

WATER & SOIL

MISCELLANEOUS PUBLICATION

NO 4

SYNTHETIC DETERGENTS WORKING PARTY REPORT

NATIONAL WATER AND SOIL CONSERVATION ORGANISATION

ISSN 0110-4705

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**SYNTHETIC DETERGENTS WORKING PARTY
REPORT**

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Published by the Water and Soil Division, Ministry of Works and
Development, P.O. Box 12-041, Wellington, New Zealand, for the
National Water and Soil Conservation Organisation

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E C KEATING, GOVERNMENT PRINTER, WELLINGTON, NEW
ZEALAND - 1978

1. INTRODUCTION

The Working Party on Synthetic Detergents was constituted originally by the Water Pollution Control Council in August, 1971 to investigate the field of synthetic detergents and report to the council on any necessary or desirable methods of controlling the manufacture and distribution of these products.

With periodic changes in membership the Working Party has met from time to time to assess progress and review its objectives.

It presents the following report on the present status of the field of synthetic detergents to draw to an interim conclusion the current phase of its investigations.

2. CRITERIA

Investigation into the field of synthetic detergent leads inevitably to involvement with a complex range of issues because of the variability of the constitution of the products as marketed and of the widely varied usage of the products. Much of the data received and studied by the committee have posed as many new questions as have been answered. There is, however, a sufficient order of agreement in the parameters of cardinal interest to the Water Resources Council to allow of the current status being defined under the subsequent headings of usage, biodegradability, and phosphate content. The figures given for usage are not precise but the Working Party is satisfied they give a realistic representation of the position within an order of accuracy of $\pm 10\%$.

3. QUANTITY OF USAGE AND COMPOSITION

The total production of all types of formulated detergents in New Zealand in the year 1975 was in excess of 12,000 tonnes p.a. It may be assumed in general terms that this quantity of formulated product was constituted as follows:

(a) Surface active agent (surfactant) 33%	3,950 tonnes
(b) Elementary phosphorus in phosphatic compounds 5.4%	650 tonnes
(c) Other builders, boosters, fillers and ancillaries	7,400 tonnes
	<u>12,000 tonnes</u>

The 3,950 tonnes of surfactant was directed to the following use categories:

(a) Domestic use in the form of non-soapy powders	1,300 tonnes
(b) Domestic use in liquids and pastes	1,790 tonnes
Total domestic use	<u>3,090 tonnes</u>
(c) Wool scouring	440 tonnes

(d) Other industrial uses	420 tonnes
Total industrial use	<u>860 tonnes</u>
Total industrial and domestic use	<u>3,950 tonnes</u>

It is of note that nearly 80% of surfactant consumption is in the domestic area and is equivalent to an annual per capita consumption of 1.00 Kg. The comparative figure for UK as quoted in the 14th Progress Report of the UK Standing Technical Committee for 1971 was 1.32 Kg with an annual rate of increase of 3.3%. Accordingly, per capita domestic surfactant usage in New Zealand is about 2/3rds that in UK.

4. BIO-DEGRADABILITY

The surfactants used fell within the following chemical categories:

(a) an-ionic soft	3,000 tonnes
(b) non-ionic soft	200 tonnes
(c) non-ionic hard	750 tonnes
	<u>3,950 tonnes</u>

The term "hard" implies that a surfactant is not degraded by at least 80% when subjected to the standard degradation tests prescribed by OECD. These tests simulate the treatment which would be received by detergent materials in a municipal wasteflow passing through a conventional treatment process. The tests measure the extent to which undegraded organic material may carry through to rivers and estuaries and cause unsightly foaming or adversely affect the aquatic ecology. Recently an acceptable test procedure to evaluate non-ionic surfactants was adopted by OECD. There is now evidence to indicate that under favourable conditions of dilution and temperature some of the non-ionic 'hard' surfactants will meet the standard degradation test. Accordingly, the distinction between 'hard' and 'soft' is of lesser moment than may have been thought previously, especially in the New Zealand situation where use in the 'hard' category is proportionately small.

The 'hard' surfactant usage is in the following areas:

	tonnes pa	% of gross surfactant use
(a) wool scouring	440	11
(b) other industrial	120	3
(c) domestic	<u>190</u>	<u>5</u>
	750 tonnes pa	19%

Because it is the major single use of 'hard' detergents at this time the wool scouring industry has been the focus of special attention by the Working Party. The industry in New Zealand currently scours approximately 134,000 tonnes of wool, which is nearly half the total clip. Surfactant consumption is thereby, on the average, 0.33 Kg per hundred Kg of

wool scoured. (0.33% W/W). As a comparison the Australian wool scouring industry is reported to have a consumption of about 2.0% W/W. The quantity of wool scoured in New Zealand is about 70% more than in Australia while the consumption of detergent here is substantially lower. This is attributed to the high grease content of Australian merino wool as compared to the cross-bred wools of New Zealand and the added detergent usage in carbonising of some of the wool which takes place in Australia but not in New Zealand.

The gross cost of detergent used in New Zealand wool scouring (material only) is about \$400,000 pa and this yields an added market value to the wool clip of \$10–12 million pa.

The surfactant used in the scouring industry is generally a non-ionic alkyl phenol ethoxylate which has been selected on the basis of its lesser cost as well as its established suitability for the function.

The wool scouring industry has been kept aware of the council's desire that it should convert to 'soft' detergents. Manufacturers of surfactants, recognising the market prospects, are proceeding energetically with research toward production of an acceptable soft substitute. It is probable this conversion will become effective within the next few years.

Meantime the Working Party does not view the present situation with undue concern. The pollution problems from those woolscouring works not satisfactorily accommodated within municipal drainage treatment systems originate from the material scoured from the wool the detergents used in scouring being only a small portion of the total pollution load discharged from a wool scouring works.

In summary it can be said on the aspect of bio-degradability of detergents that New Zealand has not experienced consequential severe problems either with foaming in rivers or in operation of sewage treatment plants. Further, the conversion to bio-degradable surfactants in the majority of household detergents, by voluntary cooperation between manufacturers and the Water Resources Council provides the added assurance that such problems will not emerge in any widespread sense in the foreseeable future. There may be a few local situations such as restricted dilution which could justify specific limits being placed upon the concentration of surfactant residues in a particular discharge.

In such event the regional water board can obtain guidance upon the practicable limits and test procedures in consultation with the Water and Soil Division and DSIR, Chemistry Division. Improved standards can then be met by a discharger by recourse to a more highly degradable detergent or to an extension of his secondary treatment process.

Chemistry Division, DSIR, has established a facility for presumptive biodegradability testing and an examination of surfactants used

both domestically and industrially within New Zealand is in progress. The results of this work will be published in 1977.

There is no justification at this stage for the application of further constraints at national level upon detergent suppliers or manufacturers to further improve bio-degradability. The possible exception is the wool scouring industry, but here time is available to allow the almost inevitable substitution of 'softer' detergents to evolve voluntarily.

5. PHOSPHORUS

Formulated synthetic detergents as previously noted in section 3 contain an average of 5.4% or 650 tonnes annually of phosphorus, the majority of which passes to the country's rivers, lakes and estuaries. More than 90% occurs in the form of sodium tripolyphosphate, $\text{Na}_5\text{P}_3\text{O}_{10}$. In quantity this usage (expressed as P) is equivalent to 0.21 Kg/capita/annum and represents a significant increase over the assessed level in 1970 of 0.12 Kg/capita/annum.

For purposes of comparison the aggregated human faecal contribution of elementary phosphorus to the New Zealand environment is about 1200 tonnes pa and the contribution to the land through application of superphosphate 200,000 tonnes pa. A minor proportion only of the phosphorus from these latter origins, however, finds its way into natural water but the committee believes it could be of the same order or greater than that derived from detergent phosphorus.

The pertinent question for the Water Resources Council is one of whether there are widespread pollution problems throughout the country which are due primarily to phosphates originating from the use of synthetic detergents. Lake Rotorua presents an example of one of the more acute eutrophic problem areas in this context and even here results show that detergent usage is not responsible for the major part of the problem. It is reasonable to assume that in other waterways the influence of phosphorus addition through detergents is of lesser significance than Rotorua.

Eutrophication abatement programmes overseas have had the effect of providing inducement for manufacturers of laundry detergents to find a substitute 'builder' for the traditional phosphate. In Canada legislation was passed to limit the phosphate content of laundry detergents to less than 5% as P_2O_5 as of January 1973.

As with the property of bio-degradability it can reasonably be assumed that overseas constraints will lead progressively to a substitution for the phosphate content in detergents, and New Zealand formulations will, in time, change in sympathy with the world trend.

In local situations, regional water boards may consider the justification for imposing a

specific limit upon the phosphorus concentration in a particular discharge.

The Working Party does not consider there is any validity at national level for application of constraints upon the phosphorus content of detergents marketed within New Zealand subject to:

- (a) there being continued overseas technological progress toward the attainment of an acceptable substitute for phosphate.
- (b) there being no clear evidence that widespread receiving water pollution could be significantly ameliorated by the reduction or elimination of phosphorus in detergents.

Chemistry Division of DSIR is supporting the general trend to lower phosphate levels. The specification for the Government Stores Board purchases of laundry detergent powder states that phosphates may be replaced in whole or in part by other suitable sequestering agents provided the level of performance afforded by use of phosphates is maintained.

CONCLUSION

Having brought together the results of its studies over a five year period into the foregoing report, the Working Party on Synthetic Detergents of the Water Resources Council considers the purpose for which it was constituted to have been largely fulfilled at least for the present.

Quantification of the usage of synthetic detergents in New Zealand has provided the council with a necessary measure of perspective of one potential pollution origin.

The conclusion that synthetic detergent

usage does not pose a major pollution threat to the country at this stage will provide the council with the necessary assurance that it need take no action toward the implementation of formal controls upon product specification.

Representation on the Working Party, as listed in the Appendix, has provided an effective link between manufacturing industry and Government through its regulating agencies. Technical support from other informed agencies has been a valuable supplement. Since constitution of the Working Party, a Director of Research has been appointed to the Water and Soil Division, Ministry of Works, and it is anticipated that future questions on synthetic detergents will, in the first instance, be considered by his department. The DSIR representative has provided valuable advice to the Working Party and it is envisaged that he will continue to provide an avenue for ongoing consultation by the Director of Research.

It is proposed that the Working Party on Synthetic Detergents should terminate. A new group can be constituted if thought desirable in the future to advise on matters where its particular expert advice could be of value.

J L VICKERMAN

Chairman

**Working Party on Synthetic Detergents
Water Resources Council**

February 1977

APPENDIX

WATER RESOURCES COUNCIL WORKING PARTY ON SYNTHETIC DETERGENTS

J L Vickerman	WRC Manufacturers Federation Representative NZ Forest Products Limited (Chairman)
J J Bray	Unilever NZ Limited
D H Bugden	Trade and Industry Department
I R C McDonald	DSIR, Chemistry Division
W J Rae	Ivon Watkins Dow
R Stewart	Wool Research Organisation
P Welsby	Auckland Regional Authority

STAFF MWD

A R Croasdale	Secretary
C A Cowie	Manager Water Resources

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D F Fowlds	NZ Forest Products Limited (Chairman)
I D Beatson	Ivon Watkins Dow
A B Marshall	Unilever NZ Limited
N L Paterson	Trade and Industry Department
B A Martin	MOW (Secretary)