Ocular exposure may also occur but is more unlikely. Inhalation exposure is unlikely due to the high molecular weight and expected low volatility of the notified polymer, enclosed decanting processes and good general ventilation. Dermal and ocular exposure will be controlled by the use of personal protective equipment consisting of coveralls, chemical resistant gloves and chemical goggles.

Quality Analysis (2 hours/day, 8 days/year)

Sampling from import containers of neat product for quality analysis will be conducted by 4 QC chemists. Exposure to the notified polymer may occur mainly via the dermal route. To control exposure, laboratory personnel will use personal protective equipment consisting of laboratory coats, chemical resistant gloves and safety glasses.

End use – Boiler Applications

Approximately 8 warehouse staff at customer facilities Australia-wide will handle sealed containers of product containing the notified polymer. These workers may be exposed to the polymer but only in the event of inadvertent puncture of containers.

Approximately 70 Sales Representatives working 1-4 hours/day, 60 days/year and 70 Wastewater Treatment Operators working 1-2 hours/day, 340 days/year will open repackaged containers of notified polymer and set up automatic dosing equipment. The feed system is largely enclosed. However, potential exposure may occur mainly via the dermal route for approximately 5-10 minutes during the attachment of transfer lines to customer containers, pump testing and calibration. During these procedures, workers will control exposure by using coveralls, chemical resistant gloves and chemical goggles.

Contact with the notified polymer may occur for plant workers through contact with boiler water released during blowdown. However, this is unlikely because of the low levels of polymer in boiler water (< 100 ppm) and the enclosed boiler fill/empty transfer lines.

Steam released from boilers will contain the polymer in an aerosol form. However, similarly, given the low level of polymer in boiler water and unlikely steam release during normal boiler operations, the possibility of inhalation exposure during end use in this manner would be low.

7. PUBLIC EXPOSURE

The polymer product will not be sold to the public. It will be applied to boilers for generating steam used in industrial situations and in hospitals or hotels for heating and other purposes. Since the notified polymer has high molecular weight, is not volatile, and is not to be carried in the steam phase, public exposure to the notified chemical will be minimal.

8. ENVIRONMENTAL EXPOSURE

8.1 Release

After importation, the notified polymer will be transported by trucks from the dockside to Nalco's site at Botany, NSW where the containers will be repacked into alternate containers. Repackaging will be done with automatic pumping equipment either directly into the alternate containers or via a decanting vessel through a closed system. Estimation of the amount of spillage and residue left in containers after repackaging combined with about 50,000 L of effluent/day would result in about 5 mg/L of the notified polymer in the effluent. This is treated in an on-site waste facility prior to discharge to municipal facilities. Any spillage or residue is expected to be removed during the waste treatment process.

Release to the environment of the undiluted polymer would generally be through unintended spills. Solids from wastewater treatment systems containing the polymer will be disposed of to landfill according to regulations.

The majority of the notified polymer will be released to the environment when boiler systems

undergo either short-term manual system blowdown or total shut-down for cleaning. Boiler blowdown is sometimes recycled within an industrial facility for other water uses such as cooling tower makeup water. More often, blowdown is treated in an on-site waste treatment plant at large facilities or discharged directly to municipal sewage treatment plants for small facilities. A typical concentration of the polymer in the boiler blowdown water is <100 mg/L.

For a typical small boiler system of 1,500 L capacity generating 500-1,000 kg/hour of steam, the blowdown rate would be 20-50 L/hour running 12 hours/day. This would equate to 219,000 L/year of released boiler water. Presuming a worst case concentration of 100 mg/L in the blowdown water, the amount of notified polymer released would be 21.9 kg/year most likely discharged directly to municipal sewers.

A large industrial sized boiler system of 200,000 L capacity would have a blowdown of 4,000 L/hour equivalent to 17.52 ML/year (presuming a 12 hour/day running time). At a polymer concentration of 100 mg/L, this would result in 1,752 kg/year of released polymer to an on-site treatment facility.

8.2 Fate

No information was provided on the disposal of polymer residues that remain in empty drums and containers. Presumably, empty containers will be sent to either licensed drum reconditioners or the drums disposed of directly to a licensed landfill site along with solid residues from drum reconditioners.

Similarly no studies were provided on the environmental chemistry or fate of the polymer. Therefore, a worst case scenario will be assumed in which all of the polymer will remain dissolved in the water and is persistent.

It is not expected bioaccumulate in organisms as the polymer is water soluble with a very low log P (Connell 1990).

9. EVALUATION OF TOXICOLOGICAL DATA

No toxicological data were submitted.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

A draft report on algal toxicity was provided by the notifier.

Test	*Species*	*Results*
96 h Algal Growth Inhibition	*Selenastrum capricornutum*	96-h E_bC50 = 47 (45, 50) mg/L based on biomass

* NOEC - no observable effect concentration

In a draft report, Wilbury Laboratories (2001) examined the effect of the notified polymer on the growth and biomass of the green alga *Selenastrum capricornutum* over 96 hours based on

methods of the US EPA and OECD. Serial dilutions of the polymer up to 200 mg/L containing algal cells (10,000 cells/mL) were incubated at 24±2°C and constant light on a rotary shaker. The 96-hour EbC50 (based on biomass) and ErC50 (based on growth rate) values were 47 (45, 50) and 100 (50, 200) mg/L, respectively. This would classify the polymer at worst as slightly toxic to green algae. However, the raw data were not submitted to allow verification of these results.

No information was submitted on the toxicity of the polymer to other aquatic organisms. The literature (Boethling and Nabholz 1997) suggests that algae are not necessarily the most sensitive test species for these types of polymers.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The intended use pattern of the notified polymer is expected to result in the majority of the notified polymer being eventually released to the environment. However, this will be diluted as the notified polymer contained within the water treatment solution released from boiler systems will mix with other effluent at municipal sewage treatment plants for small boilers and additionally with effluent from on-site treatment plants for large boilers. Treatment at local sewage treatment plants would reduce the notified chemical to very low concentration levels. If the notified polymer is used at other sites that do not have on-site treatment plants, then environmental exposure is still expected to be low since the polymer is only expected to be used at a maximum concentration of 100 mg/L.

In a worst case based on maximum annual imports of 20 tonnes/year, all of which is released to sewer and assuming that none is removed during sewage treatment processes, assuming a national population of 19,000,000 (Australian Bureau of Statistics 2001) and that each person contributes an average 150 L/day to overall sewage flows, the predicted concentration in sewage effluent on a nationwide basis is estimated as 15.4 µg/L.

Amount of NGIT Polymer entering sewer annually	20,000 kg
Population of Australia	19 million
Amount of water used per person per day	150 L
Number of days in a year	365
Estimated PEC	19.2 µg/L (19.2 ppb)

When released to receiving waters, the concentration is generally understood to be reduced by a further factor of about 10, and so the predicted environmental concentration (PEC) is 1.92 µg/L. If the notified polymer were all to be used in one major capital city such as Sydney (population 4.04 million, Australian Bureau of Statistics 2001), the PEC of the receiving waters would be 9.0 µg/L.

The nationwide PEC (1.92 µg/L) indicates that after discharge to receiving waters, the environmental concentration of the notified polymer will be four orders of magnitude less than the demonstrated toxicity to the alga *Selenastrum capricornutum* (96-h EbC50 = 47 (45, 50) mg/L). As this toxicity value was based on only one draft report and no other ecotoxicity data were submitted, a 1,000 fold safety factor was applied which brings the predicted no effect concentration (PNEC) down to 47 µg/L. This is 25 times higher than the PEC of 1.92 µg/L which indicates a low hazard to aquatic organisms. Similarly, the PNEC is 5.2 times lower than the large city PEC of 9.0 µg/L which also indicates a low hazard.

Wastes containing the notified polymer including residues from imported drums, from formulation and sludge will be disposed of in landfill and are expected to be immobile. Even though the notified chemical is soluble in water, it is expected to adsorb to soil and sediment if released from boiler systems to soil.

Therefore, the environmental exposure and overall environmental hazard from the notified polymer is expected to be low.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Hazard Assessment

No toxicological information has been provided for the notified polymer. However, due to its high molecular weight and likely low bioavailability, it is unlikely to be a hazardous substance in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances* (National Occupational Health and Safety Commission, 1999). The MSDS for the imported polymer products indicates that it may be irritating to skin, eyes and mucous membranes. These effects may be due to residual monomer rather than the polymer itself.

Occupational Health and Safety

The polymer will be imported and used as a minor component (12%) of a formulated rust inhibitor for use in industrial boiler systems. It will be repackaged for introduction via automatic dosing equipment. Potential exposure to the notified polymer is most likely during repackaging and end use where containers are opened and spears and transfer lines are connected and disconnected. Manual sampling from import containers by quality control staff may also provide a scenario for exposure. During these operations, dermal contact with the polymer is possible through slops, spills and residue. Ocular contact from minor splashes may also occur. The likely low vapour pressure of the polymer, enclosed transfer lines and general ventilation make inhalation exposure unlikely. Although aerosols containing the polymer may be encountered through contact with steam during end use, steam release is unlikely during normal boiler operations and so the possibility of inhalation exposure during end use is low.

The MSDS for the inhibitor product warns of the possibility of irritation following dermal, ocular or respiratory contact. Given the risk of irritation, good occupational hygiene would consider the prudent use of personal protective equipment consisting of impervious clothing, gloves and chemical goggles during handling of the polymer solution in an area of good general ventilation. For workers who will engage in activities where the polymer is decanted or sampled and where these controls are used, the health risk associated with the polymer would be assessed as low.

Following addition to boiler water, the risk associated with the polymer for workers involved in boiler operations would be assessed as negligible given the low level of polymer in boiler water and the enclosed plant.

Given no requirement for opening polymer containers and therefore the low possibility of exposure, the health risk associated with the polymer for import, transport and storage

workers would be assessed as negligible.

Public Health

The imported product containing the notified polymer will not be sold to the public. It will only be used in boiler water systems where steam is generated for industrial, commercial and institutional uses. In view of its high molecular weight, likely low volatility, low toxicity and the use pattern (in boilers for generating steam used in heating and other purposes), the potential risk to public health induced by the notified polymer should be very low.

13. RECOMMENDATIONS

Regulatory Controls

- Use the following safety phrases for the MSDS and label for the imported product containing the notified polymer:

  – S24/25 – Avoid contact with skin and eyes

Control Measures

Occupational Health and Safety

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified chemical in the product NEXGUARD/NGIT:

  – Impervious clothing and footwear;
  – Impervious gloves eg. rubber;
  – Chemical goggles.

  Guidance in selection of personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

- A copy of the MSDS should be easily accessible to employees.

If products and mixtures containing the notified chemical are classified as hazardous to health in accordance with the NOHSC Approved Criteria for Classifying Hazardous Substances, workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

Secondary notification

The Director of Chemicals Notification and Assessment must be notified in writing within 28 days by the notifier, other importer or manufacturer:

Under Subsection 64(2) of the Act:

- if any of the circumstances listed in the subsection arise.

The Director will then decide whether secondary notification is required.

No additional secondary notification conditions are stipulated.

14. MATERIAL SAFETY DATA SHEET

The MSDS for the notified chemical was provided in a format consistent with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (National Occupational Health and Safety Commission, 1994).

This MSDS was provided by the applicant as part of the notification statement. It is reproduced here as a matter of public record. The accuracy of this information remains the responsibility of the applicant.

15. REFERENCES

Australian Bureau of Statistics (2001) Population size and growth. Website www.abs.gov.au/ausstats.

Boethling RS and JV Nabholz (1997) Environmental assessment of polymers under the U.S. Toxic Substances Control Act. In: Hamilton JD and R Sutcliffe, eds, Ecological Assessment of Polymers: Strategies for Product Stewardship and Regulatory Programs. Van Nostrand Reinhold, New York, USA.

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