File No: NA/954

August 2001

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

NEJI-3

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.

For the purposes of subsection 78(1) of the Act, copies of this full public report may be inspected by the public at the Library, National Occupational Health and Safety Commission, Plaza level, Alan Woods Building, 25 Constitution Avenue, Canberra ACT 2600 between 9 AM and 5 PM Monday to Friday.

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

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1. APPLICANT

Epson Australia Pty Ltd of 70 Gibbs Street CHATSWOOD NSW 2067 has submitted a limited notification statement in support of their application for an assessment certificate for NEJI-3.

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 use and import volume have been exempted from publication in the Full Public Report and the Summary Report.

Marketing Name:	NEJI-3
Methods of Detection and Determination:	Infrared and nuclear magnetic resonance spectroscopy.
Spectral Data:	Infrared and nuclear magnetic spectra were provided.

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C & 101.3 kPa:	White powder.
Melting Point:	267°C; the substance decomposes without boiling.
Specific Gravity:	1.16 at 23°C
Vapour Pressure:	$< 1.4 \times 10^{-6}$ kPa at 25°C.
Water Solubility:	< 0.928 mg/L at 20°C.
Partition Co-efficient (n-octanol/water):	log Pow > 6.2
Hydrolysis as a Function of pH:	The test was not conducted due to low water solubility.
Adsorption/Desorption:	A log Koc value of greater than 5.12 was calculated using Quantitative Structure Activity Relationships

(QSAR).

Dissociation Constant:	Not determined.
Particle Size:	16.8% < 10 micron; 21.8% < 100 micron.
Flash Point:	Not determined.
Flammability Limits:	Not flammable.
Autoignition Temperature:	366°C
Explosive Properties:	Based on chemical structure and experience in use, the substance is predicted not to be explosive.
Reactivity/Stability:	The chemical does not have oxidising properties based on chemical structure and experience in use.

3.1 Comments on Physico-Chemical Properties

The melting and boiling points, relative density, vapour pressure, water solubility and partition coefficient of the notified polymer were determined in accordance with OECD Test Guidelines.

Estimation of hydrolysis of the notified polymer was precluded by its low water solubility. A computer estimate of hydrolysis potential was obtained using Hydrowin v1.67, SRC-Hydro for Microsoft Windows. The half- lives ($t_{1/2}$) at pH 8 and pH 7 were calculated to be 1.83 and 18.3 years, respectively. This is consistent with the polymer containing ester groups that would only be expected to hydrolyse very slowly under environmental conditions (pH 4-9).

The adsorption coefficient of the notified polymer was not experimentally determined due to the lack of valid reference materials. A QSAR estimate of log Koc was determined using the experimentally determined log Pow value of > 6.2. The adsorption/desorption coefficient of the polymer (log Koc) was calculated to be > 5.12, using the equation log Koc = 0.81 log Pow + 0.10, and the polymer is likely to adsorb strongly to soils and sediments (Mensink, 1995).

Estimation of the dissociation constant of the notified polymer was precluded by its low water solubility. The notified polymer contains weakly acidic carboxylic acid moieties which would dissociate only at high pH under environmental conditions (pH 4 - 9), where water solubility would be higher.

4. PURITY OF THE CHEMICAL

Degree of Purity:	98% (range: 98 – 100%)
Hazardous Impurities:	Residual monomers are present in the polymer at concentrations of less than 0.25% (for each monomer).

Chemical name:	2-butoxyethanol
CAS No.:	111-76-2
Weight percentage:	0.1%
Toxic properties:	Harmful by inhalation, in contact with skin and if swallowed at concentrations above 20%; irritating to respiratory system at concentrations above 12.5% (NOHSC, 1999a).

Chemical name:	2-(2-butoxyethoxy)ethanol
CAS No.:	112-34-5
Weight percentage:	0.1%
Toxic properties:	Irritating to eyes at concentrations above 20% (NOHSC, 1999a).

Non-hazardous Impurities (> 1% by weight):

Chemical name:	Water
Weight percentage:	1.02%
CAS No.:	7732-18-5

Additives/Adjuvants: No residue of the initiator.

5. USE, VOLUME AND FORMULATION

The substance will be used as a component of printing inks. The formulated ink, containing a maximum of 2% by weight of the substance, is imported into Australia contained in plastic cartridges for direct use in inkjet printers. Less than 100 kg per year will be imported up to the fifth year.

6. OCCUPATIONAL EXPOSURE

Printing inks containing the notified polymer will be imported in pre-packed cartridges, each containing a maximum of 2% w/w notified polymer.

The 5 – 10 waterside, warehouse and transport workers are unlikely to be exposed to the notified polymer unless the packaging is breached.

Office workers (approximately 1000) and printer maintenance workers may be intermittently exposed to the notified polymer contained in the ink cartridge when replacing the spent ink cartridge, and during repair maintenance and cleaning of ink jet printers. Maintenance workers for printers may potentially come in contact with the notified polymer more often than office workers. Exposure is expected to be controlled through the design of the ink cartridges and the printing machines. Printer maintenance personnel often wear cotton

disposable gloves. Pre-packed ink cartridges are sealed and worker exposure to the ink is minimised by the use of the replacement procedures recommended by the manufacturer.

Contact with paper printed with printing inks containing the notified polymer is unlikely to result in dermal exposure, as it will be bound in the structure of the paper.

7. PUBLIC EXPOSURE

Public exposure to the notified polymer will only occur with rupture of cartridges as a result of an accident. According to the MSDS spilled ink should be soaked up using a damp cloth and disposed of in accordance with regulations.

Emptied cartridges will contain very small quantities of the notified polymer. These cartridges will be disposed of in landfill where public exposure to the notified polymer is unlikely.

There will be contact with the ink product during cartridge changes, clearing of paper jams and printer maintenance. The quantities of ink on the printed page is extremely small, and is bound to the paper. Public exposure through these avenues is expected to be limited.

8. ENVIRONMENTAL EXPOSURE

8.1 Release

Transport

Losses during transport will be minimal as the notified polymer is contained in sealed cartridges. These cartridges are designed to prevent release of the ink blend until a sealing tape is removed. Accidental spillage of the polymer, either during transport or use should result in ink wastes being sent either to landfill or to incineration facilities.

End User Site

Losses are expected to be very low because the ink cartridges will remain sealed until they are placed inside printers. Under normal use, the ink is transferred onto a sheet of paper where it is fixed to the surface and there will be limited release to the environment. Accidental spillage of the polymer, during replacement of cartridges, should result in ink wastes being sent to landfill. Additional release to the environment will result from the disposal of the used inkjet cartridge from the printer. It is estimated that up to 10% of the ink content of the cartridge remains in the cartridge, and the amount of notified polymer within spent cartridges disposed of to landfill will be less than 10 kg per annum. The disposal of spent cartridges is likely to be widespread across Australia.

Recycling and Disposal

The majority of the notified polymer entering the environment will be bound to paper during

the reprographic process. The waste paper generated will be disposed of to landfill, by recycling, or by incineration. Current paper recycling rates in Australia are estimated to be approximately 70 - 92% (Australian Environmental Review, 2001). In landfill, the ink (and thus the notified polymer) should remain fixed to the paper substrate and remain immobile.

When paper is recycled, waste sludge containing the notified polymer will be disposed of to landfill. It is estimated that the efficiency of removal rate of ink particles during the de-inking phase of recycling of ink-jet printed paper is 30 - 60%. It is likely that the same proportion of polymer retained in the paper fibre is retained in the sludge when the waste paper is re-pulped. Recycling is carried out in paper mills where at least primary sedimentation is expected to be carried out. It can be assumed that nearly 100% of easily soluble substances will be released to waste water after primary treatment and approximately 50% of poorly soluble substances will be removed. Sludge produced by flotation and clarification will have water removed and disposed of to landfill (EC, 1994). During the recycling process, waste paper is repulped using a variety of alkalis, dispersing and wetting agents, water emulsifiable organic solvents and bleaches. These agents enhance fibre separation, ink detachment from paper fibres, pulp brightness, and the whiteness of paper. De-inking wastes are expected to ultimately reside in the sewerage system.

Overall Release

Virtually all of the notified polymer will ultimately be released to the environment. Over 90% of the polymer will be bound to printed paper and either buried in landfill, incinerated, or released in effluent generated from the de-inking process. Empty cartridges will be disposed of with normal office garbage. Up to 10% of the notified polymer will be disposed of to landfill in spent cartridges.

8.2 Fate

Paper recycling trends will determine the fate of the majority of the notified polymer, as it is anticipated that more than 90% of the polymer will be disposed of as paper-bound waste. Some waste paper may be disposed of directly to landfill with the polymer bound to the paper. It is anticipated that prolonged residence in an active landfill will eventually degrade the notified polymer. Incineration of the waste paper will destroy the polymer with the generation of water vapours and oxides of carbon. Recent literature suggests that current paper recycling rates are 70 - 92% (Australian Environmental Review, 2001). Given the low water solubility of the notified polymer, only modest amounts are likely to ultimately reside in the sewerage system, where it will associate with sludges and soils. The remainder of polymer wastes generated from the recycling process will be bound to the paper pulp and be an integral part of the recycled paper.

Up to 10 kg per annum of the notified polymer will be disposed of to landfill as residues in spent inkjet cartridges. The low water solubility of the polymer suggests that it will readily associate with organic matter if released to the environment, when used cartridges rupture within landfill. Significant leaching of any polymer from landfill would not be expected given its low water solubility and high log Pow and log Koc values.

The biodegradability of the notified polymer was not determined. Most reviews on biodegradable polymers suggest that, with the exception of poly(vinyl alcohol) and

poly(ethylene glycol)s, most synthetic organic dispersants are recalcitrant in the environment and will not readily biodegrade (Hann, 1999).

The bioaccumulation of the notified polymer was not determined. However, it is likely that the high molecular weight of the polymer would preclude significant bioaccumulation (Connell, 1990).

9. EVALUATION OF TOXICOLOGICAL DATA

No data provided.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No data provided.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The majority of the notified polymer entering the environment will be bound to paper during the printing process but up to 10 kg per annum could go to landfill in discarded spent cartridges. The waste paper generated will be disposed of through landfill, recycling, or incineration. In a landfill, the ink (and thus the notified polymer) should remain fixed to the paper substrate and remain immobile. When the paper is recycled, waste sludge containing the notified polymer will be disposed of to landfill. Due to the low water solubility of the polymer, it is expected that the bulk of it will remain bound to the sludge and will not be available to the environment. Incinerated paper/ink wastes will generate oxides of carbon and water and do not present a significant environmental risk.

Abiotic or slow biotic processes largely would be responsible for the degradation of the notified polymer. It is not likely to be readily biodegradable. The high octanol-water partition coefficient and low water solubility indicate that the polymer will be predominantly distributed in sediments and sludges.

The environmental risk presented by the introduction of the notified polymer is predicted to be low.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Hazard Assessment

The notified polymer has a NAMW greater than 1000, does not contain residual monomers at levels likely to render the polymer a hazardous substance according to the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999b) and contains low levels of species with a NAMW < 1000. Therefore, the notified polymer can be considered not to be a health hazard.

The notified polymer will be present at a concentration of 2% in an aqueous solution containing ethylene glycol at 10% w/v, diethylene glycol at 1% w/v and glycerol at approximately 15% w/v in the ink product T033. Ethylene glycol is listed as harmful if swallowed at concentrations greater than 25% (NOHSC, 1999a) and the other components are not on the NOHSC *List of Designated Hazardous Substances*. The formulated ink is not considered to be a health hazard.

Occupational Health and Safety

Exposure to printing inks containing the notified polymer during transport of pre-filled cartridges should not result in exposure except in the event of accidental spillage.

The notified polymer will be in imported inkjet cartridges at a maximum concentration of 2%. Dermal exposure of office workers to the notified polymer will potentially occur when replacing spent cartridges and clearing paper jams from the printer. However, the design of the cartridges is such that exposure to the notified polymer should be negligible.

Dermal exposure of maintenance workers to the notified polymer is possible during routine maintenance but is expected to be low due to the low concentration of the notified polymer in the ink. However, due to their frequent exposure to inks and toners, maintenance and printer personnel should wear cotton or disposable gloves.

It is concluded that the risk of adverse health effects in workers involved in transport, storage, use and disposal of the notified polymer in this application is low.

Public Health

There will be no significant public exposure to the notified polymer as it is diluted at 2% within the ink product, the ink is contained within cartridges which are not normally opened and which release the polymer in very small doses, and contact with residue in the printer's internal workings will be very small. Contact with the printed paper is unlikely to lead to significant dermal exposure, as the ink is bound to the paper. There is unlikely to be any public health risk posed by the notified polymer.

13. RECOMMENDATIONS

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 polymer as introduced:

  – Service personnel should wear cotton or disposable gloves when removing spent printer cartridges containing the notified polymer or when servicing printers.

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

- Spillage of the notified polymer should be avoided. Spillage should be cleaned up promptly and put into containers for disposal;

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

13.1 Secondary notification

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

(1) Under Section 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 ink containing the notified polymer was provided in a format consistent with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC, 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 Environmental Review 16 (1), January 2001, p. 16.

Connell, DW (1990) General Characteristics of Organic Compounds Which Exhibit Bioaccumulation. In: Bioaccumulation of Xenobiotic Compounds, pp. 47-57. CRC Press, Boca Raton, USA.

EC (1994) Official Journal of the European Communities. Technical Guidance Document in Support of Commission Directive 93/67/EEC on Risk Assessment for New Notified Substances and Commission Regulation (EC) No 1488/94 on Risk Assessment for Existing Substances Part IV. pp. 703-707.

Hann WM (1999) Dispersants. In: Kirk Othmer Concise Encyclopaedia of Chemical Technology, 4th Edition. New York, John Wiley and Sons, p. 631

Mensink BJWG, Montforts M, Wijkhuizen-Maslankiewicz L, Tibosch H and Linders JBHJ (1995) Report no. 679101022: Manual for Summarising and Evaluating the Environmental Aspects of Pesticides. National Institute of Public Health and Environmental Protection, Bilthoven, The Netherlands.

NOHSC (1994) National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]. Canberra, Australian Government Publishing Service.

National Occupational Health and Safety Commission (1999a) List of Designated Hazardous Substances [NOHSC:10005(1999)]. Australian Government Publishing Service, Canberra.

NOHSC (1999b) Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(1999)]. Canberra, Australian Government Publishing Service.