

Phosphates and Automatic Dishwashing Detergents

Includes:
Final Research Report
Bibliography

By Ross Lashbrook

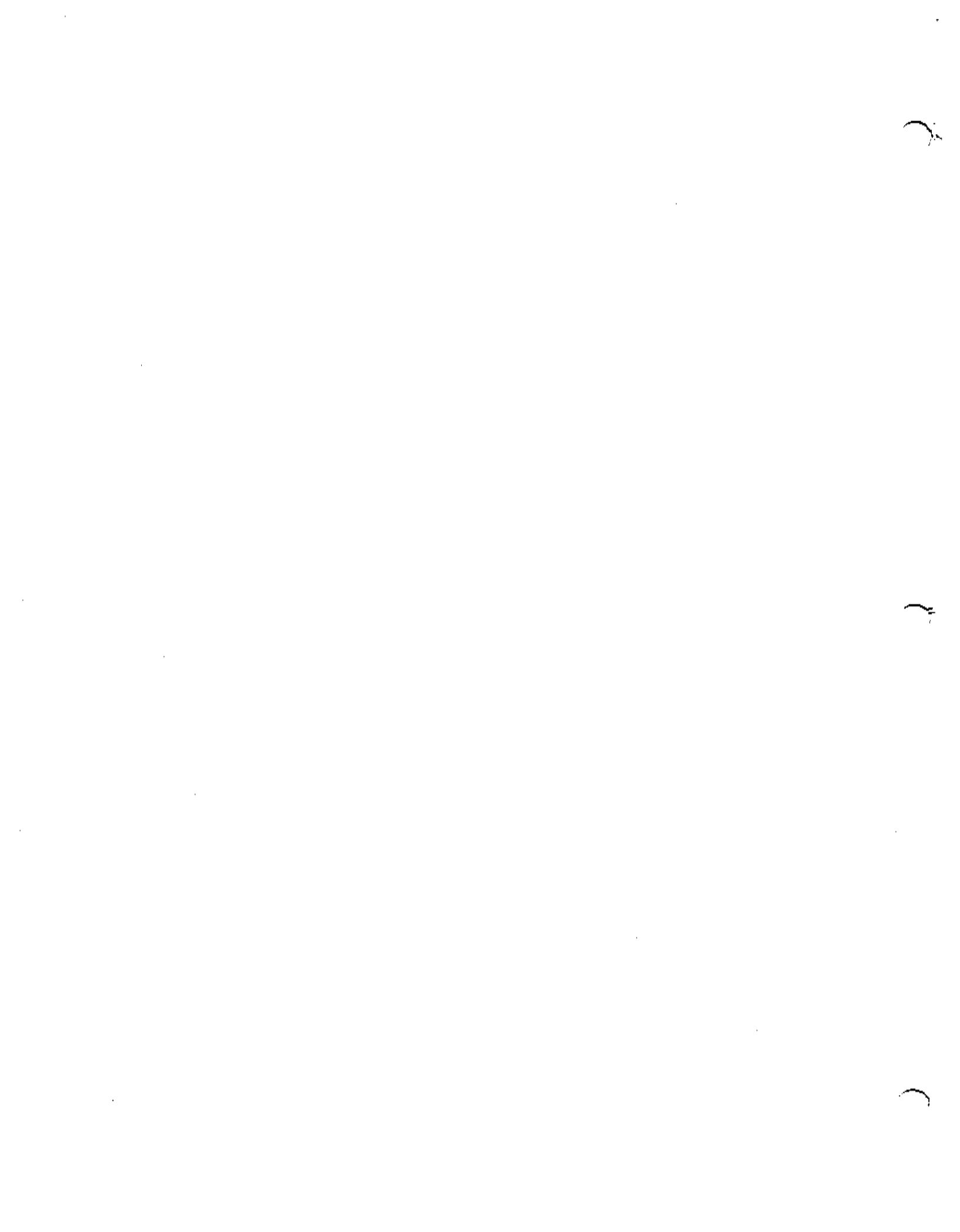
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Abstract

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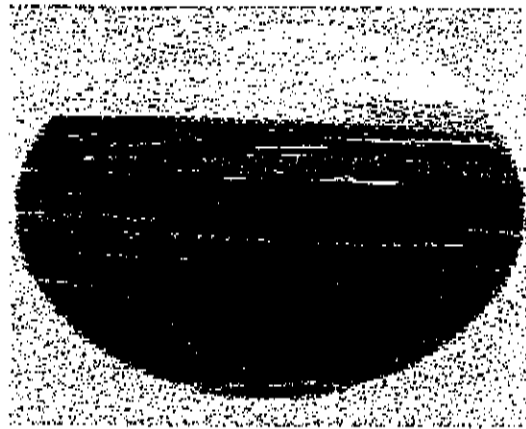
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Many recent reports have concluded that the impact of phosphorus ban in ADDs would not be significant enough to prevent eutrophication. Further, a ban would not improve lake water quality, as ADDs only contribute a small amount to total phosphorus loadings to most major lakes, between 2% and 10% (Grenon, 1994 and Chambers et al. 2001). However, these studies have not looked specifically at the use of ADDs in cottage country, where septic systems are often inadequate to protect water from nutrient enrichment. Therefore, more research is necessary.

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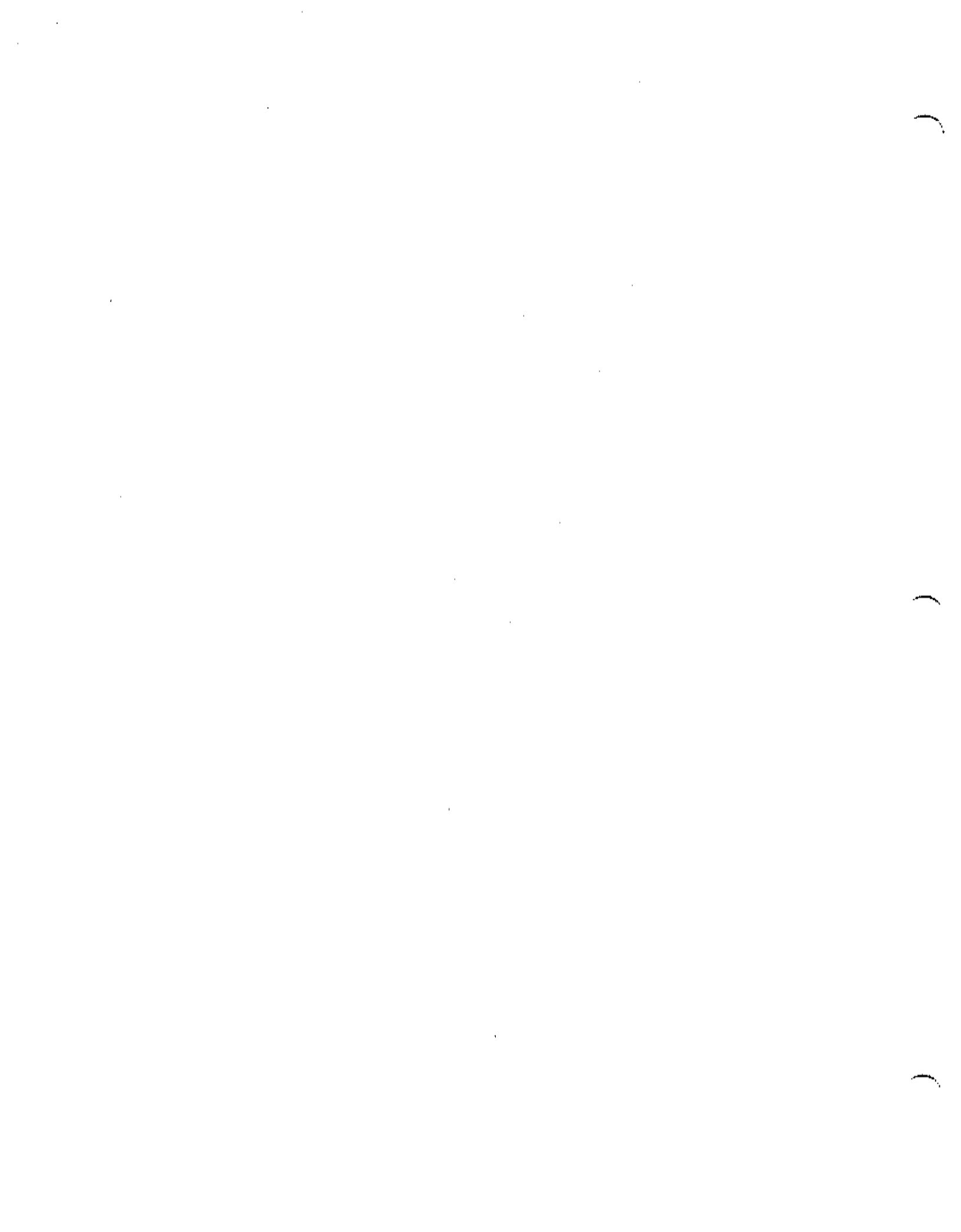
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Phosphates and
Automatic Dishwashing Detergents

Ross Tashbrook
TCCBE, Trent University
rtashbrook@trentu.ca



Abstract

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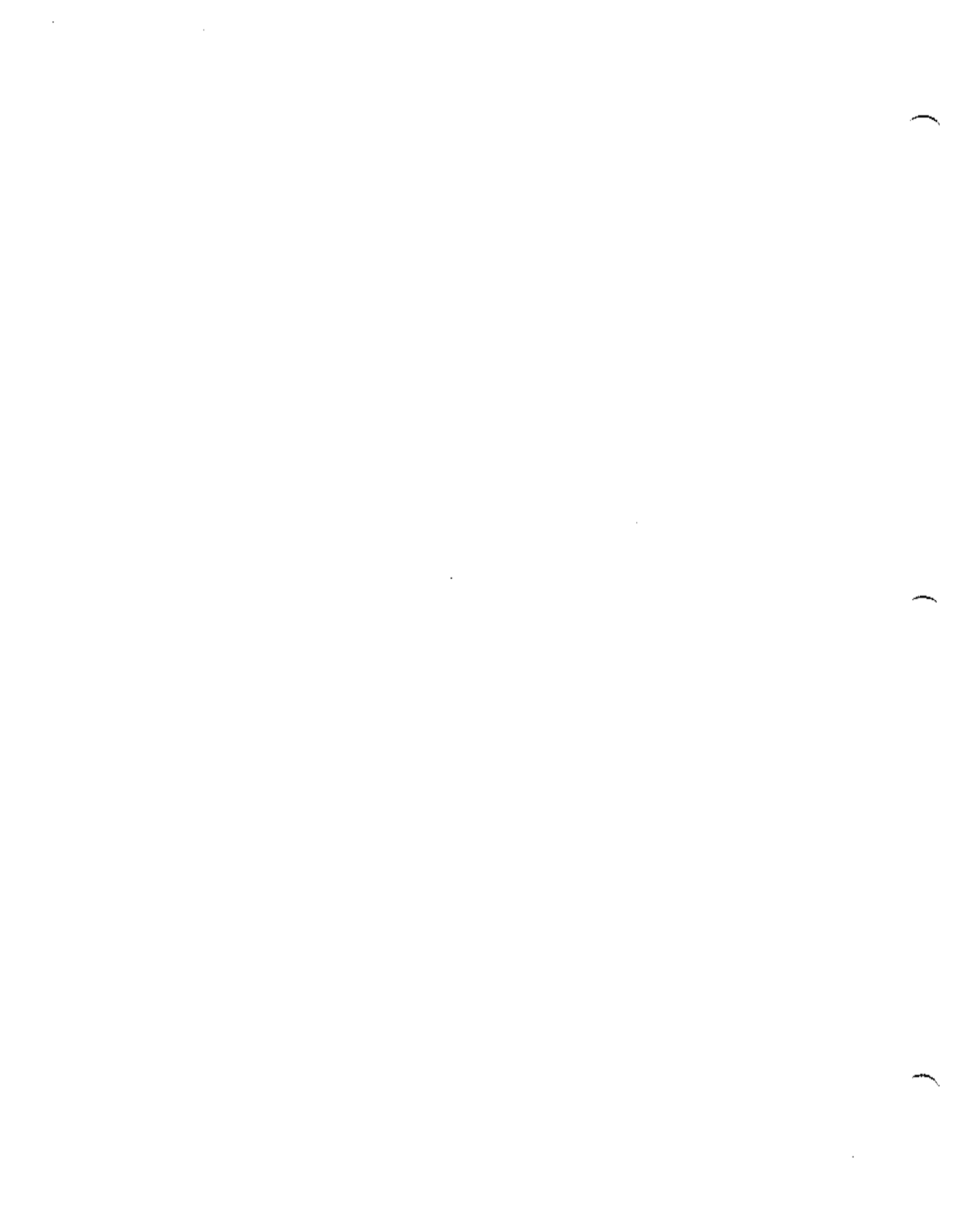
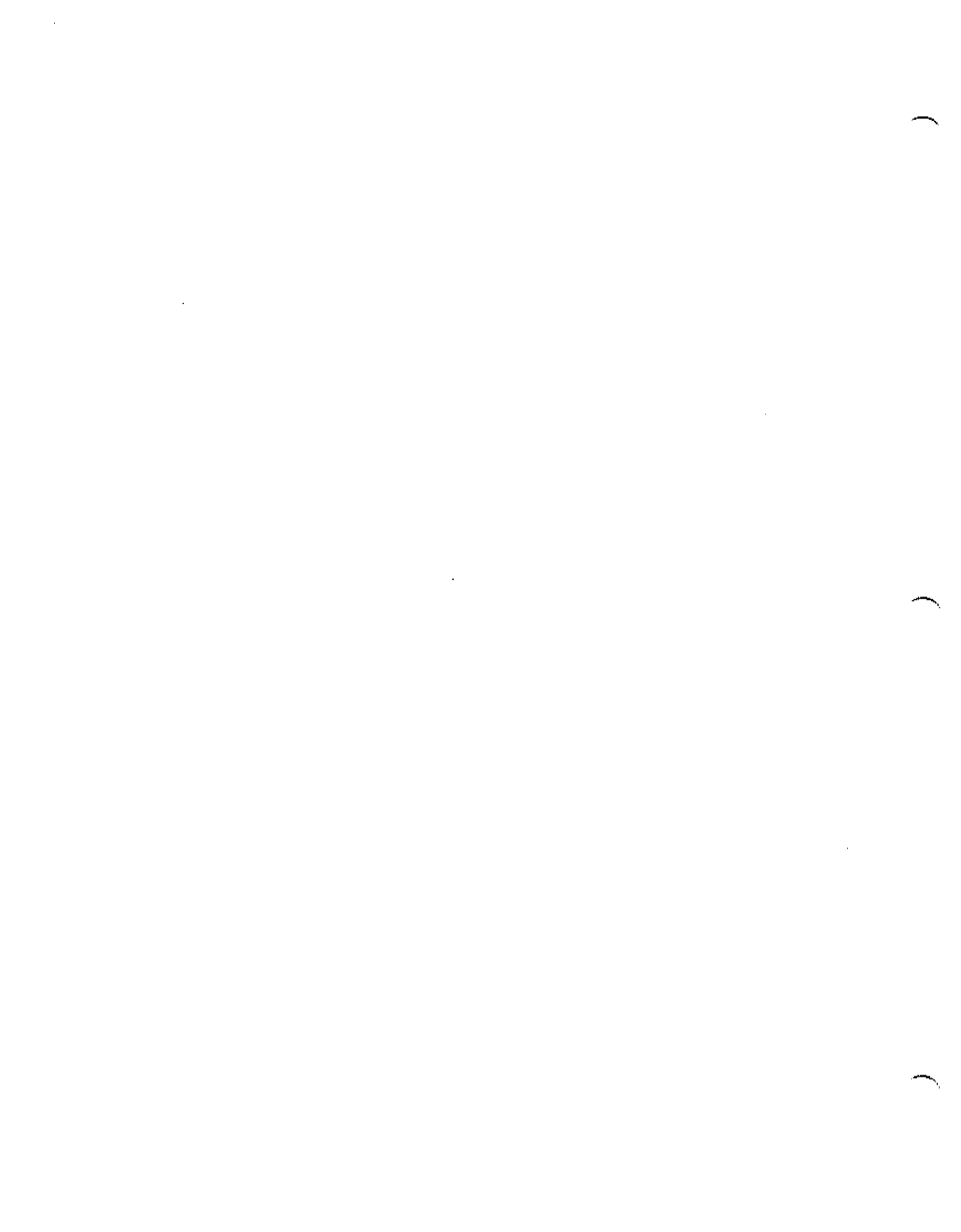


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1. Introduction

1.1 Purpose of Project

The purpose of this project was to determine several things. First, it was hoped to determine the phosphorus content of major-label automatic dishwashing detergents (ADDs). The current and past regulations regarding phosphorus were to be determined in Canada and other jurisdictions. The potential for ADDs to negatively impact the environment was to be determined, as well as what can be done to prevent these problems. The potential implication of a phosphate ban in ADDs was determined. Further, it was the goal of the project to acquire material safety data sheets (MSDS) for the major ADD products, and contact the manufacturers who did not provide phosphate concentrations on the MSDS sheets. Finally, it was expected to establish the local context of ADD use in Cottage Country, and make recommendations regarding public education.

1.2 The Issues

The main issue surrounding this project is that many Automatic Dishwashing Detergents on the market today have high phosphate concentrations. With an increasing number of people living in cottage areas year-round, this brings increased usage of laundry machines, automatic dishwashing machines, and other technologies that are best left back in the city. Because cottages are reliant on septic systems, their effectiveness at processing the phosphates used by dishwashing machines is extremely important.

Otherwise, we could begin to see increasing eutrophication of our lakes, which are of

value for recreational, economic and intrinsic reasons. This report attempts to provide a comprehensive account of phosphates and automatic dishwashing detergents, through discussing all relevant topics (where information was available).

2. Phosphorus

2.1 What is it?

Phosphorus is a naturally occurring element, contributing 0.1% to the earth's crust (Grenon, 1994). Phosphorus, more than any other nutrient, promotes the growth of aquatic plants and algae. Plants use the radiant energy of sunlight to convert water, carbon dioxide, and other inorganic nutrients to the chemical energy of plant tissue through photosynthesis (Purves et al, 1998). It is essential to all plant and animal life, and thus is non-toxic. Because of this, it is used in many products, including organic and inorganic chemicals, animal foods, soaps and detergents, fertilizers, pesticides, and more. The commercial production of phosphates has increased significantly since the 1940's (Grenon, 1994).

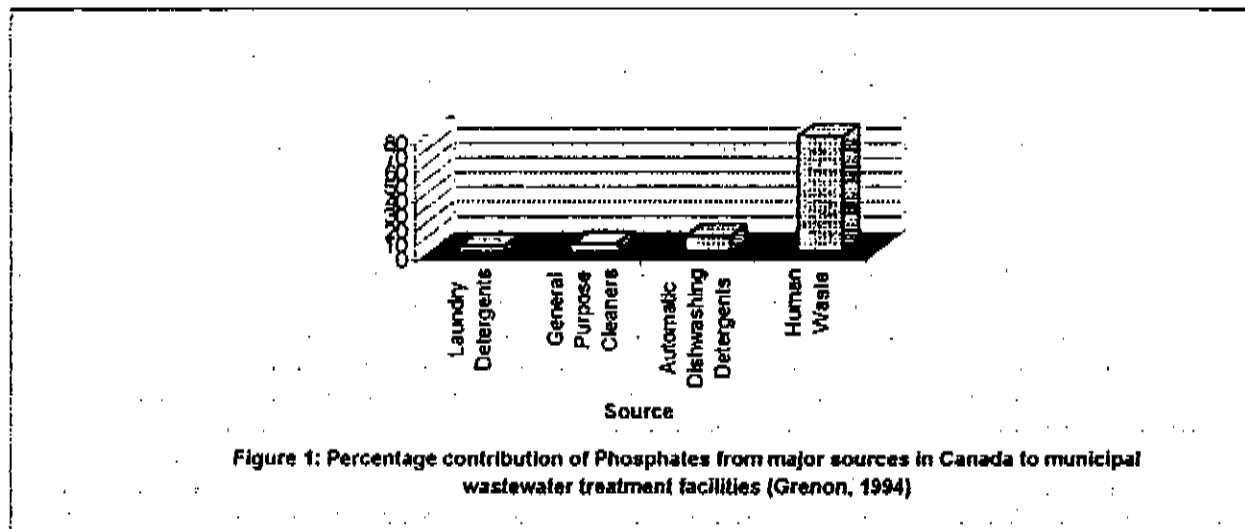
2.2 Phosphate sources

Phosphates are released into the environment through many sources, including non-point and point sources. These sources are subject to year-to-year variability, however, general trends are found (Chambers et al., 2001). Non-point sources include atmospheric deposition and land drainage from agricultural and urban areas, while point sources are primarily from Municipal Wastewater Treatment Plants (MWTPs) (which collect sewage and other urban wastewaters) (Purves et al., 1998).

2.2.1 Point Sources

Point sources are a major source of phosphates in water bodies, and the major sources of phosphorus including laundry detergents, general-purpose cleaners, automatic dishwashing detergents, and human wastes (Grenon, 1994). The total phosphorus load in

municipal wastewaters is approximately 5 563tons, after treatment and discharge from MWTPs (Chambers et al., 2001). Figure 1 outlines the contribution of various point sources to MWTPs in Canada.



Laundry detergents account for approximately 1% of total phosphate loadings, with 95% of commercial laundry detergents being phosphate-free, and 5% containing less than 2.2% (Chambers et al., 2001). In laundry detergents, as with ADDs, phosphates are used as builders, which maintain alkalinity, soften the water, keep dirt particles in suspension and increase surfactant efficiency (Grenon, 1994).

Like all detergent products, phosphates serve as builders in general purpose cleaners. Phosphates are not currently regulated under the Canadian Environment Protection Act for such cleaners. They account for approximately 3% of total phosphate loadings (Grenon, 1994). Their overall contribution is therefore largely insignificant.

More than 45% of Canadians currently use automatic dishwashing detergents, and this figure is increasing at about 5% per year. Table 1 shows the increase in the number

of automatic dishwashing machines in Canada. The use of phosphates in detergents is discussed in sections 2.4 and 5. of this report.

Table 1: Number of Canadian households with automatic dishwashers (Grenon, 1994).

| | Year | | | |
|---|-----------|-----------|------------|------------|
| | 1977 | 1988 | 1993 | 1997 |
| Number of households | 7 022 000 | 9 244 000 | 10 247 000 | |
| Number of households with automatic dishwashers | 1 530 796 | 3 817 772 | 4 629 000 | 5 700 000~ |
| % of households with automatic dishwashers | 21.8 | 41.3 | 45.17 | 51~ |

* The number of households with automatic dishwashers continues to increase by approximately 5% per annum (Chambers et al., 2001).

~ Approximate value based on numbers from Chambers et al., 2001

Because ADDs 'require' the use of phosphates, their contribution to total phosphorus loadings is more significant, at approximately 7% (Chambers et al., 2001), based upon an average phosphate concentration in ADD products at 6.0%. However, the results of this project, and those of Grenon (1994) indicate phosphate concentrations are likely much greater than 6%, with Grenon estimating an average level of 13.8%. This value increases the total contribution of phosphates from ADDs to approximately 10.6%, primarily in the form of P_2O_5 . Overall, Canadians use 42×10^3 tons of ADDs per year (Chambers et al., 2001). As a side note, modern dishwashing machines use approximately 28 litres of water per use, which makes them about 50% more water efficient than older-model dishwashers (UMN, 2000).

The largest component of point source phosphorus is human waste, with the average human excreting 1.8g/day of phosphorus (Chambers et al., 2001). Therefore, the human waste component contributes between 53% and 79% of all phosphate loadings (from Chambers et al. (2001) and Grenon (1994)). This makes it clear, that whether

phosphorus is released from MWTPs or septic systems, the largest contributor to overall loading is from human wastes.

2.2.2 Non-point Sources

Because this report was focussed on the impacts of ADDs on the environment, only a brief discussion of non-point sources is warranted. Phosphates can be deposited from the atmosphere onto lake surfaces from precipitation, dry deposition and turbulent transfer to the water surface (Grenon, 1994). Contributors to phosphorus in the atmosphere are numerous, and include fertilizer application, phosphoric acid production, elemental phosphorus production, forest fires, and many more (Grenon, 1994).

Urban run-off is also considered a non-point source, where water sewage systems collect wet weather flow from urban drainage and sanitary sewage (Grenon, 1994). No data was available as to the extent urban run-off contributes to total phosphorus loadings.

The principal source of phosphorus in Canada has been shown to be agriculture, as a result of soil erosion, land drainage, and the application of phosphate fertilizers and animal manure (Grenon, 1994). Further, Grenon estimates that agriculture accounts for more than 74% of total phosphate loading in Quebec, which would likely be fairly similar for Canada as a whole. Table 2 outlines various source contributions to total loading in Quebec.

Table 2: Total phosphate loading in Quebec (Grenon, 1994).

| Source | Quantity (KT of P ₂ O ₅ /year) | Percentage |
|----------------------------------|--|------------|
| Laundry Detergents | 0.5 | 0.98 |
| General Purpose Cleaners | 0.68 | 1.34 |
| Automatic Dishwashing Detergents | 1.21 | 2.39 |
| Atmosphere | 1.46 | 2.89 |
| Human Waste | 17.8 | 17.8 |
| Agriculture | 74.6 | 74.6 |

2.3 Why is phosphorus important?

In detergents, complex or condensed phosphates are used, typically in the form of P_2O_5 . In water, this form is unstable, and is usually hydrolysed to the orthophosphate form (PO_4^{3-}), which comprises approximately 50% of all phosphorus in wastewaters (Grenon, 1994). In municipal wastewater, approximately 70-90% of the phosphorus is bioavailable, that is available for the use and uptake by plants (Grenon, 1994). Some forms of phosphates are more available for others for plants, and therefore the composition of these forms in water is important. Without bioavailable forms of phosphates, they would not contribute to eutrophication.

2.4 Why is it used in detergents?

The major components of laundry and automatic dishwashing detergents are surfactants and builders. Phosphates are used as builders. The builder is the agent which gives the detergent its cleaning power. The use of phosphate-based builders in laundry detergents has largely been replaced, however their use is still continued in ADDs. It helps remove oil and dirt and keeps particles in suspension once they have been removed. Further, it helps prevent the hardness constituents in water (Calcium, Magnesium) from interfering with the action of the surfactant by combining with elements to form a soluble chemical complex. It further aids the wash process by making the water slightly alkaline (McGucken, 1991). Thus, phosphates provide many functions in detergents, and when they are replaced, many other compounds must be added to achieve the same qualities.

3. Eutrophication

3.1 General Discussion

The growth of plants in an ecosystem is referred to as primary productivity. An increase of primary productivity gives rise to an increase in productivity at all levels of the food chain, because of increased biomass (Purves et al., 1998). Nutrient enrichment can increase productivity of an ecosystem substantially, often creating significant problems. The process of nutrient enrichment and increased biological productivity of waters is known as eutrophication (Goulden et al., 1970). Because all lakes require nutrients for the production of life, some eutrophication is good for a lake. However, too much growth can interfere with all levels of aquatic life and can interfere with recreational activities. The problem of eutrophication became an international issue in the late 1960's, when Lake Erie and several European lakes were essentially declared dead, due to eutrophication, a result of increased nutrient loadings, with detergents contributing approximately 40% of total phosphate loading (Grenon, 1994).

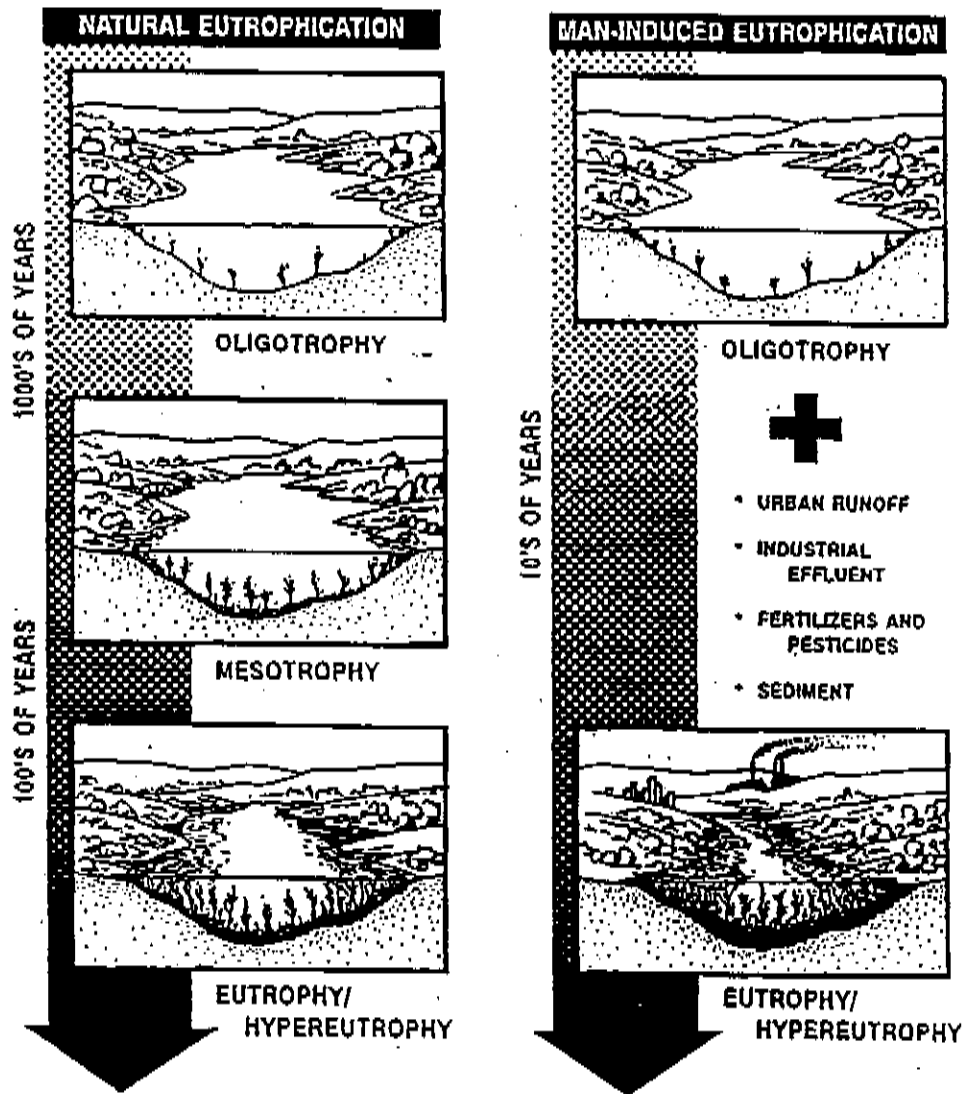
The law of limiting factors states the growth of plants (or animals) is controlled by a large number of factors, if one is inadequate or in excess, no matter how sufficient all other factors are, growth is limited. Major nutrients include phosphorus, nitrogen and potassium. Minor nutrients essential to plant growth include Calcium, Magnesium, Silicon and Iron. Other factors that contribute to excessive aquatic plant growth include availability of carbon dioxide, abundant sunlight, water clarity, warm temperatures and more (Goulden et al., 1970). Without these essential factors, aquatic life would not exist.

The addition of even small quantities of nutrients, particularly phosphates, upsets the ecological balance of a body of water and triggers abnormal growth of vegetation,

particularly algae. Figure 2 displays the differences between natural and cultural eutrophication. Algal growth becomes uncontrollable in eutrophic lakes, causing poor water quality; reduced dissolved oxygen levels, and increases turbidity. An extreme eutrophic lake turns green with algal blooms. As algae die, they sink to the bottom of the lake and decompose, using up the dissolved oxygen in the lake. Deepwater fish, such as lake trout, brook trout and salmon, which require moderate levels of dissolved oxygen often die off, while less desirable fish, such as sunfish and carp proliferate. These species are of little recreational, economic, or environmental value (T. Hutchinson, pers. comm.). Gradually, with the depletion of dissolved oxygen, anaerobic microorganisms become predominant, giving rise to bad smells and poor water quality. As the process proceeds, lakeshores and beaches become fouled by decaying algae. If the process is not halted, the lake quality deteriorates to the point at which it is essentially dead. However, as has been seen with Lake Erie, even a dead lake can, with time, become relatively healthy if action is taken in time.

The use of phosphate-based detergents contributed primarily to the eutrophic state of the Great Lakes, beginning in the 1940's. Usage peaked in the 1960's, at which point it was realized that Lake Erie and all other large water bodies had declined significantly (Grenon, 1994). After much research, and protest by the detergent industry, it was determined that phosphate detergents had a large impact on the eutrophic state of the waters and that action was necessary. This is an example of cultural eutrophication, which is preventable and controllable.

Fig. 4: Natural versus man-induced eutrophication (38)



— (left column) The progression of natural lake aging or eutrophication through nutrient-poor (oligotrophy) to nutrient-rich (eutrophy) sites. Hypereutrophy represents extreme productivity characterized by algal blooms or dense macrophyte populations (or both) plus a high level of sedimentation. The diagram depicts the natural process of gradual nutrient enrichment and basin filling over a long period of time (e.g., thousands of years).

(right column) Man-Induced or cultural eutrophication in which lake aging is greatly accelerated (e.g., tens of years) by increased inputs of nutrients and sediments into a lake, as a result of watershed disturbance by humans.

Figure 2: Cultural vs. Natural Eutrophication

From: U.S. Environmental Protection Agency, 1990

3.2 Lake Status

Since 1971, the Province of Ontario has, through the assistance of lake organizations, cottagers, etc, been able to undertake water quality assessments. Currently, the Ministry of the Environment (MOE) provides one free sample for phosphorus testing per year to most lakes. Further, many lake associations and the Federation of Ontario Cottagers often will pay for additional water testing. The MOE recommends the use of two key water quality indicators – water clarity measured by secchi disc and algal abundance (Cottagers Self-Help Program, 1989). Secchi disc depth is simply measured by measuring the depth at which the disc is visible from the surface, where poor visibility characterizes productive lakes with high algal densities, and good visibility indicates lakes with low algal densities. Algal abundance is measured by water samples, which are then analyzed photospectrometrically by the MOE or private laboratories.

4. Septic Systems

4.1 Introduction

Septic systems are used by more than 1/3 of US households (Robertson et al., 1991) and by more than ¼ of Canadian households (Chambers et al., 2001). Septic systems are designed to deal with the wastewater created in households, by making it harmless to the surrounding environment, preventing biological and chemical contaminants from polluting water supplies and water bodies. This section will focus on how septic systems work, what problems can arise if not properly used and maintained, how phosphates respond in properly and poorly designed systems, what the government is doing to ensure septic systems are maintained, and how septic systems can be maintained to ensure the environment is protected.

The introduction of the Ontario Environmental Protection Act in 1975 laid out specific details on the proper construction of septic systems. As of April 1998, the Ontario Building Code covers the installation of a new septic system. While these rules are put in place by the province, local agencies are responsible for the issuing of permits and doing inspections. In Haliburton County, this jurisdiction lies with the local Health Unit.

4.2 Design and function

The type of disposal system used varies according to lot size, topography, soil type, hydrologic conditions and sewage flows (Cottagers Self-Help Program, 1989). If conditions do not allow for a septic system, often a holding tank is used. This tank must be pumped regularly, and therefore is not a preferred method for most cottagers. The

Muskoka-Haliburton area is located on the Precambrian shield, with glacial till soils and many granite rock outcroppings (Cottagers Self-Help Program, 1989). Soils are often poorly developed in cottage country. Many lots are therefore unsuitable for septic systems, and are modified by the addition of filter material (sands), slope adjustments, and drainage alterations.

Septic systems, or wastewater disposal units consist of two major parts, the treatment tank (septic or aerated), and the seepage (or tile) bed (Bernhart, 1967). Figure 3 shows a basic schematic of such a system.

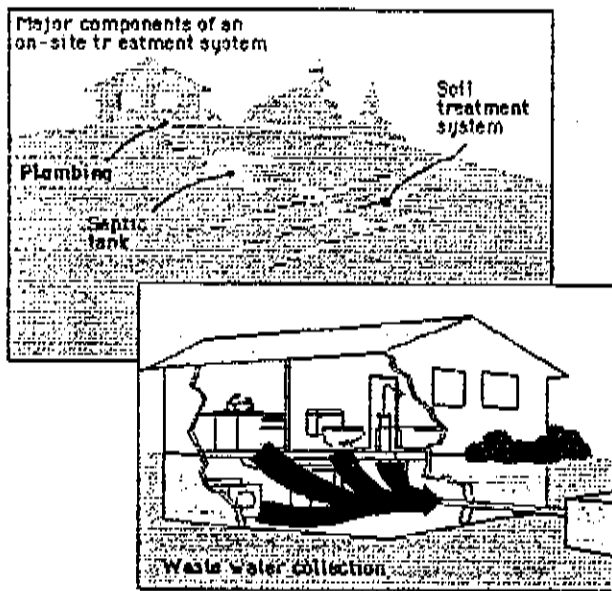


Figure 3: Typical household septic system design.

As water leaves the house, wastewater enters the septic treatment tank where it remains stagnant for two to four days (Bernhart, 1967). In the first few hours of that time, all of the dissolved oxygen of the wastewater is used up, and anaerobic actions reduce solid and dissolved pollutants. Within the tank, sedimentation and flotation occurs. Settleable solids sink to the bottom (forming the sludge layer – figure 4), and anaerobic bacteria reduce the sludge volume considerably. Solids lighter than water float to the surface.

where a grease and scum layer forms. It is this scum layer that resists anaerobic reduction in septic systems, and therefore must be periodically pumped out – every 2 or 3 years (Canter and Knox, 1988). Sludge also accumulates at the bottom of the septic tank, and is partially removed upon pumping. A small sludge layer is left at the bottom of the tank for seeding purposes (Bolton and Klein, 1976). If the tank is not periodically pumped, effluent can reach the tile bed, causing clogging and significantly reducing the lifetime of the system.

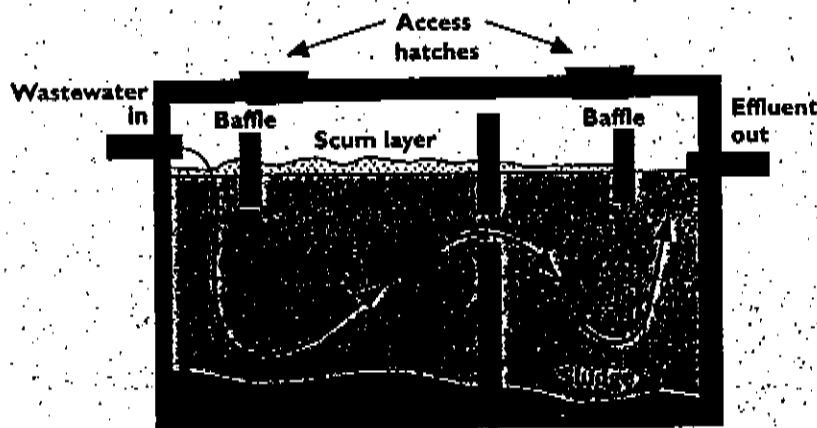


Figure 4: Basic septic tank design.

The wastewater which separates from the scum and sludge layer enters the seepage or tile bed as it is displaced by incoming water. It is important that septic tanks be designed with peak flows of water from the household in mind; otherwise the wastewater in the tank may enter the tile bed too quickly. In the tile bed, aerobic biological actions continue, reducing the biological oxygen demand and suspended solids. Larger microorganisms keep bacterial growth under control and keep the soil pores partially open for water infiltration (Bernhart, 1967). Most contaminants, such as bacteria and viruses are killed beneath the tile field. The aerobic actions depend on dissolved oxygen, which must be available as water reaches the tile bed. Oxygen must be

replenished from air, which is why typically a shallow layer of sand is placed above the tile bed.

Wastewater from the septic tank flows to the tile bed through a distribution box. The tile bed consists of underground perforated pipes or clay tiles which evenly distribute wastewater over the soil (Canter and Knox, 1988). Once the wastewater, now significantly cleaner, reaches the tile bed, it begins to infiltrate the soils beneath. The tile bed further treats the wastewater through bacterial action, removing suspended particles, organics, and other materials. The soils beneath the tile field play an important role in how effective the treatment system is at protecting the groundwater from contamination. Sands and muck soils have little ability of absorb nutrients and prevent their movement (FOCA, 2001), which is often a problem in cottage areas with poor soil structures. Clay and loam soils have a much greater ability to absorb nutrients over the long term, and are much more desirable. These considerations are supposed to be accounted for when designing the tile bed. Infiltration into the ground depends on the soil structure, its density, composition, chemical properties, and water content (Canter and Knox, 1988).

Septic systems in cottage areas are of great concern. They are often located very close to water bodies (often less than 15m, which is now the law), and can become saturated as the water table rises at certain times of the year. This contributes to excess leakage directly into the surrounding waters. Further, when shorelines erode, the likelihood of increased pollution is much higher, and not only involves nutrient pollution, but that of viruses and bacterial contamination.

4.3 Septic systems in Cottage Country

Cottage areas in Canada are unsewered, and therefore landowners must use on site sewage treatment, primarily in the form of septic systems. With an increase in the number of cottagers, the demand on the surrounding soils to purify wastewater is constantly increasing. Further, as our lifestyles bring things like laundry machines and dishwashers to these areas, septic systems begin to play an increasingly important role. Most laundry detergents on the market today are low-or-free of phosphates, however this is not the case with automatic dishwashing detergents.

The province of Ontario Ministry of the Environment has recognized since the early 1970's that septic systems in cottage areas need to be monitored and constructed properly. The Cottage Pollution Control Program (1970) was designed to study the cottage waste disposal problem, evaluate existing systems, and to enforce repairs to unsatisfactory systems. The MOE began a fairly comprehensive testing program in the Muskoka-Haliburton area to determine how well septic systems were working, beginning in 1986. The study of over 1000 septic systems on several area lakes determined that over 60% of septic systems were inadequate. This included 23% which were classified as substandard (which did not meet current standards, and are not currently polluting but may do so if not maintained properly), 39% considered nuisance (a system which allows grey water to be exposed to the surface, allowing phosphates and other nutrients to effect lake quality), and 1% direct polluters (which permit sewage or leachate to contaminate the ground or surface waters). Owners of these systems were contacted by the MOE and advised that their system should be monitored and may need to be upgraded in the near

future. Sixty-seven percent of those contacted had taken remedial action by 1987, a just over a year later. Further, of those who had not taken action, the majority were forced to sign agreements committing to upgrading by the summer of 1988. I do not know if this program has continued because of substantial cutbacks in all government departments. However, this program did show substantial success in getting cottage owners to take action, and was therefore very beneficial. It is recommended that programs such as these continue. However, general educational information can aid cottagers in making appropriate decisions about their septic systems. The Federation of Ontario Cottagers (FOCA) and the Ontario Ministry of the Environment provide several tips on proper septic system maintenance:

4.4 Septic System Guidelines:

1. First, ensure new septic tank systems are sited well back from the lake, at least 15-20 meters. This allows phosphorus from the septic system to be absorbed by soil and vegetation rather than reaching the lake. Further, ensure construction activities minimize soil and vegetation disruption on the property. Some areas have increased the minimum setback to 30m, which should become the standard for cottage areas.
2. Ensure disposal systems are in compliance with provincial regulations, and have them designed to accommodate larger than expected inputs. Put an inspection program in place by the local Health Unit to ensure septic systems around lakes are maintained.
3. Take care of your septic system by pumping regularly, at least every 2 to 5 years, depending on how often it is used.
4. Keep the area over the tile field grassed and left open to wind and to encourage evapotranspiration. Protect the tile field from tree roots that may damage and reduce the lifetime of the field. Ensure the tile bed is kept free of compaction by vehicles.
5. Minimize the use of water in the cottage. A smaller amount of water reaching the septic system reduces the potential for pollution and increases the lifetime of the system. Avoid the use of laundry machines and automatic dishwashing detergents where possible, because these use large quantities of water, and many dishwashing detergents contain large quantities of phosphates.

6. Plant trees between the tile bed and the lakefront. These will reduce the potential for contamination by stopping and absorbing nutrients. Keep shorelines natural, there is no need for lawn to extend right to the edge of the water. Vegetation slows erosion, especially in areas with poor soils. The Ministry of Natural Resources and many cottage associations have shoreline restoration programs in place; find out what you can do.
7. Have the septic system inspected regularly, at least every two years. Let the system grow with the household, upgrade when necessary. When in doubt, contact a local septic system company or the local inspection agency.

4.5 Phosphorus concerns

The ability of nutrients, such as carbon, nitrogen and phosphorus to travel beneath the septic tile field is very important. Some nutrients can travel long distances in the ground depending on soil type, amount of waste produced, and the shape of the septic system. Nitrogen often travels great distances through soils beneath septic systems (Robertson, 1995), while the phosphorus can be easily absorbed by soil particles, particularly clays (FOCA). The ability of phosphorus and its derivatives to migrate from septic systems, and its geochemical evolution along its migration, has been studied by several people, however it appears as though this field is still relatively poorly understood.

In the unsaturated zone, beneath the tile field, and the saturated zone (groundwater table), microbial and chemical reactions occur which reduce the effluent to closer to subsurface conditions (Canter and Knox, 1988). However, as stated by P. Dillon (pers. comm.), the use of high phosphate automatic dishwashing compounds can increase the phosphate loading on a septic system by as much as 50%. The ability of septic systems to handle this increased loading is the main concern. Jacks et al. (2000) have found that the efficiency of phosphorus removal in settling and infiltration is in the

order of 70%, while Ryding and Rast (1989, in Chambers et al., 2001) have found that 25-40% of P is retained. Robertson et al. (1998, in Chambers et al., 2001) demonstrated a total retention of 72%, in both the septic tank itself and the drainage field.

Clearly the retention of phosphates depends on the size and maintenance of the system, soils, its loadings and other things, and will therefore vary significantly between locations. Wilhelm et al. (1994) indicate that dissolved organic carbon (DOC) and ammonia (NH_4) are almost completely reduced beneath the tile bed, while PO_4^{3-} is typically detectable in groundwater beneath the bed, but appears to be advancing slowly, if at all. Robertson (1995) showed through long term monitoring that PO_4^{3-} in a sandy soil septic plume has migrated 20m from the infiltration bed over 17 years, with a concentration of $>1\text{mg/L}$. This indicates a migration velocity of about 1 meter per year for phosphates. Over a twenty-year lifespan of a septic system, the plume has the potential to reach groundwater and cause some degree of contamination. Further, Robertson (1995) found that while PO_4^{3-} migration is controlled by adsorption, the magnitude of migration is also governed by the constraints of mineral solubility, and this should be given priority in areas with sandy soils and high water tables. The research has generally found that phosphates migrate slowly in septic system plumes. Increased phosphate loadings may contribute to higher concentrations within the septic system itself and beneath the tile field, however the migration will likely follow the trend of approximately 1m per year.

In Ontario, the Ministry of the Environment has set a maximum recommended guideline of $20\mu\text{g/L}$ for total P in water bodies to avoid nuisance concentrations of algae in lakes (OME, 1984). Based upon the phosphate concentrations found within the septic

plume (at 1 mg/L) (Robertson, 1995), and given that the septic plumes can be very long (greater than ten meters in length), it is possible that when a plume containing this much phosphorus reaches water, it will significantly increase aquatic production. Septic systems must therefore be set back from water bodies as far as possible, to reduce the potential for the septic plume to interfere with aquatic life.

Regardless of how well maintained septic systems are, a given area has a finite capacity to absorbing the wastes leaching from these systems. In cottage country, the number of residences is increasing substantially, and with a further increase in the number of people living there year-round, the demand on local soils to absorb phosphorus and other nutrients could become too much. Since the mid-1970's, the MOE has used a water quality assessment model to determine development capacities of lakes in Ontario. The Lakeshore Capacity Model (LCA) is based on the input of phosphorus from septic systems, and is used to predict how much residential and commercial development a lake can sustain without impaired water quality. The Ministry of Natural Resources has used the model to protect recreational water quality and lake trout habitat. This model is currently under revision, however it could provide valuable insight into the capacity of a lake to respond to development. Further, it may take into consideration the increased use of phosphate automatic dishwashing detergents in cottage settings, which has traditionally been neglected. This tool will be very useful for local government planning purposes, specifically in cottage areas.

Cottage areas are susceptible to phosphate contamination because many septic systems have been in use since the cottages were originally built, often more than 30

years ago. Further, poor soil structure, rocky conditions, and proximity to lakes increase the likelihood of phosphates reaching water. Proper septic system maintenance, especially in areas such as these is mandatory. Using phosphate-based automatic dishwashing detergents is therefore not desirable in most cases, but more studies are necessary to determine if phosphates from dishwashing detergents pose a serious threat.

4.6 Further Discussion

This report was focussed solely on the impact of phosphates from ADDs. However, there are many ingredients in ADDs which are potentially dangerous to the environment, including chlorine bleaches, perfumes and other additives. Not only are these ingredients potentially harmful to aquatic life, but also they may interfere with the functioning of septic systems. Chlorinated compounds kill or inhibit bacteriological action in wastewater systems (Bolton and Klein, 1976). This reduces the quality of the effluent, resulting in a higher biological oxygen demand, more total suspended solids, and can result in the formation of hydrogen sulphide and ammonia (Canter and Knox, 1988). It is apparent that the impact of ADDs on the environment is not solely related to the use of phosphates, but the entire chemical formulation of most ADD products.

As a side note, it is relevant to discuss the potential impact of water usage from automatic dishwashing machines. The average North American household in 1971 used between 170 and 378 litres of water per day, for activities ranging from bathing to flushing the toilet (Zwick and Benstock, 1971). This is a substantial amount of water, especially for a septic system that is poorly constructed. Dishwashers originally used between 45 and 56 litres of water per cycle. However, current water and energy efficient

dishwashers have reduced that volume by as much as 50% (UMN, 2000). Therefore, a modern dishwasher will only contribute a small amount of water to the entire volume used in a given household, likely about 16% of total usage in a house using 170L per day. However, hand dishwashing often uses an equivalent volume (22.7L) compared to a modern dishwasher, or up to 60L if dishes are basin rinsed (UMN, 2000). In either case, the dish-washing process uses about 16% (or less for households consuming larger quantities of water) of total water used.

5. Detergents

5.1 What are they?

Detergents are defined as soaps, any of numerous synthetic water-soluble or liquid organic preparations that are chemically different for soaps but are able to emulsify oils, hold dirt in suspension, and act as wetting agents (Websters English Dictionary). Soaps have been used for 100's of years, initially made from animal and vegetable fats and caustic soda (McGucken, 1991) However, problems were faced with these soaps, as the fatty acids in soaps react with calcium and magnesium ions in the water to produce scum. In the 1930's, the first synthetic soap-like products appeared, made primarily from petrochemical derivatives. In the mid 1940's, it was discovered that combining surface-active ingredients with phosphates yielded a product with tremendous cleaning power while reducing the formation of scum. Modern detergents are composed of numerous chemicals, including stabilizers, perfumes, and disinfectants. The primary ingredients in detergents however are the surfactant and the builder (Goulden et al., 1970).

5.2 How do they work?

The surfactant is the suds-producing ingredient, and is soluble in both oil and water. This allows for further 'wetting', permitting the effective removal of particles and grease. Often, the surfactant comprises up to 20% of the packaged product (Goulden et al., 1970). The builder is the agent that gives the detergent its cleaning power. The use of phosphate-based builders in laundry detergents has largely been replaced, however their use continues in ADDs. Phosphorus helps remove oil and dirt and keeps particles in suspension once they have been removed. Further, it helps prevent the hardness

constituents in water (Calcium, Magnesium) from interfering with the action of the surfactant by combining with elements to form soluble chemical complex. It further aids the wash process by making the water slightly alkaline (McGucken, 1991).

The surfactants are organic chemicals, obtained through complex chemical reactions from oil or fat raw materials (European Centre for the Study of Phosphates, CEEP, 2000). For many years, the surfactant used in detergents was alkyl benzene sulphonate (ABS) (McGucken, 1991). This was the foaming ingredient which produced large quantities of suds when mixed with water and agitated. Since ABS is non-biodegradable, it persists in water, retaining its surfactant properties, resulting in foaming that would not go away. Research in the early 1960's lead to the development of a new surfactant, called linear alkylate sulphonate (LAS). This product is considered to be biodegradable, and since 1966 many detergents have used LAS as the primary surfactant, in both laundry and dishwashing detergent compounds. Comprehensive testing by the EPA in the United States indicated that waters released from sewage plants where LAS had been used all but eliminated the problem of foaming. Other surfactants include anionic soaps and ethoxylated fatty alcohols (non-ionic). Both non-ionic and anionic surfactants are currently used in ADDs (see appendices 1-4). However, there was another problem with the constituents, that of the builder, which was based upon phosphates, tripolyphosphates in particular (P_2O_5).

There is considerable variation in the amount of phosphate builder used in ADDs today. While in the US they are typically limited to 8.7% (D. Grieser, pers. comm.) in Canada, the range varies from approximately 4% to as high as 35% (see table 3). The use of phosphate builders in laundry detergents has all but been eliminated, with regulations

in Canada limiting concentrations to 5%. Specifically in dishwashing detergents, phosphates attach to water hardness minerals and prevent food particles from landing back on dishes (D. Griesing, pers. comm.). This gives the detergent the ability to work effectively in both hard and soft water conditions. Areas that legislate phosphate levels in laundry detergents have allowed the use of these phosphates in ADDs because the detergent industry has been unable to develop an ADD that will work satisfactorily.

Other main ingredients in detergents include bleaching agents, such as chlorines and sodium perborate. These chemicals eliminate difficult stains and kill bacteria through oxidation. Enzymes are used in many ADDs today, such as proteases, lipases and amylases. These function to catalyze the degradation of stains and therefore help in their elimination (CEEP). Detergents also use quantities of enzyme stabilizing agents, anti-redeposition agents, anti-foams, perfumes and other materials. Many detergents (such as Cascade) use fillers, which enable the adjustment of the active matter in the detergent to the doses needed. Common fillers include sodium sulphate in powders, and water and solvents in liquids (CEEP).

The Soap and Detergent Association (SDA) is comprised of industry representatives from the detergent industry. This organization voiced opposition to the theory that phosphates were indeed the cause of eutrophication in the Great Lakes in the early 1970's. The Vice President of the association, Dennis Griesing has been active in preventing jurisdictions from banning phosphate use in ADDs, claiming many things. The industry claims that they have been able to reduce phosphate levels, but elimination

is not foreseeable, because phosphates are the "major workhorse" ADDs. It is true that the industry has greatly reduced phosphate levels, and in the U.S a reduction of over 50 000 tons has been realized over the 1984-2002 period (EPA). However, Environment Canada assumes an increase of 7000 tons between 1992 and 1997 in the use of phosphates. Current estimated quantity of phosphate use in Canada stands at 42000 tons (Chambers et al., 2001). Further, with a growth rate in the use of ADDs in Canada at 5% (Chambers et al., 2001) and similar in the U.S, the increase or decrease in phosphate use may or not be significant.

The SDA and the major detergent manufacturers (Proctor and Gamble, Reckitt-Benckiser, Unilever) have claimed that inputs of phosphates into the environment from these products constitutes as little as 1% of total inputs. Environment Canada's figures put this at approximately 7% of total inputs, which seems low because they consider an average phosphate concentration of 6% (and the MSDS sheets reveal many phosphate levels well in excess of this figure, see appendices 1-4). Further, with new automatic dishwashing machines being built to be more energy and water efficient, the industry claims this puts further stress on the detergent to achieve proper cleaning, and only phosphates can handle this (D. Griesing, pers. comm.). New generation dishwashers use significantly less water than their older counterparts, using up to 60% less (UMN). Further, hand dishwashing can use the same amount of water a new dishwasher does, and if 'faucet rinsed', hand washing can use up to 266% more water than new dishwashing machines. However, the detergent requirement for new ADDs is just as much as older machines, and as stated previously, these new machines put further stress upon the detergent products used.

The European Centre for Phosphates (CEEP) claims that it is quite possible to formulate phosphate-free detergents which wash just as well as phosphate based ones. However, their claim is that because phosphates provide multiple functions in detergents (water softeners, preventing redeposition, etc), phosphate-free detergents tend to work less effectively, and require the use of greater quantities of other chemicals. Further, the European phosphate industry notes that phosphates are the only recyclable detergent ingredients, and by replacing them, we potentially introduce non-biodegradable compounds into the environment. The industry may have a fairly sound argument, however the development of biodegradable compounds is possible, and the potential for phosphates to disturb aquatic ecosystems is clear. The method of choice in these days of sustainability is to prevent pollution occurring in the first place, not just come up with better ways to deal with its consequences once released.

Phosphate bans have been put in place across North America in laundry detergents, in response to the problems of eutrophication. These bans have been very helpful, as it was estimated that detergents comprised more than 40% of the phosphate inputs into Lake Erie in the 1960's (Goulden et al., 1970). Currently, phosphate inputs to municipal treatment plants from all cleaning products combined are less than 10% of total (Chambers et al., 2001). However, these bans are only effective when better water treatment methods are used to further limit the quantity of inputs from wastewater. With human waste contributing more than 53% of total input of phosphorus to municipal water treatment plants (MWTPs), it is clear that this is the major source that must be controlled.

The impact of a ban of phosphate-based automatic dishwashing detergents has been quite controversial, right from the beginning of the debate in the late 1960's.

5.3 Implications of a phosphate ban

The literature studying the potential benefits of a total phosphate ban in detergents appears to be very inconclusive, for many reasons. Primarily, the battle between government agencies and the powerful detergent industry seems to be the root of the problem. However, lakes are complex ecosystems, and it is very difficult to quantify total phosphorus inputs and determine their sources and sinks.

In 1970, the IJC recognized that the removal of phosphorus from wastewater effluents is essential for reducing the eutrophication potential of these effluents on receiving waters (Leversedge, 1974). The detergent industry, through the SDA claimed that the best way to do this was through the creation of nutrient removal treatment facilities at sewage treatment plants (T. Lee, in Leversedge, 1974). However, the IJC did not feel that this method would work fast enough to immediately reduce phosphate loadings, and thus partial limits on the concentrations of phosphates were introduced through the Canada Water Act in Canada, and through numerous state legislatures in the U.S.

Many studies were done at this time to determine the potential impact of reducing phosphates in detergents. Various reports, including the works of Shannon and Kamp (1973, *in* Cottagers Self-Help Program, 1989) found that phosphorus removal from detergents would decrease the total phosphorus loadings at MWTPs by 25-50%, with Grenon (1994) estimating the regulations reduced the amount of phosphates discharged from detergents by 80%. The reductions set forth in the 1970's by both the U.S and

Canada are credited with essentially saving the Great Lakes from oxygen depletion and deadly eutrophication. Currently these lakes continue to face many problems, but eutrophication is all but removed.

The impact of a further total phosphate ban is now being considered by many areas that are still concerned with eutrophication. The general opinion seems to be that there may have been the situation where the detergent phosphate ban in the 1970's resulted in an improvement in a waterbody's water quality (Hoffman and Bishop, 1994). However the detergent's contribution of the phosphorus in wastewaters has declined significantly, to the point where a phosphate ban would not impact the phosphorus content of domestic wastewaters sufficiently to cause an improvement in eutrophication-related water quality (Grenon, 1994). The contention is that phosphorus concentrations have been lowered so significantly that any eutrophication currently occurring is due to other sources, such as agriculture and industry (see figure 1). Currently, detergents (including ADDs, laundry detergent and general purpose cleaners) contribute approximately 10% to the total phosphorus loading in municipal wastewaters (Chambers et al., 2001). Further, these products contribute roughly 7% of the total phosphate load in Canada (Grenon, 1994).

Lee and Jones (1986) reported that a minimum 25% reduction in the bioavailable phosphorus load to a water body is needed before a noticeable change in the planktonic algal biomass would occur, after a comprehensive 5-year study was performed. A ban on phosphates in laundry detergents and improved wastewater treatment facilities in Chesapeake Bay Virginia resulted in a 16% decrease in the available phosphorus in the bay and James River between 1984 and 1992. However, this decrease did not result in a

change in water quality in the region (Lee and Jones, 1995). Therefore, many recent works, including that of Grenon (1994) have concluded that a regulation limiting phosphate concentration in ADDs would have little or no impact on the total amount of phosphates released in Canada, and that such regulations would not improve water quality significantly.

6. Regulations

1 History

Eutrophication was determined to be the major cause of pollution in the lower Great Lakes in September 1969, after four years of research. The Joint Canadian United-States Advisory board submitted a report to the International Joint Commission (IJC) identifying that the major cause for this advanced stage of eutrophication was the addition of phosphorus, particularly since the late 1930's. Following this report, the issue of eutrophication and control of phosphorus loadings became a major issue internationally.

The investigation conducted by the IJC between 1964 and 1969 showed an advanced state of eutrophication in Lake Erie and evidence of substantial decline in the water quality of all of the lower great lakes water bodies. The investigation determined that the largest change in nutrient loadings was the amount of phosphorus, particularly from municipal sewage, land run-off, and industry. The primary sources of phosphorus in municipal sewage were human waste and laundry detergents, which often contained more than 70% phosphates (Leversedge, 1974). Between 1931 and 1966, the use of detergent phosphate rose from 0.03lbs to 1.5lbs per person in Canada (Leversedge, 1974), a significant increase, especially in Southern Ontario.

The report to the IJC recommended specific water quality objectives for the lower Great Lakes, involving drastic reductions of the phosphate loadings. The report recommended several stages, beginning with the reduction and elimination of phosphate compounds in detergents, the treatment of sewage waste to reduce nutrients, and control of run-off and other non-urban sources.

The decisions made by the Advisory Committee to the IJC were essentially groundbreaking at the time, involving a new advance in public-decision making (Leversedge, 1974). The Advisory Committee's recommendations were put forth solely to preserve environmental quality, and were not directly related to protecting the environment for human health. Traditionally, all decisions regarding environmental concerns were only addressed when the health of the human population was threatened. Public hearings were then held in the lower Great Lakes basin, and focussed on the "posited connection between the use of sodium tripolyphosphate in detergents and the eutrophic state of many lakes" (Leversedge, 1974; p84).

The detergent companies attacked the hypothesis that phosphorus was the limiting nutrient, that is the nutrient that, when in excess, allows uncontrolled growth. They argued that carbon, nitrogen, and phosphorus were all essential to plant growth, and that any one of these could be a limiting agent. The Canadian government and the United States congress's scientists however determined that not only was phosphorus the limiting nutrient, but it was the only nutrient that could be controlled. The detergent industry's argument was that phosphates were an essential and safe constituent of detergents, the properties of which are well known (which was not the case with possible substitutes), consumers were not prepared to sacrifice the cleaning power phosphates provide, and that detergents were only one source of phosphate inputs among many. The counter argument among scientists hinged on the availability of a substitute.

In 1970, the IJC recommended that waste treatment and phosphate replacement was necessary in order to attack eutrophication. Canada immediately regulated the level of phosphorus in detergents through the Canada Water Bill. In January 1971, the content

of phosphorus pentoxide (P_2O_4) in detergents was limited to 20% by weight, with a further reduction to 5% by the end of 1972. The United States lagged behind Canada's rapid action, however most of the Great Lakes states had regulations in place emulating those of Canada by the end of 1971.

The search for a substitute for phosphates was long and arduous. The major focus was placed on the tri-sodium salt of nitrilotriacetic acid (NTA). Canada, in its research decided that NTA did not present a threat to human health, while the United States Surgeon-General did, stating "the potential danger to human health was felt to be greater from NTA than from continued use of phosphates in detergents" (Leversedge, 1974; p90). NTA was thought to be a possible human carcinogen. Differing policies on the use of NTA in the two countries created problems in establishing standards for nutrient loadings in the lakes. Research showed, however, that NTA was not the dangerous compound it was thought to be.

In Canada, the Great Lakes are the centre of population and economic activity. In the states surrounding the Great Lakes the economic activity and population may overshadow that of Canada, but they are a smaller focal point. Therefore, the policy enacted in Canada was given national accord, while in the US, was given regional priority. To this day, Canada regulates the use of phosphates in cleaning agents through the Canadian Environmental Protection Act (CEPA, 1999), while individual states in America are given the opportunity to regulate phosphates. Provinces in Canada have jurisdiction over their own water bodies, and often set guidelines different from national guidelines. However, the provinces do not have jurisdiction over product formulations

(JD Whall, pers. comm.). Environment Canada believes that there is a need for national guidelines for products of this nature (JD Whall, pers. comm.).

6.2 Canada

In Canada, phosphorus concentrations are currently regulated under the Canadian Environmental Protection Act (CEPA) 1999. The original regulations were under the Canada Water Act of 1970, with recommendations put forth by the International Joint Commission (IJC). In these regulations, the legislation permitted the regulation of "the manufacture, use, sale or import into Canada of any cleaning agent or water conditioner containing nutrients" (CWA, 1970), and came into force on August 1, 1970. The first regulations limited the phosphate content of laundry detergents to 20% phosphorus became law on January 1971. Further, the Canadian government limited the permitted level of phosphates to 5% (or 2.2% by weight as elemental phosphorus) by the end of 1972.

In 1988, the CEPA was created with the intention of responding to environmental pollution caused by toxic substances and wastes. It incorporated provisions in the Canada Water Act to allow regulation of nutrient content in cleaning products and water conditioners, where a:

"Cleaning Product" – is a phosphate compound or other substance that is intended to be used for cleaning purposes, and includes laundry detergents, dishwashing compounds, metal cleaners, de-greasing compounds and household, industrial and commercial cleaners.

"Nutrient" – a substance or combination of substances that, if released in any waters, provides nourishment and promotes the growth of aquatic vegetation.

“Water Conditioner” – a substance that is intended to be used to treat water, and includes water-softening chemicals, anti-scale chemicals and corrosion inhibitors.

CEPA 1999 Part 7, Division 1, 116.

The regulations put forth in CEPA 1988 were amended in CEPA 1999, with the new regulations stated to “emphasize pollution prevention and the consideration of a holistic ecosystem approach when addressing environmental contamination” (E. Roberts, pers. comm.). Therefore, the regulations allow for the regulation of nutrients in cleaning products and water conditioners;

“for the purpose of preventing or reducing the growth of aquatic vegetation that is caused by the release of nutrients in waters and that can interfere with the functioning of an ecosystem or degrade or alter, or form part of a process of degrading or altering, an ecosystem to an extent that is detrimental to its use by humans, animals or plants” (CEPA 1999 Part 7, Division 1, 118).

The section amended in the 1999 CEPA gives the Minister the authority to regulate nutrients in all cleaning products and water conditioners (CEPA 1999 Part 7, Division 1, 117), and not solely in laundry detergents cleaning agents (which was the case with CEPA 1988). To date, the federal regulations made under CEPA focus only on controlling phosphorus in laundry detergents, to a maximum permissible limit of 2.2%, and phosphate concentrations in laundry detergents are still the only “nutrient” regulated under CEPA. Currently, 95% of all laundry detergents sold in Canada are phosphate free, while 5% contain up to the allowable 2.2% (Chambers et al., 2001).

Therefore, it is possible under the CEPA to regulate nutrient content in other cleaning products, such as automatic dishwashing compounds, however it has not been proven that these products fulfill the conditions of CEPA 1999 Part 7, Division 1, 118.

Further research must be done to determine if ADDs do indeed impact the aquatic environment.

6.3 United States

The United States has taken a slightly different approach to the regulation of nutrients. Currently, such regulations lie with individual states, and therefore laws can vary in different regions. Most states surrounding the Great Lakes had enacted laws similar to Canada by 1973 (Leversedge, 1974), regulating phosphate concentrations in laundry detergents. Many states went on to ban phosphate detergents, including Indiana, Michigan, Minnesota, New York, and more. The manufacture of phosphate-based detergents ended voluntarily in 1994 after these bans had been established (USGS, 2000). Currently, more than 40% of the states have legislation on phosphorus (Grenon, 1994).

No states have banned the use of phosphates in automatic dishwashing detergents. However, several states, including Massachusetts, Washington and Arkansas, have considered banning phosphates from ADDs (Grenon, 1994). However, intense lobbying and little research resulted in phosphate levels being limited to 8.7% by weight (or 20% as phosphorus pentoxide) in many jurisdictions. This level has become the de facto national standard (D. Griesing, Pers. comm.). Further, phosphorus concentrations are provided on the packages of ADD products, unlike in Canada, deriving from a voluntary agreement from the 1970's. This is demonstrated by the Proctor and Gamble ADD products which list phosphate concentrations, because of the use of North American packaging. However, other multi-national companies including Unilever and Reckitt-Benckiser do not label product concentrations in Canada.

6.4 Abroad

Many countries across the world have banned phosphorus in laundry detergents, including Switzerland, Venezuela, Japan and Austria. Germany and Finland allow between 5 and 7% phosphorus (Grenon, 1994). Voluntary agreements have been made between the detergent industry and Netherlands, Sweden and France, limiting phosphorus in laundry detergents to 5 or 7.5% (Grenon, 1994). However, it seems as though the focus in the European Union (EU) has been on removal of phosphates from sewage through treatment methods, rather than through comprehensive phosphate bans. In fact, the European Union "Ecolabel" for laundry detergents allows for the inclusion of up to 27% phosphates by weight. There is no available information regarding either a full or partial ban on phosphate use in ADDs in any of these countries, however many phosphate free ADDs have been on the market since at least 1994 in Europe (Grenon, 1994).

7. Brands researched

The brands of automatic dishwashing detergents used in this report are those which are commonly available at grocery stores. These brands claim to have almost 99% of the ADD market in the U.S. (SDA website). Many independent companies, such as Owl Innovations of Sutherland ON produce phosphate-free formulations, however these products are not easily accessible to the average consumer. Shaklee Canada also markets a phosphate-free detergent, available only to Shaklee members. Due to time constraints, I was unable to search for similar products. Further, the sale of these products accounts for only 0.35% of all detergents (SDA). These products are often much more expensive than their counterparts and many do not work as well as their major competitors.

7.1 The Brands

| | |
|--------------------|--|
| Proctor and Gamble | Cascade Powder Cascade Tablets Cascade Pure Rinse Gel |
| Unilever Canada | All Sunlight |
| Reckitt-Benckiser | Electrasol Dual Action Tabs with Baking Soda Electrasol Gel with Baking Soda Electrasol Lemon Scent Gel Electrasol Tabs with Jet-Dry Electrasol Dual Action with Baking Soda |
| President's Choice | Clear Choice |
| Sobey's | Our Compliments – Brilliance Smart Choice |

7.2 Phosphate findings

Each manufacturer was contacted regarding their product(s), as described in the Methodology section of this report (section 9). Phosphate levels in the ADDs are provided below in table 3, where they were made available.

Table 3: Product Information and Phosphate Concentrations (where available)

| Manufacturer | Product | Phosphate Concentration (as P ₂ O ₅) | MSDS available |
|----------------------|--|---|----------------|
| Reckitt-Benckiser | Electrasol Lemon Scent Gel | <20 | y |
| | Electrasol Lemon Scent Gel, Canadian | 4 to 6 | y |
| | Electrasol Tabs with Jet-Dry Powerball | <35 | y |
| | Electrasol Tabs with Baking Soda | Unavailable | y |
| | Electrasol Dual Action | <40 | y |
| | Electrasol Gel with Baking Soda | Unavailable | y |
| | Shaklee Canada | Basic-D Dishwashing Concentrate | 0 |
| Unilever | All | Unavailable * | y |
| | Sunlight | Unavailable * | y |
| Korex Canada/Loblaws | President's Choice Clear | Unavailable | y |
| Proctor and Gamble | Cascade Tablets | 8.5 | y |
| | Cascade Powder | 7.4 | y |
| | Cascade Pure Rinse Gel | 4.4 | y |
| Sobey's | Smart Choice | Unavailable | n |
| | Our Compliments Brilliance | Unavailable | n |

* Unilever claims that sodium tripolyphosphate is third on the list of 9 ingredients, which could be at least 20%.

8. Material Safety Data Sheet Information

Part of this project involved the assembling of Material Safety Data Sheets (MSDS) for automatic dishwashing detergents available on the market today. The primary goal of this is to obtain phosphate concentrations within the dishwashing compounds from these data sheets.

MSDS sheets are required under Canada's Workplace Hazardous Materials Information System (WHIMIS). MSDS requirements are set out under the Hazardous Products Act (HPA) and associated Controlled Products Regulations. These regulations are administered through Health Canada. Therefore, information provided on MSDS sheets is only required to be presented for materials which are considered in the HPA and the Controlled Products Regulations. The aim of MSDS information and WHIMIS in general is balance the workers right-to-know with industry's right to protect confidential business information.

MSDS sheets were obtained from each of the major detergent manufacturers (Unilever, Proctor and Gamble, and Reckitt-Benickser), as well as from President's Choice (see appendices 1-4). Because MSDS sheets are only required under the right-to-know regulations of WHIMIS, they are not available to the general public. *Many of the manufacturers contacted would not provide MSDS to individuals.* For this reason, Sobey's Private Label brands would not provide me with MSDS sheets for their Our Compliments and Smart Choice brand ADDs. Unilever would not provide MSDS sheets when asked to do so over their consumer information line, however upon contacting them through e-mail, the MSDS were obtained without question. Proctor and Gamble's MSDS sheets are provided on their general website, and hence are accessible to the general

public. Reckitt-Benckiser and President's Choice both provided product MSDS information happily.

Because MSDS sheets are designed to provide information regarding hazardous materials to people in the workplace environment, only constituents considered hazardous are required to be identified. For this reason, manufacturers are not required to list phosphates on MSDS sheets, because phosphates are not regulated under the HPA. Proctor and Gamble lists all product ingredients in their MSDS sheets, identifying regulated substances. All other manufacturers do not list entire ingredients, only those under the Hazardous materials section of the sheets. However, many manufacturers do list approximate tripolyphosphate concentrations in this section though they are not required to do so. Further, because WHIMIS protects industry's right to protect confidential business information, they are not required to disclose ingredient information.

From the MSDS information, it is apparent that sodium carbonate is the most common ingredient in ADDs, followed several other sodium complexes, enzymes, alcohols, and phosphates. All MSDS sheets obtained are available in the following appendices:

| <u>Manufacturer</u> | <u>Brand</u> | <u>Appendix</u> |
|------------------------------------|-----------------------------------|-----------------|
| Proctor and Gamble | Cascade Powder | A1.1 |
| | Cascade Tablets | A1.2 |
| | Cascade Pure Rinse Gel | A1.3 |
| Unilever Canada | All | A2.1 |
| | Sunlight | A2.2 |
| Reckitt-Benckiser- (Electrasol) | Dual Action Tabs with Baking Soda | A3.1 |
| | Gel with Baking Soda | A3.2 |

| | |
|------------------------------|------|
| Lemon Scent Gel | A3.3 |
| Tabs with Jet-Dry | A3.4 |
| Dual Action with Baking Soda | A3.5 |

| | | |
|--------------------|--------------|------|
| President's Choice | Clear Choice | A4.1 |
|--------------------|--------------|------|

9. Methodology

The following section outlines the details of how manufacturers were contacted to get product information.

9.1 MSDS sheets

Each manufacturer was contacted to request MSDS sheets. Manufacturers were contacted either by telephone or through the Internet to request information, and MSDS sheets were obtained from all manufacturers except Sobey's, who would not release the information citing business confidentiality reasons. Details are provided in the Material Safety Data discussion (section 8.) of this report.

9.2 Telephone Interviews

Each manufacturer was contacted by telephone interview with the hope of determining the phosphate concentrations in their products. The telephone interview questions were approved by the Trent University Environmental and Resource Studies Ethics Committee, chaired by David Holdsworth. A sample interview outline is provided in appendix 5.1. Interview questions and details are available for each manufacturer in appendices 5.2-5.5. Proctor and Gamble however was not contacted because they provided phosphate information previously. Because the interview had to be reviewed by the Ethics Committee, the results of this method were not fruitful. It was required that each manufacturer be asked for consent to make the information they provided public, as a company response to the questions. This action was responsible for the lack of success

with this approach. As mentioned previously, details as to the exact company responses are provided:

Reckitt-Benckiser, appendix: 5.2
President's Choice, appendix: 5.3
Sobey's, appendix: 5.4
Unilever, appendix: 5.5

9.3 Letter and Results

As an additional method, each manufacturer was contacted via letter mail, requesting information regarding product phosphate concentrations, the reasons for use of phosphates, company research and innovations, and more. A sample letter is available in appendix 6. The letters were sent out to each manufacturer on November 3, 2001 hoping to receive responses by the end of the month. Addresses mailed to include all 'consumer response' addresses found on product labels. Further, letters were sent to the manufacturer of President's Choice brand product, Korex Canada, to the Reckitt-Benckiser address provided on their MSDS sheets, and to the Unilever Canada consumer response centre address provided on the company letterhead. Summary of responses is as follows:

Reckitt-Benckiser: Did not respond initially. One letter mailed (sent to address on product label) was returned by Canada Post, company not found/moved/incorrect address. Contacted by telephone on November 26th with telephone interview. This interview led the manufacturer to respond with a letter (available in appendix 7.1), however no product information was provided. Further, the correspondence sent from the company was not useful. It was stated that Reckitt-Benckiser products (Electrasol) were labelled with phosphate concentrations. However, this is not true in Canada, and it was determined in a follow-up call that their products are labelled only in the United States. An attempt was made to speak directly with the letter-writer to determine if they would provide me with phosphate concentrations, however the call was not returned.

Unilever: Did not respond. Contacted by telephone interview (appendix 5.5), with little luck. However, company did state that the proper method was to write a letter (which

had already been done). A second letter was issued on November 26th (by fax). As of December 16th, no response had been received. Was only able to get MSDS sheets through the Internet.

President's Choice: Did not respond. However, when contacted by telephone interview on November 29th, the representative realized that it I had sent the letter dated November 3rd, and it is likely this is why a written response was not received. No useful information provided (see appendix 5.3).

Sobey's: Response received November 20th. Company position is not to provide such information because of business confidentiality. Response is available in appendix 7.2.

Proctor and Gamble: Contacted me on December 6th by telephone, regarding when the information requested was required by. Written response received December 7th by fax. Response is available in appendix 7.3.

9.4 Commentary

Typically when contacting individual people for research, either by phone or in person, an ethics review is warranted to protect the individual. Because this project involved contacting companies, it was not believed an ethics protocol was required. However, I was told that I needed to submit a protocol. Upon doing so, I was required to state who I was, what my research was for, and make it known that the information they provided would be made public. This requirement made this methodology ineffective because manufacturers are unlikely to disclose information which will be made public. It was quoted by Unilever (see telephone interview, appendix 5.5) that the phosphate levels would be provided to me if I were not going to publicize the findings, however because I could not ethically state that, I was unable to get the product information.

It is surprising that more responses were not received from the letter which was sent. These companies are in business to respond to consumers; after all it is us who purchase their products. Further, they have a responsibility to address our concerns in a

timely manner. The only company who was very helpful was Proctor and Gamble, however it took more than a month to receive their response. Sobeys was the first company to respond to the letter, however they did not provide useful information, and were quite defensive in the telephone interview. In the letter sent, I requested that information be sent regarding their phosphate concentrations, any testing or research conducted by the company, and what they had done to lower phosphate concentrations. However, no response received addressed all questions posed.

9.5 Barriers to Research

In September, upon starting this project, it was discovered that there is very little information available on the use of phosphate-based automatic dishwashing detergents. The scientific community has done little research in this regard, except for a few government reports, and many studies performed in the 1970's surrounding laundry detergents. Research into the subject a long period of time, and was often not fruitful. Government reports were often very difficult to access, for instance, the report by Grenon (1994) was not found until early December. The report was located at a secluded Environment Canada library in St. Foy Quebec. No one in Environment Canada had heard of any specific research conducted, or anyone at the Canadian Institute of Water Research. These setbacks led to research on basic phosphorus principles and septic systems.

Further obstacles were encountered in dealing with the detergent industry. As stated previously, many companies did not respond to telephone calls or letters. Because they are not required by law to provide the information requested, they often did not. The

law gives the industry the right to protect 'confidential business information'. A lot of the information provided by the industry, through individual company websites and the Soap and Detergent Industry, is essentially propaganda, and therefore is not useful.

However, a lot was learned in the process of data collection. I realized how difficult it can be to get information from anyone, and the importance of persistence. I learned about septic systems, eutrophication, detergents, and more, and the limitations and barriers that can be encountered when undertaking research on a fairly poorly understood topic.

10. Product Testing

Two companies were approached to have automatic dishwashing detergents tested.

Lakefield Research, Lakefield Ontario.

Contact: Christopher Sullivan.

Phone: 705-652-2308 ext. 2372

Details: Cost for analysis is \$31.25 per sample plus \$5.50 for sample preparation.

Zenon Laboratories, Burlington Ontario.

Contact: Kim Risi

Phone: 905-332-8788

Details: Cost for analysis is \$13.00 per sample plus \$10.00 for sample preparation, minimum billing of \$75.00.

Both companies expressed reservations about the effectiveness of the techniques they would use due to interference from the formation of suds. However, both later outlined they felt this obstacle could be overcome with adequate sample preparation and fairly high sample phosphate concentrations (greater than 1%). The sample testing costs are in addition to the purchase costs of the products to be tested.

The testing of products that did not provide phosphate concentrations however is not recommended at this time. It would be a better choice for the Advisory Committee to promote only those products that provided phosphate concentrations willingly, as a method of telling the detergent industry that it is their responsibility as manufacturers to provide consumers with the information they desire.

11. Conclusions

Apparently the use of phosphates is required in automatic dishwashing detergents. It has been thirty years since the detergent industry was forced to find a replacement for phosphates in laundry detergents, and the industry was able to do so in less than 4 years. The Canadian government sees no use in banning phosphates in ADDs, citing that they only contribute a small amount of total phosphate loadings. Total phosphate loading from ADD products is somewhere between 7% and 10% (Chambers et al. (2001) and Grenon, (1994)). With a reduction in phosphate loading of at least 20% required to prevent or reverse eutrophication (Grenon, 1994), a ban on phosphate use in ADDs would not be beneficial. However, the use of dishwashing machines is increasing at 5% per year, with almost 50% of Canadian households owning one. As this figure continues to increase, additional phosphates will find its way into our lakes and rivers. Average phosphate concentration was determined to be approximately 17% from the data collected. This is slightly higher than the average levels determined by Grenon (1994) and Chambers et al. (2001).

The use of septic systems in cottage areas is mandatory, however the physical locations are often not conducive to proper septic system construction and maintenance. Poorly developed soils and rocky topography creates the potential for contamination. These systems are the primary barrier protecting the environment from the harmful waste products created from households. With typical phosphate migration in sandy soils at 1 meter per year, and a setback from water of 15 meters, it could be expected a well maintained septic system could contaminate water within 15 years of use. Current

practice of locating new septic systems 30m back from shore will ensure protection of lakes and rivers for an extended period of time.

As an increasing number of people begin to live at cottages year round, using laundry machines, dishwashing detergents, household cleaners, etc., the demand put on septic systems increases significantly. These areas are especially sensitive to environmental degradation, and must be safeguarded appropriately. The use of phosphate-based detergents in cottages is therefore not recommended, and steps must be taken to ensure the availability of phosphate-free detergents. It is amazing that the detergent industry, when forced to, found a substitute for phosphorus in laundry detergents in less than 4 years. If the industry was forced to do the same thing for automatic dishwashing detergents, we could likely expect to see the same sort of results. Pressure must be put upon the industry to develop effective alternatives. In addition, further research must be conducted on this topic, which will become increasingly important in the future.

12. Recommendations

Several steps should be taken in order to ensure the protection of our natural environment from the hazards of modern day technology. While a precautionary approach would be optimal, our society is not willing to sacrifice the conveniences of modern technology. We must:

- Develop an effective and ongoing septic system inspection program in cottage areas, providing financial penalties to those who do not maintain their septic systems. We must ensure that new septic system construction is monitored by local inspection agencies. We also need to ensure the general public is aware of the importance of maintaining septic systems, through educational campaigns.

- Conduct further research into the replacement of phosphates in ADDs and the potential harm these detergents may cause the environment (not only from phosphates, but from all detergent constituents).
- Lobby government to place restrictions on phosphate concentrations in ADDs.
- Aid companies who produce phosphate-free ADDs. through marketing and increased public awareness that such products exist.

Thanks are due to several people for their support, including Frances Enns (and those at the TCCBE), Doug Evans (supervisor), Val Bishop (project host), Kate Hall (at U-links), J.D Whall (at Environment Canada), and those at the County of Haliburton Advisory Committee on the Environment. Without the advice and contributions of these people, I would not have been able to complete this report. Thank you very much; this project has been an invaluable learning experience for me.

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Page 1 of 4
 Procter & Gamble
 Fabric and Home Care Division
 Ivorydale Technical Center
 5299 Spring Grove Avenue
 Cincinnati, OH 45217-1087

MATERIAL SAFETY DATA SHEET

MSDS #: D00001M

Supersedes: N/A

Issue Date: 3/7/00

Issue Date: N/A

SECTION I - CHEMICAL PRODUCT

Identity: Powder Automatic Dishwashing Detergent

Brands: CASCADE Powder (All Variations)

Hazard Rating:

| | | |
|---------------|---|-------------|
| Health: | 1 | 4=EXTREME |
| Flammability: | 0 | 3=HIGH |
| Reactivity: | 0 | 2= MODERATE |
| | | 1=SLIGHT |

Emergency Telephone Number: 24hr P&G Operator: 1-800-765-5516 or call Local Poison Control Center

SECTION II - COMPOSITION AND INGREDIENTS

Ingredients: Complexed sodium phosphates and sodium carbonate, oxygen bleaching system and enzymes, nonionic wetting agents, sodium silicate, sodium sulfate, perfume and dye.

Under normal consumer use, this product would not constitute a hazardous product under OSHA Hazard Communication. With increased industrial exposure this mixture, when tested as a whole, is considered an inhalation hazard within the meaning of the OSHA Hazard Communication Standard.

Hazardous Ingredients as defined by OSHA, 29 CFR 1910.1200.

| Chemical Name | Common Name | CAS No. | Recommended Limits | Composition Range | LD50/LC50 |
|-------------------|--------------------|-----------|--------------------------------------|-------------------|-----------|
| Subtilisin (P) | Proteolytic enzyme | 9014-01-1 | ACGIH TLV: 0.00006 mg/m ³ | <1% 7.4% | |

SECTION III - HAZARDS IDENTIFICATION

Health Hazards (Acute and Chronic):

Inhalation: Inhalation of dust may cause mild, transient irritation.
 Ingestions: Ingestion may cause vomiting and transient, moderate gastrointestinal irritation.
 Eye Contact: May cause moderate, transient irritation.
 Skin: May cause moderate, transient irritation, including dryness.

Signs and Symptoms of Exposure:

Ingestion: Ingestion of larger amounts leads to emesis.
 Eye Contact: Stinging and burning of eye can occur unless flushed immediately with water.
 Inhalation: Dust irritation is possible
 Skin Contact: Mild irritation is possible with prolonged contact

SECTION IV - FIRST AID INFORMATION

Emergency and First Aid Procedures:

Inhalation: Leave dusty area.
 Ingestion: Give a large glassful of water or milk.
 Eye Contact: Flush thoroughly with water for 15 minutes.
 Skin: Rinse skin thoroughly with water.

Other: Label caution statements. Front Label: "CAUTION: Harmful if swallowed. Eye and skin irritant.
 Back Label: "CAUTION: In case of eye or skin contact, flush with water. If swallowed, give a glassful of water or milk. Call a physician or poison control center. KEEP OUT OF REACH OF CHILDREN."

SECTION V - FIRE FIGHTING INFORMATION

Flash Point (Method Used): N/A Explosive Limits: LEL: N/A UEL: N/A

Extinguishing Media: N/A

Special Fire Fighting Procedures: None.

Unusual Fire Hazards: None

Stability Unstable: Conditions to Avoid: None known
 Stable: X

Incompatibility (Materials to Avoid): None known

Hazardous Decomposition/By Products: None known

Hazardous Polymerization: May Occur: Conditions to Avoid: None known
 Will Not Occur: X

SECTION VI - ACCIDENTAL RELEASE MEASURES

Personal Precautions: None

Environmental Precautions: DISPOSAL IS TO BE PERFORMED IN COMPLIANCE WITH ALL REGULATIONS. Household solutions may be disposed of in sewer. Dry product waste may be landfilled.

Steps To Be Taken in Case Material is Released or Spilled: Minimize dust levels while collecting product (see "Inhalation" health effects). Dispose of according to local regulations.

SECTION VII - HANDLING AND STORAGE

Precautions To Be Taken in Handling and Storing: No unusual precautions necessary. Keep product dry to maintain free-flowing granules.

Other Precautions: None.

SECTION VIII - EXPOSURE CONTROLS, PERSONAL PROTECTION

Respiratory Protection (Specify Type): None required with normal use.

Ventilation Local Exhaust: None required with normal consumer use. Special: None

Mechanical (General): General dilution ventilation is acceptable. Other: None

Eye Protection: None required with normal consumer use.

Protective Gloves: None required with normal use.

Industrial Setting: Protective gloves (rubber, neoprene) should be used for prolonged direct contact.

Other Protective Equipment: None required with normal use.

| SECTION IX - PHYSICAL AND CHEMICAL PROPERTIES | |
|--|---|
| Boiling Point °F: Not known | Specific Gravity (H ₂ O=1): ~0.94-1.03 |
| Vapor Pressure (mm Hg): N/A | Percent Volatile by Volume (%): ~60-65% |
| Vapor Density (Air=1): N/A | Evaporation Rate (nBuOAc=1): Unknown |
| Odor Threshold: N/A | Freezing Point: N/A |
| Coefficient of Water/Oil Distribution: N/A | pH (1% solution): ~11 |
| Scooped Density: N/A | Solubility in Water: Nearly 100% |
| Appearance and Odor: White granular agglomerate with blue speckles. Product is perfumed. | Reserve Alkalinity: 10.8 |

| SECTION X - STABILITY AND REACTIVITY |
|---|
| Possible Hazardous Reactions/Conditions: None known |
| Conditions to Avoid: None |
| Materials to Avoid: None |
| Hazardous Decomposition Products: None known |
| Other Recommendations: None |

| SECTION XI - TOXICOLOGICAL INFORMATION |
|---|
| See sections III and IV. Cascade Saturn Powder is expected to exhibit a generally low order of acute toxicity. It may be irritating to mucous membranes and the gastrointestinal tract, but it is not known to be corrosive. It is expected to be emetic. Estimated Acute Oral LD ₅₀ (rat): > 2 g/kg. |

| SECTION XII - ECOLOGICAL INFORMATION |
|--|
| No issues. This product is safe for septic tanks and would not pose an environmental threat unless high product concentrations were dumped into water. |

| SECTION XIII - DISPOSAL CONSIDERATIONS |
|---|
| Waste Disposal Method: Disposal is to be performed in compliance with Federal, state and local regulations. Household solutions may be disposed of in sewer. Dry product waste can be landfilled if local restrictions allow. |

| SECTION XIV - TRANSPORT INFORMATION |
|-------------------------------------|
| No transportation issues |

SECTION XV - ADDITIONAL REGULATORY INFORMATION

All components are listed on the US TSCA Inventory.

This product has been classified with Hazard Criteria of the Canadian Control Products Regulation (CPR) and this MSDS contains all information required by the Canadian Products Regulation.

SECTION XVI - OTHER INFORMATION

*N/A. - Not Applicable

*N/K. - Not Known

The submission of this MSDS may be required by law, but this is not an assertion that the substance is hazardous when used in accordance with proper safety practices and normal handling procedures. Data supplied is for use only in connection with occupational safety and health.

The information contained herein has been compiled from sources considered by Procter & Gamble to be dependable and is accurate to the best of the Company's knowledge. The information relates to the specific material designated herein, and does not relate to the use in combination with any other material or any other process. Procter & Gamble assumed no responsibility for injury to the recipient or third persons, for any damage to any property resulting from misuse of the controlled product.



MATERIAL SAFETY DATA SHEET

MSDS #: D99
 Supersedes: N/A

Issue Date: 11/1/99
 Issue Date: 5/98

SECTION I - CHEMICAL PRODUCT

Identity: Tablet Automatic Dishwashing Detergent

Brands: CASCADE (All Variations)

Hazard Rating:

Health:

Flammability:

Reactivity:

4=EXTREME

3=HIGH

2= MODERATE

1=SLIGHT

Emergency Telephone Number: 24hr P&G Operator: 1-800-844-2544 or call Local Poison Control Center

SECTION II - COMPOSITION AND INGREDIENTS

Ingredients: Complex sodium phosphates and sodium carbonate, enzymes, oxygen bleach, nonionic wetting agents, sodium silicate, sodium sulfate, binding agents, dyes and perfume.

Under normal consumer use, this product would not constitute a hazardous product under OSHA Hazard Communication. With increased industrial exposure this mixture, when tested as a whole, is considered an inhalation hazard within the meaning of the OSHA Hazard Communication Standard.

Hazardous Ingredients as defined by OSHA, 29 CFR 1910.1200.

| Chemical Name | Common Name | CAS No. | Recommended Limits | Composition Range | LD50/LCS 0 |
|---------------|-----------------|-----------|--------------------------------------|-------------------|------------|
| Subtilisin | Protease enzyme | 9014-01-1 | ACGIH TLV: 0.00006 mg/m ³ | | |
| Amylase | Amylase enzyme | 9000-90-2 | ACGIH TLV: 0.00006 mg/m ³ | | |

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SECTION III - HAZARDS IDENTIFICATION

Health Hazards (Acute and Chronic):

- Inhalation: Inhalation of dust may cause transient irritation.
- Ingestions: Tablet or tablet fragments may present a choking hazard. Ingestion may result in tablet lodging causing moderate to severe upper gastrointestinal irritation, burning, discomfort or corrosion of tissue which may impede a person's ability to speak or swallow.
- Eye Contact: May cause mild transient irritation.
- Skin: May cause moderate, transient irritation, including dryness.

Signs and Symptoms of Exposure:

- Ingestion:
- Eye Contact:
- Inhalation:
- Skin Contact:

| SECTION IV - FIRST AID INFORMATION | |
|--|---|
| Emergency and First Aid Procedures: | |
| Inhalation: | Leave dusty area. |
| Ingestion: | Give at least a glassful of water or milk and seek immediate medical attention. |
| Eye Contact: | Flush thoroughly with water. |
| Skin: | Rinse skin thoroughly with water. |
| Other: Label caution statements: | |
| Front Label: "WARNING: Harmful if swallowed or put in mouth. Skin and eye irritant. KEEP OUT OF REACH OF CHILDREN. See Warning on Back Label. | |
| Back Label: "WARNING: Tablet fragments may present a choking hazard. Do not break tablets. Do not use broken tablets. Safely discard any tablet fragments. Do not let young children touch product in dishwasher. After placing tablet in dispenser cup, close immediately. Store out of reach of children. Do not reuse canister. | |
| FIRST AID: In case of accidental ingestion, give at least a glassful of water or milk and seek immediate medical attention. Skin and eye irritant. In case of contact, flush with water." | |

| SECTION V - FIRE FIGHTING INFORMATION | | | |
|---------------------------------------|-------------------|----------------------|-------------------|
| Flash Point (Method Used): | N/A | Explosive Limits: | LEL: N/A UEL: N/A |
| Extinguishing Media: | N/A | | |
| Special Fire Fighting Procedures: | None. | | |
| Unusual Fire-Hazards: | None | | |
| Stability | Unstable: | Conditions to Avoid: | None known |
| | Stable: X | | |
| Incompatibility (Materials to Avoid): | None known | | |
| Hazardous Decomposition/By Products: | None known | | |
| Hazardous Polymerization: | May Occur: | Conditions to Avoid: | None known |
| | Will Not Occur: X | | |

| SECTION VI - ACCIDENTAL RELEASE MEASURES | |
|--|---|
| Personal Precautions: | None |
| Environmental Precautions: | DISPOSAL IS TO BE PERFORMED IN COMPLIANCE WITH ALL REGULATIONS. Household solutions may be disposed of in sewer. Dry product may be landfilled if acceptable to local landfill. |
| Steps To Be Taken in Case Material is Released or Spilled: | Minimize dust levels while collecting product (see "Inhalation" health effects). Dispose of according to local regulations. |

| SECTION VII - HANDLING AND STORAGE | |
|--|---|
| Precautions To Be Taken in Handling and Storing: | No unusual precautions necessary. Keep product dry. |
| Other Precautions: | None. |

| SECTION VIII - EXPOSURE CONTROLS, PERSONAL PROTECTION | | | |
|---|--------------------------------|---|---------------|
| Respiratory Protection (Specify Type): | None required with normal use. | | |
| Ventilation | Local Exhaust: | None required with normal consumer use. | Special: None |
| | Mechanical (General): | General dilution ventilation is acceptable. | Other: None |

Eye Protection: None required with normal consumer use.

Protective Gloves: None required with normal use.

Industrial Setting: Protective gloves (rubber, neoprene) should be used for prolonged direct contact.

Other Protective Equipment: None required with normal use.

SECTION IX - PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|--|
| Boiling Point °F: N/A | Specific Gravity (H ₂ O=1): ~ 1.7 |
| Vapor Pressure (mm Hg): N/A | Percent Volatile by Volume (%): N/A |
| Vapor Density (Air=1): N/A | Evaporation Rate (nBuOAc=1): Unknown |
| Odor Threshold: N/A | Freezing Point: N/A |
| Coefficient of Water/Oil Distribution: N/A | pH (1% solution): 10.81 |
| Scooped Density: N/A | Solubility in Water: Nearly 100% |
| Appearance and Odor: White granular tablet with blue and green speckles. Product is perfumed. | Reserve Alkalinity: 13.65 |

SECTION X - STABILITY AND REACTIVITY

Possible Hazardous Reactions/Conditions: None known

Conditions to Avoid: None

Materials to Avoid: None

Hazardous Decomposition Products: None known

Other Recommendations: None

SECTION XI - TOXICOLOGICAL INFORMATION

SECTION XII - ECOLOGICAL INFORMATION

SECTION XIII - DISPOSAL CONSIDERATIONS

Waste Disposal Method: Disposal is to be performed in compliance with Federal, state and local regulations. Household solutions may be disposed of in sewer. Dry product may be landfilled if acceptable to local landfill.

SECTION XIV - TRANSPORT INFORMATION

SECTION XV - ADDITIONAL REGULATORY INFORMATION

All components are listed on the US TSCA Inventory. No components are affected by Significant New Use Rules (SNURs) under TSCA §5.

No components of Cascade Tablets are subject to California Proposition 65.

All ingredients are CEPA approved for import to Canada by Procter & Gamble. This product has been classified with Hazard Criteria of the Canadian Control Products Regulation (CPR) and this MSDS contains all information required by the Canadian Products Regulation.

SECTION XVI - OTHER INFORMATION

*N/A. - Not Applicable

*N/K. - Not Known

The submission of this MSDS may be required by law, but this is not an assertion that the substance is hazardous when used in accordance with proper safety practices and normal handling procedures. Data supplied is for use only in connection with occupational safety and health.

The information contained herein has been compiled from sources considered by Procter & Gamble to be dependable and is accurate to the best of the Company's knowledge. The information relates to the specific material designated herein, and does not relate to the use in combination with any other material or any other process. Procter & Gamble assumed no responsibility for injury to the recipient or third persons, for any damage to any property resulting from misuse of the controlled product.



MATERIAL SAFETY DATA SHEET

MSDS #: D96014M

Issue Date: 11/1/00

Supersedes: N/A

Issue Date: N/A

SECTION I - CHEMICAL PRODUCT

Identity: Automatic Dishwashing Detergent Gel

Brands: CASCADE Pure Rinse

Hazard Rating:

| | | |
|---------------|---|-------------|
| Health: | 3 | 4=EXTREME |
| Flammability: | 0 | 3=HIGH |
| Reactivity: | 2 | 2= MODERATE |
| | | 1=SLIGHT |

Emergency Telephone Number: 24 hr P&G Operator: 1-800-765-5516 or call Local Poison Control Center

SECTION II - COMPOSITION AND INGREDIENTS

Ingredients: Water softeners (potassium and/or sodium complex phosphates, and/or carbonate salts), cleaning agent (chlorine bleach), dishware, flatware, and dishwasher protection agents (sodium and/or potassium silicates), water, thickening agent, buffering agent, stabilizing agent, colorant and perfume.

This mixture, when tested as a whole, is considered an eye and skin irritant within the meaning of the OSHA Hazard Communication Standard.

Hazardous Ingredients as defined by OSHA, 29 CFR 1910.1200:

| <u>Chemical Name</u> | <u>Common Name</u> | <u>CAS No.</u> | <u>Recommended Limits</u> | <u>Composition Range</u> | <u>LD50/LC50</u> |
|--------------------------------|---------------------|----------------|--------------------------------|--------------------------|-------------------------------------|
| Hypochlorous acid, sodium salt | Sodium hypochlorite | 7681-52-9 | WEEL STEL: 2 mg/m ³ | 1-5% | N/A |
| Potassium hydroxide | Potassium hydroxide | 1310-58-3 | ACGIH TLV: 2 mg/m ³ | 1-5% | LD50 in rats 1.23 g/kg |
| Sodium hydroxide [F] | Sodium hydroxide | 1310-73-2 | ACGIH TLV: 2 mg/m ³ | 1-5% 4.4% | LD50 Rats 500 mg/kg (10% son) |

Personal Precautions: Prior to exposure, cover any exposed skin and eyes. Peel off and wash any clothing that becomes wet with the product.

Environmental Precautions: DISPOSAL IS TO BE PERFORMED IN COMPLIANCE WITH ALL REGULATIONS. Undiluted waste product from this product would be RCRA "Corrosive" hazardous waste. Do not landfill. Do not sewer without pH trim first. Household waste may be disposed of down the sewer.

Steps To Be Taken in Case Material is Released or Spilled: Contain the spill. Try to prevent from reaching waterway or sewer. Cascade is a RCRA "Corrosive" liquid because of its high pH.

SECTION VII - HANDLING AND STORAGE

Precautions To Be Taken in Handling and Storing: No unusual precautions necessary.
Other Precautions: None.

SECTION VIII - EXPOSURE CONTROLS, PERSONAL PROTECTION

Respiratory Protection (Specify Type): None required with normal use.
Ventilation *Local Exhaust:* None required with normal consumer use. *Special:* None
Mechanical (General): General dilution ventilation is acceptable. *Other:* None
Eye Protection: None required with normal consumer use.
Industrial Setting: For splash protection use chemical goggles. Eye wash fountain is desirable.
Protective Gloves: None required with normal use.
Industrial Setting: Protective gloves (rubber, neoprene) should be used for any direct contact.
Other Protective Equipment: Cover clothes as spills will bleach your clothing.

SECTION IX - PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|--|
| Boiling Point °F: N/A | Specific Gravity (H₂O=1): 1.35 g/cc |
| Vapor Pressure (mm Hg): N/A | Percent Volatile by Volume (%): <1 |
| Vapor Density (Air=1): N/A | Evaporation Rate (nBuOAc=1): Unknown |
| Odor Threshold: N/A | Freezing Point: N/A |
| Coefficient of Water/Oil Distribution: N/A | pH (1% solution): 11.7 |
| Scooped Density: N/A | Solubility in Water: Miscible with water. Contains small amount of insoluble, colloidal size particles. |
| Appearance and Odor: Creamy white or yellow thick, viscous gel. Products are perfumed. | Reserve Alkalinity: ~5 |

SECTION X - STABILITY AND REACTIVITY

Possible Hazardous Reactions/Conditions: None known
Conditions to Avoid: None
Materials to Avoid: None
Hazardous Decomposition Products: None known
Other Recommendations: None

SECTION XI - TOXICOLOGICAL INFORMATION

LD50 - N/A
ED50 - not necessarily strongly emetic

SECTION XII - ECOLOGICAL INFORMATION

Virtually all ingredients used in Cascade Gel are fully biodegradable. Cascade Gel has been tested safe for septic tanks.

SECTION XIII - DISPOSAL CONSIDERATIONS

Waste Disposal Method: DISPOSAL IS TO BE PERFORMED IN COMPLIANCE WITH ALL REGULATIONS. Undiluted waste product from this product would be RCRA "Corrosive" hazardous waste. Do not landfill. Hazardous waste treatment to reduce the pH is necessary prior to disposal. Household waste may be disposed of down the sewer.

SECTION XIV - TRANSPORT INFORMATION

DOT Classification: In household quantities, Cascade Gel Automatic Dishwashing Detergent is not DOT hazardous and is not regulated under the DOT Hazardous Materials Regulations (49 CFR, Parts 171-180) which govern the safe transport of hazardous materials.

Transportation of bulk quantities may be considered DOT hazardous.

SECTION XV - ADDITIONAL REGULATORY INFORMATION

All components are listed on the US TSCA Inventory. No components are affected by Significant New Use Rules (SNURs) under TSCA §5.

No components of Cascade Gel are listed in California Proposition 65 regulation.

| <u>Chemical Name</u> | <u>CERCLA 304 RQ (LBS)</u> |
|----------------------------|----------------------------|
| Nitric acid | 1000 lbs. |
| Potassium hydroxide | 1000 lbs. |
| Sodium hypochlorite | 100 lbs. |
| Sodium hydroxide | 1,000 lbs. |
| Sodium phosphate, tribasic | 5,000 lbs. |

All ingredients are CEPA approved for import to Canada by Procter & Gamble. This product has been classified with Hazard Criteria of the Canadian Control Products Regulation (CPR) and this MSDS contains all information required by the Canadian Products Regulation.

SECTION XVI - OTHER INFORMATION

*N/A. - Not Applicable

*N/K. - Not Known

The submission of this MSDS may be required by law, but this is not an assertion that the substance is hazardous when used in accordance with proper safety practices and normal handling procedures. Data supplied is for use only in connection with occupational safety and health.

The information contained herein has been compiled from sources considered by Procter & Gamble to be dependable and is accurate to the best of the Company's knowledge. The information relates to the specific material designated herein, and does not relate to the use in combination with any other material or any other process. Procter & Gamble assumed no responsibility for injury to the recipient or third persons, for any damage to any property resulting from misuse of the controlled product.

M A T E R I A L S A F E T Y D A T A S H E E T

Dishwasher all

80240

Date Prepared 04/16/01

PRODUCT INFORMATION

Product Trade Name Dishwasher all
 Product Use Automatic dishwasher detergent
 Supplier Name Unilever Canada, A Division of U L Canada Inc.
 Address 160 Bloor Street East, Suite 300, Toronto, Ont. M4W 3W3
 Emergency Phone No. 416-462-2200

This information is presented under right-to-know regulations, in the context of use in the workplace, and is not intended for domestic use.

HAZARDOUS INGREDIENTS

| Ingredient | CAS No. | Range (%w/w) | LD ₅₀ Oral mg/kg | LD ₅₀ Dermal g/kg | LC ₅₀ Inhl mg/m ³ /4h |
|------------------------------|------------|--------------|-----------------------------|------------------------------|---|
| Sodium carbonate | 497-19-8 | 15-40 | 2,800 (rat) | Not available | Not avail. |
| Sodium silicate | 1344-09-8 | 5-10 | 3,300 (rat) | Not available | Not avail. |
| Alcohols, alkoxyated, linear | 37251-67-5 | 1-5 | 2,700 (rat) | > 2 (rabbit) | 100,000 |
| Sodium dichloroisocyanurate | 51580-86-0 | 1-5 | 620 (rat) | 11 (rabbit) | Not avail. |

PHYSICAL DATA

| | | | |
|-------------------------|---|------------------------|---------------|
| Physical State (deg. C) | Solid | Specific Gravity | 0.92 (25) |
| Vapour Pressure | Not available | Coeff. Water/Oil Dist. | Not available |
| Vapour Density | Not available | Evaporation Rate | Not available |
| Boiling Point available | Not available | Freezing Point | Not |
| PH | ca. 11 (1 % aq.) | Odour Threshold | Not available |
| Odour and Appearance | Odourless, white, free flowing granular powder. | | |

FIRE OR EXPLOSION HAZARD

| | |
|------------------------------------|---|
| Conditions of Flammability | None. |
| Means of Extinction | Not applicable. Use media appropriate for surrounding fire. |
| Flash Point (deg. C) and Method | Not applicable |
| Upper Flammable Limit | Not applicable |
| Lower Flammable Limit | Not applicable |
| Auto Ignition Temperature (deg. C) | Not applicable |
| Hazardous Combustion Products | May release chlorine and similar hazardous gases if involved in fire. |
| Sensitivity to Static Discharge | Not applicable |
| Sensitivity to Impact | Not applicable |

FIRST AID MEASURES

Inhalation Remove from exposure and provide respiratory support if necessary.

Eyes Immediately remove any contact lenses, force eyelids open and flush eyes with running water for at least fifteen minutes. Obtain immediate medical attention.

On Skin Remove any contaminated clothing and flush skin with running water. If irritation occurs or persists, obtain medical attention.

Ingestion Do not induce vomiting. Give sips of water or milk only if conscious and obtain prompt medical care or call the local Poison Information Centre.

REACTIVITY DATA

Conditions of Instability Temperatures above 200 deg. C.

Incompatible Substances Easily oxidizable organic material, ammonia or similar nitrogen-containing compounds, and inorganic reducing compounds.

Conditions of Reactivity Exposure to heat and incompatible materials.

Thermal Stability / Decomposition Chlorine containing gases may be produced, especially at elevated temperatures.

PREVENTIVE MEASURES

Personal Protective Equipment Select personal protective equipment depending upon conditions of use. Where eye contact and/or repeated or prolonged skin contact is expected to occur, wear safety glasses with side shields, long sleeves, and gloves. If exposure exceeds occupational exposure limits, use an appropriate NIOSH/CSA/MSHA approved respirator.

Engineering Controls General ventilation is recommended to control indoor fugitive emissions. Use local exhaust ventilation to prevent exceeding exposure limits.

Dishwasher SUNLIGHT
 Date Prepared 04/16/01

80260

PRODUCT INFORMATION

Product Trade Name Dishwasher SUNLIGHT
 Product Use Automatic dishwasher detergent
 Supplier Name Unilever Canada, A Division of U L Canada Inc.
 Address 160 Bloor Street East, Suite 300, Toronto, Ont. M4w 3W3
 Emergency Phone No. 416-462-2200

This information is presented under right-to-know regulations, in the context of use in the workplace, and is not intended for domestic use.

HAZARDOUS INGREDIENTS

| Ingredient | CAS No. | Range (%w/w) | LD ₅₀ Oral mg/kg | LD ₅₀ Dermal g/kg | LC ₅₀ Inhl mg/m ³ /4h |
|------------------------------|------------|--------------|-----------------------------|------------------------------|---|
| Sodium carbonate | 497-19-8 | 15-40 | 2,800 (rat) | Not available | Not avail. |
| Sodium silicate | 1344-09-8 | 5-10 | 3,300 (rat) | Not available | Not avail. |
| Sodium dichloroisocyanurate | 51580-86-0 | 1-5 | 620 (rat) | 11 (rabbit) | Not avail. |
| Alcohols, alkoxyated, linear | 37251-67-5 | 1-5 | 2,700 (rat) | >2 (rabbit) | 100,000 |

PHYSICAL DATA

| | | | |
|---------------------------|--|------------------------|---------------|
| Physical State (deg. C) | Solid | Specific Gravity | 0.92 (25 |
| Vapour Pressure | Not available | Coeff. Water/Oil Dist. | Not available |
| Vapour Density | Not available | Evaporation Rate | Not available |
| Boiling Point (available) | Not available | Freezing Point | Not |
| pH | ca. 11 (1 % aq.) | Odour Threshold | Not available |
| Odour and Appearance | Fragrant, white, free flowing granular powder. | | |

FIRE OR EXPLOSION HAZARD

| | |
|------------------------------------|---|
| Conditions of Flammability | None. |
| Means of Extinction | Not applicable. Use media appropriate for surrounding fire. |
| Flash Point (deg. C) and Method | Not applicable |
| Upper Flammable Limit | Not applicable |
| Lower Flammable Limit | Not applicable |
| Auto Ignition Temperature (deg. C) | Not applicable |
| Hazardous Combustion Products | May release chlorine and similar hazardous gases if involved in fire. |
| Sensitivity to Static Discharge | Not applicable |
| Sensitivity to Impact | Not applicable |

FIRST AID MEASURES

- Inhalation** Remove from exposure and provide respiratory support if necessary.
- Eyes** Immediately remove any contact lenses, force eyelids open and flush eyes with running water for at least fifteen minutes. Obtain immediate medical attention.
- Skin** Remove any contaminated clothing and flush skin with running water. If irritation occurs or persists, obtain medical attention.
- Ingestion** Do not induce vomiting. Give sips of water or milk only if conscious and obtain prompt medical care or call the local Poison Information Centre.

REACTIVITY DATA

- Conditions of Instability** Temperatures above 200 deg. C.
- Incompatible Substances** Easily oxidizable organic material, ammonia or similar nitrogen-containing compounds, and inorganic reducing compounds.
- Conditions of Reactivity** Exposure to heat and incompatible materials.
- Hazardous Decomposition Products** Chlorine containing gases may be produced, especially at elevated temperatures.

PREVENTIVE MEASURES

- Personal Protective Equipment** Select personal protective equipment depending upon conditions of use. Where eye contact and/or repeated or prolonged skin contact is expected to occur, wear safety glasses with side shields, long sleeves, and gloves. If exposure exceeds occupational exposure limits, use an appropriate NIOSH/CSA/MSHA approved respirator.
- Engineering Controls** General ventilation is recommended to control indoor fugitive emissions. Use local exhaust ventilation to prevent exceeding exposure limits.

Section 1. Product and Company Identification

| | | | |
|---------------------|--|------------------------------------|-------------------------|
| Name | ELECTRASOL® AUTOMATIC DISHWASHER DETERGENT, DUAL ACTION TABS (TM) W/ BAKING SODA | MSDS# | Not available. |
| Description | Automatic dishwasher detergent tablets with a blue layer of pre-soakers and a layer of baking soda to deliver sparkling clean dishes without a chlorine smell. | Validation Date | 8/14/2000 |
| Manufacturer | Reckitt Benckiser Inc. 1655 Valley Road Wayne, N.J. 07474 | Print Date | 1/17/2001 |
| Identifier | Not available. | In case of Emergency: | Telephone: 800-228-4722 |
| Number | 369253 | Transportation Emergencies: | Chemtrec: 800-424-9300 |
| Number | ADDT115RW1 (Lemon) & ADDT114RW1 (Fresh Scent) | | |
| Number | 51700-32800, 51700-32810 (15 Tablets, 10.6 oz); 51700-32805, 51700-32815 (26 tablets, 18.3 oz); 51700-32840 (36 tablets, 25.4 oz); 51700-32815, 51700-32850 (84 Tablets, 45.1 oz); 51700-75540 (80 Tablets, 56.4 oz) | | |

Section 2. Composition and Information on Ingredients

| | CAS # | % by Weight | Exposure Limits : TLV/PEL |
|------------------------------------|-----------|-------------|--|
| ENZYME MIXTURE, PROTEASE & AMYLASE | 9014-01-1 | 1-3 | CEIL: 6e-005 (mg/m ³) from ACGIH (TLV) [United States] |
| SODIUM CARBONATE | 497-19-8 | 30-35 | Not Available |
| SODIUM PERBORATE | 7632-04-4 | 10-15 | Not Available |

Section 3. Hazards Identification

| | |
|---------------------|---|
| Key Overview | CAUTION: HARMFUL IF SWALLOWED. Eye irritant. Avoid eye contact. May cause skin irritation. KEEP OUT OF REACH OF CHILDREN! |
|---------------------|---|

Section 4. First Aid Measures

| | |
|-------------------|--|
| Contact | CAUTION: In case of eye contact, immediately rinse eyes thoroughly with plenty of water. Remove contact lenses and continue rinsing your eyes for at least 15 minutes. If irritation persists, seek medical attention. |
| Inhalation | In case of skin contact, immediately wash with plenty of soap and water. If irritation occurs or persists, get medical attention. |
| Swallowing | Remove to fresh air. |
| Other | If swallowed, drink a glass of water and immediately call physician or Poison Control Center. |

Section 5. Fire and Explosion Data

| | |
|------------------------------------|---|
| Flammability | Not flammable. See Section 14 for any Shipping Classifications. |
| Explosive | Not applicable. |
| Concentration Limits in Air | Not available. |
| Flash Point of Combustion | Not available. |

Continued on Next Page

Fire and Explosion Hazards None known.

Extinguishing Media and Instructions Not a fire hazard. Use extinguishing media suitable for surrounding materials.

Special Fire Fighting Instructions Wear self-contained breathing apparatus and protective clothing appropriate for fighting a chemical fire.

Section 6. Accidental Release Measures

Accidental Spill Collect spilled tablets and return to container. If powder has resulted from broken tablet(s), flush area with water or wipe with absorbent material (wet paper towel). Rinse well and dry floors to avoid slippery condition.

Section 7. Handling and Storage

Handling and Storage CAUTION: HARMFUL IF SWALLOWED. Eye irritant. Avoid eye and skin contact. May cause skin irritation. KEEP OUT REACH OF CHILDREN!

Store in original container in a dry, secure area inaccessible to children and pets.

Section 8. Exposure Controls/Personal Protection

Ventilation Requirements No specific controls are needed.

Eye Protection Avoid eye contact. Emergency responders should wear eye protection.

Skin Protection Avoid skin contact. -May cause skin irritation after prolonged or repeated use. -Emergency responders should wear impermeable gloves.

Respiratory Protection None required. Avoid breathing dust from broken tablet(s). Emergency responders should wear suitable respiratory protection where exposure to airborne dust is possible.

Other Protection None required

Work/Hygienic Practices Washing with soap and water after use is recommended as good hygienic practice to prevent possible skin irritation and/or eye irritation from hand contact.

Section 9. Physical and Chemical Properties

| | | | |
|-----------------------------------|---|--------------|--------------------------------------|
| Description | Solid. (Solid rectangular tablets with rounded corners composed of a white layer and a smaller blue layer.) | Odor | Citrus, fruity, apple-like or lemon. |
| pH | 11 [Basic.] | Color | White and blue layered tablet. |
| Boiling/Condensation Point | Not applicable. | | |
| Specific Gravity | The only known value is 2.53 (Water = 1) (SODIUM CARBONATE). | | |
| Vapor Pressure | Not applicable. | | |
| Vapor Density | Not available. | | |
| Viscosity | Not available. | | |
| Solubility | Complete. | | |
| Physical Chemical Comments | Not available. | | |

Section 10. Stability and Reactivity Data

| | |
|----------------------------------|-------------------------------------|
| Normal Stability | The product is stable. |
| Conditions of Instability | Do not mix with anything but water. |
| Compatibility with Various Media | None known. |
| Thermal Decomposition | May generate chlorine or oxygen. |
| Chemical Polymerization | None known. |

Section 11. Toxicological Information

Acute effects

| | |
|-------------|--|
| Inhalation | Eye irritant. |
| Eye Contact | May cause skin irritation. |
| Ingestion | Contains enzymes: Avoid breathing dust from broken tablets. May cause mild nasal irritation upon prolonged or repeated contact to the dust in an occupational or emergency response situation. |
| Swallowing | Harmful if swallowed. Will cause burning in mouth and throat. Difficulty swallowing, excessive salivating in infants. Reddening and swelling of mucous membranes of the mouth and throat. |
| Toxicity | Not listed as carcinogenic by OSHA, NTP or IARC. |

Section 12. Ecological Information

| | |
|----------|----------------|
| Toxicity | Not available. |
|----------|----------------|

Section 13. Disposal Considerations

| | |
|----------|---|
| Disposal | Collect tablets and return to container, if broken tablet(s) left powder on surface, collect powder, raising as little dust as possible. Wash surface or wipe with wet paper towel. Discard small amounts of material with trash collection. Discard single empty containers in household trash. For large amounts of waste product, dispose of in accordance with local, state and federal regulations. |
|----------|---|

Section 14. Transport Information

| | | |
|---|--|--|
| Classification | Not a DOT controlled material (United States). | |
| Shipping Name | Not applicable. | |
| Identification Number | Not applicable. | |
| Group | Not applicable. | |
| Mode of Transportation | Not available. | |
| Hazardous Substances Available Quantity | Not available. | |
| Provisions for Transport | Not available. | |

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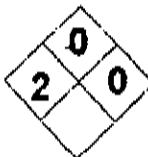
| | |
|----------------|--------------------------------|
| Classification | Not a TDG controlled material. |
| Classification | Not available. |
| Classification | Not controlled under IMDG. |
| Classification | Not controlled under IATA. |

Section 15. Regulatory Information

| | |
|-------|--|
| State | SARA Title III, Section 313 Toxic Chemical Notification & Release Reporting: |
| State | None |
| | California Proposition 65: This product contains the following ingredients which require a warning under the Safe Drinking Water & Toxic Enforcement Act: 1) Not available. |

| | |
|-----------------|--|
| Classifications | WHMIS (Canada) Not controlled under WHMIS (Canada) |
|-----------------|--|

Section 16. Other Information

| | | | | | | | | | | | | |
|---------------------|--|---------------|---|-------------|---|------------|---|---------------------|---|--|---|--|
| (U.S.A.) | <table border="1"> <tr> <td>Health Hazard</td> <td>2</td> </tr> <tr> <td>Fire Hazard</td> <td>0</td> </tr> <tr> <td>Reactivity</td> <td>0</td> </tr> <tr> <td>Personal Protection</td> <td>a</td> </tr> </table> | Health Hazard | 2 | Fire Hazard | 0 | Reactivity | 0 | Personal Protection | a | National Fire Protection Association (U.S.A.) Health |  | Fire Hazard Reactivity Specific hazard |
| Health Hazard | 2 | | | | | | | | | | | |
| Fire Hazard | 0 | | | | | | | | | | | |
| Reactivity | 0 | | | | | | | | | | | |
| Personal Protection | a | | | | | | | | | | | |

| | |
|--------------------|-----------------|
| NFPA Aerosol Level | Not applicable. |
|--------------------|-----------------|

| | |
|------------------------------|--------------------|
| Product Safety on 8/14/2000. | Printed 1/17/2001. |
|------------------------------|--------------------|

Disclaimer
 To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are listed, we cannot guarantee that there are no other hazards that exist.

Section 1. Product and Company Identification

| | | | |
|---------------------------|---|------------------------------------|-------------------------|
| Name | ELECTRASOL® AUTOMATIC DISHWASHER DETERGENT GEL W/ BAKING SODA - ALL SCENTS | MSDS# | Not available. |
| Description | Automatic dishwasher detergent gel with baking soda to deliver sparkling clean dishes with no powder residue. | Validation Date | 12/28/2000 |
| Manufacturer | Reckitt Benckiser Inc. 1655 Valley Road Wayne, N.J. 07474 | Print Date | 1/17/2001 |
| Product Identifier | Not available. | In case of Emergency: | Telephone: 800-228-4722 |
| Product Number | 51700-32705-00 | Transportation Emergencies: | Chemtrec: 800-424-9300 |
| UN Number | ADLA200CUS1 (Lemon) | | |
| Other Numbers | 51700-32700 (50 oz.), 51700-32705 (65 oz.), 51700-32707 (85 oz.) | | |

Section 2. Composition and Information on Ingredients

| | CAS # | % by Weight | Exposure Limits : TLV/PEL |
|---------------------|-----------|-------------|---|
| SODIUM HYPOCHLORITE | 7681-52-9 | 2.0 | Not available. CEIL: 2 (mg/m ³) from ACGIH (TLV) [United States] TWA: 2 (mg/m ³) from OSHA OSHA (PEL) [United States] Not available. |
| SODIUM HYDROXIDE | 1310-73-2 | 2-4 | |
| SODIUM CARBONATE | 497-19-8 | 3.0 | |

Section 3. Hazards Identification

Emergency Overview CAUTION: HARMFUL IF SWALLOWED. EYE IRRITANT. Causes eye irritation. CONTAINS CHLORINE BLEACH. Do not mix with hand dishwashing liquids, other cleaning products or ammonia as hazardous fumes may result. KEEP OUT OF REACH OF CHILDREN.

Section 4. First Aid Measures

Contact In case of eye contact, immediately rinse eyes thoroughly with plenty of water. Remove any contact lenses and continue rinsing for at least 15 minutes. If irritation persists, get medical attention.

Inhalation In keeping with good hygienic practices, wash exposed areas thoroughly with soap and water.

Removal Remove to fresh air.

Ingestion Rinse mouth and drink a glass of water. Call a physician or poison control center.

Section 5. Fire and Explosion Data

Flammability See Section 14 for any Shipping Classifications.

Flash Point Not applicable.

Explosive Limits in Air Not available.

Products of Combustion Not available.

Continued on Next Page

Explosion Hazards None known.

Flammability Not a fire hazard. Use extinguishing media suitable for surrounding materials.

Fire Fighting Wear self-contained breathing apparatus and protective clothing appropriate for fighting a chemical fire.

Section 6. Accidental Release Measures

Spill Small spill: Wipe up or collect spilled material with absorbent material and discard in household trash. Flush area with water or wipe with wet paper towel. Rinse floor surfaces well and dry to avoid slippery condition.
Large spills: Contain and collect gel and transfer to a suitable container for recycling or disposal. Rinse floors and surfaces with water and wipe dry to avoid slippery condition.

Section 7. Handling and Storage

Handling and Storage CAUTION: HARMFUL IF SWALLOWED. EYE IRRITANT. Avoid eye contact.
Store in original container in a secure area inaccessible to children and pets. KEEP OUT REACH OF CHILDREN!

Section 8. Exposure Controls/Personal Protection

Exposure Requirements No specific controls are needed.

Respiratory Protection Avoid eye contact.

Eye Protection None required under normal use conditions. May cause skin irritation after prolonged or repeated use.

Skin Protection None required.

Hand Protection None required.

Hygienic Practices Washing with soap and water after use is recommended as good hygienic practice to prevent possible skin irritation.

Section 9. Physical and Chemical Properties

Appearance Liquid. (Opaque liquid.)

Odor Citrus. Slight bleach odor.

pH 11 [Basic.]

Color Yellow opaque liquid.

Boiling Point Not applicable.

Density Weighted average: 2.31 (Water = 1)

Vapor Pressure Not applicable.

Volatility Not available.

Stability Not available.

Reactivity Complete

Chemical Comments Not available.

Continued on Next Page

Section 10. Stability and Reactivity Data

| | |
|---------------------------------------|-------------------------------------|
| Chemical Stability | The product is stable. |
| Conditions of Instability | Do not mix with anything but water. |
| Compatibility with Various Substances | None known |
| Thermal Decomposition Data | None known |
| Chemical Polymerization | None known |

Section 11. Toxicological Information

Acute effects

| | |
|--------------|---|
| Eye Contact | Eye irritant. |
| Skin Contact | None expected under normal use conditions. May cause skin irritation upon prolonged or repeated contact. |
| Inhalation | None known. |
| Ingestion | Harmful if swallowed. Will cause burning in mouth and throat. Difficulty swallowing, excessive salivating in infants. Reddening and swelling of mucous membranes of the mouth and throat. |
| Mutagenicity | Not listed as carcinogenic by OSHA, NTP or IARC. |

Section 12. Ecological Information

| | |
|----------|----------------|
| Toxicity | Not available. |
|----------|----------------|

Section 13. Disposal Considerations

| | |
|----------------|---|
| Final Disposal | Discard small amounts of material by flushing with water to drain (sanitary sewer). Rinse and discard empty container in trash or rinse and recycle where appropriate. For large amounts of waste product, dispose of in accordance with local, state and federal regulations. |
|----------------|---|

Section 14. Transport Information

| | | |
|--|--|--|
| Classification | ORM-D | |
| Proper Shipping Name | Consumer Commodity | |
| Identification Number | Not applicable | |
| Shipping Group | Not applicable | |
| Off-Highway Transportation | Not available. | |
| Hazardous Substances Reportable Quantity | Not available. | |
| Special Provisions for Transport | ORM-D: For US Domestic Shipments Only | |
| DOT Classification | Consumer Commodity - Transborder Consignment | |

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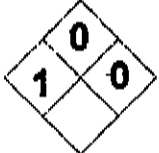
ELECTROLUX
DETERGENT GEL W/ BAKING SODA - ALL SCENTS

| | |
|-----------------------------|--|
| ADR Classification | Not available. |
| INIDG Classification | Corrosive liquid, basic, inorganic, N.O.S. (Contains Sodium Hydroxide, Sodium Hypochlorite), Class 8, UN32661, III |
| IATA Classification | DO NOT SHIP: Does not meet IATA requirements. |

Section 15. Regulatory Information

| | |
|--------------------------------------|--|
| Federal and State Regulations | SARA Title III, Section 313 Toxic Chemical Notification & Release Reporting: None California Proposition 65: This product contains the following ingredients which require a warning under the Safe Drinking Water & Toxic Enforcement Act: 1) Not available. |
| Other Classifications | WHMIS (Canada) Not controlled under WHMIS (Canada). |

Section 16. Other Information

| | | | | | | | | | | | |
|--|--|--------------------|---|-------------|---|------------|---|---------------------|---|--|---|
| HMIS (U.S.A.) | <table border="1"> <tr> <td>Health Hazard</td> <td>1</td> </tr> <tr> <td>Fire Hazard</td> <td>0</td> </tr> <tr> <td>Reactivity</td> <td>0</td> </tr> <tr> <td>Personal Protection</td> <td>M</td> </tr> </table> | Health Hazard | 1 | Fire Hazard | 0 | Reactivity | 0 | Personal Protection | M | National Fire Protection Association (U.S.A.) |  <p>Health: 1 Fire Hazard: 0 Reactivity: 0 Specific hazard: 0</p> |
| Health Hazard | 1 | | | | | | | | | | |
| Fire Hazard | 0 | | | | | | | | | | |
| Reactivity | 0 | | | | | | | | | | |
| Personal Protection | M | | | | | | | | | | |
| NEPA Aerosol Level | | Not applicable. | | | | | | | | | |
| Validated by Product Safety on 12/28/2000. | | Printed 1/17/2001. | | | | | | | | | |

Notice to Reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

| Section 1. Product and Company Identification | |
|---|--|
| Product Name | ELECTRASOL® LEMON SCENT GEL AUTOMATIC DISHWASHING DETERGENT - CANADIAN |
| MSDS# | Not available. |
| Product Description | Automatic dishwasher detergent gel to deliver sparkling clean dishes with no powder residue. |
| Validation Date | 7/11/2001 |
| Print Date | 7/12/2001 |
| Manufacturer | Reckitt Benckiser (Canada) Inc. 2 Wickman Road Toronto, Ontario M8Z 5M5 CANADA |
| Product Identifier | Not available. |
| Item Number | 51700-31514-04 |
| Formula Number | 714-134 (F/F #372551) |
| UPC Number | 51700-31514-04 (1.3 L) |
| In case of Emergency | Telephone: 800-888-0192 (Canada) |
| Transportation Emergencies | Chemtrec: 800-424-9300 |

| Section 2. Composition and Information on Ingredients | | | |
|---|------------|-------------|---|
| Name | CAS # | % by Weight | Exposure Limits : TLV/PEL |
| 1) POTASSIUM HYDROXIDE | 1310-58-3 | 1-3 | CEIL: 2 (mg/m ³) from ACGIH (TLV) (United States) Not available. Not available. TWA: 5 (mg/m ³) Respirable. TWA: 15 (mg/m ³) Total. |
| 2) SODIUM HYPOCHLORITE | 7681-52-9 | 2-4 | |
| 3) SODIUM SILICATE | 1344-09-8 | 13-15 | |
| 4) KALIUMTRIPOLYPHOSPHATE | 13845-36-8 | 4-6 | |

Section 3. Hazards Identification

Emergency Overview **DANGER: CONTAINS SODIUM SILICATE. HARMFUL IF SWALLOWED. DO NOT INGEST. Skin and eye irritant. Avoid contact with skin, eyes, mucous membranes and clothing.**

Contains Chlorine Bleach. **DO NOT** mix with any other product such as hand dishwashing liquids, other cleaning products or ammonia as harmful fumes may result. Not for hand dishwashing. **KEEP OUT OF REACH OF CHILDREN.**

Section 4. First Aid Measures.

Eye Contact In case of eye contact, immediately rinse eyes thoroughly with plenty of water. Remove any contact lenses and continue rinsing for at least 15 minutes. If irritation persists, consult a physician.

Skin Contact In case of skin contact, wash skin thoroughly with soap and water. If irritation persists, consult a physician.

Inhalation Remove to fresh air.

Ingestion **DO NOT** induce vomiting. Rinse mouth and drink a glass of water. **IMMEDIATELY** call a physician or poison control center.

Section 5. Fire and Explosion Data

| | |
|--------------------------------------|---|
| Flammability | See Section 14 for any Shipping Classifications. |
| Flash Point | Not applicable. |
| Explosive Limits in Air | Not available. |
| Products of Combustion | Not available. |
| Fire and Explosion Hazards | None known. |
| Fire Fighting Media and Instructions | Not a fire hazard. Use extinguishing media suitable for surrounding materials. |
| Special Fire Fighting Instructions | Wear self-contained breathing apparatus and protective clothing appropriate for fighting a chemical fire. |

Section 6. Accidental Release Measures

| | |
|------------------|---|
| Accidental Spill | Small spill: Wipe up or collect spilled material with absorbent material and discard in household trash. Flush area with water or wipe with wet paper towel. Rinse floor surfaces well and dry to avoid slippery condition. Large spills: Contain and collect gel and transfer to a suitable container for recycling or disposal. Rinse floors and surfaces with water and wipe dry to avoid slippery condition. |
|------------------|---|

Section 7. Handling and Storage

| | |
|----------------------|---|
| Handling and Storage | DANGER: Contains Sodium Silicate. HARMFUL IF SWALLOWED. DO NOT ingest. Skin and eye irritant. Avoid contact with skin, eyes, mucous membranes and clothing. Contains Chlorine Bleach. DO NOT MIX with any other product such as hand dishwashing liquids, other cleaning products or ammonia as harmful fumes may result. Not for hand dishwashing. Store in original container in a secure area inaccessible to children and pets. KEEP OUT REACH OF CHILDREN! |
|----------------------|---|

Section 8. Exposure Controls/Personal Protection

| | |
|--------------------------|---|
| Ventilation Requirements | No specific controls are needed. |
| Eye Protection | Wear eye protection when handling. Emergency responders should wear full eye and face protection. |
| Skin Protection | Wash hands with soap and water after use. Emergency responders should wear impermeable gloves. |
| Respiratory Protection | None required. |
| Other Protection | None required. |
| Work/Hygienic Practices | Washing with soap and water after use is recommended as good hygienic practice to prevent possible skin irritation and/or eye irritation from hand contact. |

Continued on Next Page

Section 9. Physical and Chemical Properties

| | | | |
|----------------------------|--|-------|--------------------------------|
| Description | Liquid. (translucent thick suspension). | Odor | Citrus. |
| pH | 10.8 | | |
| Boiling/Condensation Point | Not applicable. | Color | Blue translucent thick liquid. |
| Specific Gravity | 1.30 at 25°C | | |
| Vapor Pressure | Not applicable. | | |
| Vapor Density | Not available. | | |
| Viscosity | 25,000 - 35,000 cP (Brookfeld RVT @ 5 rpm) | | |
| Solubility | Complete. | | |
| Physical Chemical Comments | Not available. | | |

Section 10. Stability and Reactivity Data

| | |
|---|-------------------------------------|
| Chemical Stability | The product is stable. |
| Conditions of Instability | Do not mix with anything but water. |
| Incompatibility with Various Substances | Ammonia, acids |
| Hazardous Decomposition Products | None known. |
| Hazardous Polymerization | None known. |

Section 11. Toxicological Information

Exposure effects

| | |
|-----------------|---|
| Eye Contact | Causes burns to eyes on contact. |
| Skin Contact | Causes burns to skin on contact. |
| Inhalation | None known. |
| Ingestion | Harmful if swallowed. Will cause burning in mouth and throat. Difficulty swallowing, excessive salivating in infants. Reddening and swelling of mucous membranes of the mouth and throat. |
| Carcinogenicity | Not listed as carcinogenic by OSHA, NTP or IARC. |

Section 12. Ecological Information

| | |
|-------------|----------------|
| Ecotoxicity | Not available. |
|-------------|----------------|

Section 13. Disposal Considerations

Waste Disposal Discard small amounts of material by flushing with water to drain (sanitary sewer). Rinse and discard empty container in trash or rinse and recycle where appropriate.

For large amounts of waste product, dispose of in accordance with local, provincial and federal regulations.

Section 14. Transport Information

DOT Classification ORM-D

Proper Shipping Name Consumer Commodity.

DOT Identification Number Not applicable.

Packing Group Not applicable.

Maritime Transportation Not applicable.

Hazardous Substances Reportable Quantity Not applicable.

Special Provisions for Transport ORM-D: For US Domestic Shipments Only.

TDG Classification Consumer Commodity - Transborder Consignment.

ADR Classification Not applicable.

IMDG Classification DO NOT SHIP - Outer packaging does not qualify for transport by vessel.

IATA Classification DO NOT SHIP - Outer packaging does not qualify for transport by air.

Section 15. Regulatory Information

Federal and State Regulations SARA Title III, Section 313 Toxic Chemical Notification & Release Reporting;

None

California Proposition 65: This product contains the following ingredients which require a warning under the Safe Drinking Water & Toxic Enforcement Act:
1) Not applicable.

Other Classifications WHMIS (Canada) Not controlled under WHMIS (Canada).

Section 16. Other Information

HMIS (U.S.A.)

| | |
|---------------------|---|
| Health Hazard | 3 |
| Fire Hazard | 0 |
| Reactivity | 0 |
| Personal Protection | a |

**National Fire Protection
Association (U.S.A.)**

Health



Fire Hazard

Reactivity

Specific hazard

NFPA Aerosol Level

Not applicable.

Validated by Product Safety on 7/11/2001.

Printed 7/12/2001.

Notice to Reader

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Section 1. Product and Company Identification

| | | | |
|----------------------------|---|---------------------------------|-------------------------|
| Product Name | ELECTRASOL® 2in1 TABS WITH JET-DRY® POWERBALL™ RINSE AGENT AUTOMATIC DISHWASHING DETERGENT | MSDS# | Not available |
| Product Description | -2in1 pre-measured automatic dishwashing tablet containing a special cleaning agent, concentrated detergent and rinse agents. | Validation Date | 6/14/2001 |
| Manufacturer | Reckitt Benckiser Inc. 1655 Valley Road Wayne, N.J. 07474 | Print Date | 6/18/2001 |
| Product Identifier | Not available. | In case of Emergency: | Telephone: 800-228-4722 |
| Item Number | 371061 | Information Emergencies: | Chemtrec: 800-424-9300 |
| Formula Number | ADPM512, ADPM417B, ADPM903 | | |
| UPC Number | 51700-75755 (18 tablets, 13 oz); 51700-75756 (25 tablets, 18.4 oz.); 51700-75757 (55 tablets, 40.3 oz.) | | |

Section 2. Composition and Information on Ingredients

| Name | CAS # | % by Weight | Exposure Limits : TLV/PEL |
|---------------------------------------|---------------|-------------|--|
| 1) CITRIC ACID | 77-92-9 | <3 | Not available. |
| 2) SODIUM CARBONATE | 497-19-8 | <25 | Not available. |
| TRIPOLYPHOSPHATES | 7758-29-4 | <35 | Not available. |
| SODIUM PERBORATE MONOHYDRATE | 7632-04-4 | 10-15 | Not Available |
| 5) NONIONIC SURFACTANTS | Not available | <5 | Not available. |
| 6) ENZYME MIXTURE, PROTEASE & AMYLASE | 9014-01-1 | 1-3 | CEIL: 6e-005 (mg/m ³) from ACGIH (TLV) [United States] |

Section 3. Hazards Identification

| | |
|---------------------------|---|
| Emergency Overview | CAUTION: HARMFUL IF SWALLOWED. EYE IRRITANT. Do not get in eyes. Contains enzymes. KEEP OUT OF REACH OF CHILDREN. |
|---------------------------|---|

Section 4. First Aid Measures

| | |
|---------------------|--|
| Eye Contact | In case of eye contact, immediately rinse eyes thoroughly with plenty of water. Remove any contact lenses and continue rinsing for at least 15 minutes. If irritation persists, consult a physician. |
| Skin Contact | In keeping with good hygienic practices, wash exposed areas thoroughly with soap and water. |
| Inhalation | Remove to fresh air. |
| Ingestion | Rinse mouth and drink a glass of water. Call a physician or poison control center. |

Continued on Next Page

**POWERBALL™ RINSE AGENT AUTOMATIC
DISHWASHING DETERGENT**

Section 5. Fire and Explosion Data

| | |
|--------------------------------------|---|
| Flammability | See Section 14 for any Shipping Classifications. |
| Flash Point | Not applicable. |
| Explosive Limits in Air | Not available. |
| Products of Combustion | Not available. |
| Fire and Explosion Hazards | None known. |
| Fire Fighting Media and Instructions | Not a fire hazard. Use extinguishing media suitable for surrounding materials. |
| Special Fire Fighting Instructions | Wear self-contained breathing apparatus and protective clothing appropriate for fighting a chemical fire. |

Section 6. Accidental Release Measures

| | |
|------------------|--|
| Accidental Spill | Collect spilled tablets and return to container. If powder has resulted from broken tablet(s), flush area with water or wipe with absorbent material (wet paper towel). Rinse well and dry floors to avoid slippery condition. |
|------------------|--|

Section 7. Handling and Storage

| | |
|----------------------|---|
| Handling and Storage | CAUTION: HARMFUL IF SWALLOWED. Eye irritant. Avoid eye contact. Contains enzymes. KEEP OUT REACH OF CHILDREN. Store in original container in a dry, secure area inaccessible to children and pets. |
|----------------------|---|

Section 8. Exposure Controls/Personal Protection

| | |
|--------------------------|--|
| Ventilation Requirements | No specific controls are needed. |
| Eye Protection | Avoid eye contact. Safety glasses with side shields. Emergency responders should wear eye protection. |
| Skin Protection | None required under normal use conditions. Emergency responders should wear impermeable gloves. |
| Respiratory Protection | None required. Avoid breathing dust from broken tablet(s). Emergency responders should wear suitable respiratory protection where exposure to airborne dust is possible. |
| Other Protection | None required |
| Work/Hygienic Practices | Washing with soap and water after use is recommended as good hygienic practice to prevent possible skin irritation and/or eye irritation from hand contact. |

Section 9. Physical and Chemical Properties

| | | | |
|----------------------------|---|-------|--|
| Description | Solid. (Solid rectangular tablets with rounded corners composed of a white layer, a smaller blue layer with white coated ball.) | Odor | Perfumed. |
| pH | 10 [Basic.] | Color | White and blue layered tablet with embedded coated ball. |
| Boiling/Condensation Point | Not applicable. | | |
| Specific Gravity | Not available. | | |
| Vapor Pressure | Not applicable. | | |

Continued on Next Page

**ELECTRASOL® 2in1 TABS WITH JET-DRY®
POWERBALL™ RINSE AGENT AUTOMATIC
DISHWASHING DETERGENT**

Page Number: 3

Vapor Density Not available.

Viscosity Not available.

Solubility Complete.

Physical Chemical Comments Not available.

Section 10. Stability and Reactivity Data

Chemical Stability The product is stable.

Conditions of Instability Temperatures in excess of 50°C.

Incompatibility with Various Substances None known.

Hazardous Decomposition Products Product develops heat and releases Carbon dioxide if contacts with acids.

Hazardous Polymerization Does not occur.

Section 11. Toxicological Information

Exposure effects

Eye Contact Eye irritant.

Skin Contact Not a primary skin irritant.

Inhalation Contains enzymes: Avoid breathing dust from broken tablets. May cause mild nasal irritation upon prolonged or repeated contact to the dust in an occupational or emergency response situation.

Ingestion Harmful if swallowed. Will cause burning in mouth and throat. Difficulty swallowing, excessive salivating in infants. Reddening and swelling of mucous membranes of the mouth and throat.

Carcinogenicity Not listed as carcinogenic by OSHA, NTP or IARC.

Section 12. Ecological Information

Ecotoxicity Not available.

Section 13. Disposal Considerations

Waste Disposal Collect tablets and return to container, if broken tablet(s) left powder on surface, collect powder, raising as little dust as possible. Wash surface or wipe with wet paper towel. Discard small amounts of material with trash collection. Discard single empty containers in household trash.

For large amounts of waste product, dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information

DOT Classification Not a DOT controlled material (United States).

Proper Shipping Name Not applicable.

DOT Identification Number Not applicable.

Shipping Group Not applicable.

Continued on Next Page

**ELECTRASOL® 2in1 TABS WITH JET-DRY®
POWERBALL™ RINSE AGENT AUTOMATIC
DISHWASHING DETERGENT**

| | |
|--|--------------------------------|
| Maritime Transportation | Not available. |
| Hazardous Substances Reportable Quantity | Not available. |
| Special Provisions for Transport | Not available. |
| TDG Classification | Not a TDG controlled material. |
| ADR Classification | Not available. |
| IMDG Classification | Not controlled under IMDG. |
| IATA Classification | Not controlled under IATA. |

Section 15. Regulatory Information

Federal and State Regulations SARA Title III, Section 313 Toxic Chemical Notification & Release Reporting:
None

California Proposition 65: This product contains the following ingredients which require a warning under the Safe Drinking Water & Toxic Enforcement Act:
1) Not applicable.

Other Classifications WHMIS (Canada) Not controlled under WHMIS (Canada).

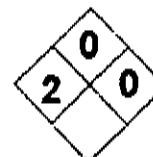
Section 16. Other Information

HMIS (U.S.A.)

| | |
|---------------------|---|
| Health Hazard | 2 |
| Fire Hazard | 0 |
| Reactivity | 0 |
| Personal Protection | a |

National Fire Protection Association (U.S.A.)

Health



Fire Hazard

Reactivity

Specific hazard.

NFPA Aerosol Level Not applicable.

Validated by Product Safety on 6/14/2001.

Printed 6/18/2001.

Notice to Reader

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Material Safety Data Sheet

Section 1. Product and Company Identification

| | | | |
|----------------------------|--|----------------------------------|-------------------------|
| Product Name | ELECTRASOL® AUTOMATIC DISHWASHER DETERGENT, DUAL ACTION W/ BAKING SODA - ALL SCENTS (POWDER) | MSDS# | Not available. |
| Product Description | Automatic dishwasher detergent with pre-soakers and baking soda to deliver sparkling clean dishes without a chlorine smell. | Validation Date | 6/18/2001 |
| Manufacturer | Reckitt Benckiser Inc. 1655 Valley Road Wayne, N.J. 07474 | Print Date | 6/18/2001 |
| Product Identifier | Not available. | In case of Emergency: | Telephone: 800-228-4722 |
| Item Number | 368947 | Transportation Emergency: | Chemtrec: 800-424-9300 |
| Formula Number | V2-G, V3-N F/F# 369983, 368947, 372241, 372240 | | |
| UPC Number | 51700-31492 (50 oz.), 51700-3157 (85 oz.), 51700-31732 (85 oz.) - Regular Fresh Scent; 51700-32565 (50 oz.), 51700-32581 (85 oz.), 51700-32807 (85 oz.), 51700-31530 (8 lb. pail), 51700-75600 (12.5 lb. pail) - Lemon Scent | | |

Section 2. Composition and Information on Ingredients

| Name | CAS # | % by Weight | Exposure Limits : TLV/PEL |
|----------------------|----------------|-------------|--|
| 1) SODIUM CARBONATE | 497-19-8 | <40 | Not available. |
| 2) TRIPOLYPHOSPHATES | 7758-29-4 | <40 | Not available. |
| SODIUM SULFATE | 7757-82-8 | <20 | Nuisance dust TWA: 5 mg/m3 (respirable dust fraction) from OSHA TWA: 15 mg/m3 (total dust) from OSHA TWA: 3 mg/m3 (respirable particulate) from ACGIH TWA: 10 mg/m3 (inhalable particulate) from ACGIH |
| 4) ENZYME MIXTURE | Not available. | 0.35 | Not available. |

Section 3. Hazards Identification

Emergency Overview CAUTION: HARMFUL IF SWALLOWED. EYE IRRITANT. Causes eye irritation.-KEEP OUT OF REACH OF CHILDREN

Section 4. First Aid Measures

Eye Contact In case of eye contact, IMMEDIATELY rinse eyes thoroughly with plenty of water. Remove any contact lenses and continue rinsing for at least 15 minutes. If irritation persists, get medical attention.

Skin Contact In case of skin contact, immediately wash with plenty of soap and water.

Inhalation Remove to fresh air.

Ingestion If swallowed, rinse mouth and drink a glass of water. Call physician or Poison Control Center.

Section 5. Fire and Explosion Data

| | |
|--------------------------------------|---|
| Flammability | Not flammable. See Section 14 for any Shipping Classifications. |
| Flash Point | Not available. |
| Explosive Limits in Air | Not available. |
| Products of Combustion | Not available. |
| Fire and Explosion Hazards | None known. |
| Fire Fighting Media and Instructions | Not a fire hazard. Use extinguishing media suitable for surrounding materials. |
| Special Fire Fighting Instructions | Wear self-contained breathing apparatus and protective clothing appropriate for fighting a chemical fire. |

Section 6. Accidental Release Measures

| | |
|------------------|--|
| Accidental Spill | Collect spilled material raising as little dust as possible. Flush area with water or wipe with absorbent material. Rinse well and dry floors to avoid slippery condition. |
|------------------|--|

Section 7. Handling and Storage

| | |
|----------------------|--|
| Handling and Storage | CAUTION: EYE IRRITANT. Avoid eye contact. Harmful if swallowed. Wear eye protection. Store in original container in a dry, secure area inaccessible to children and pets. KEEP OUT REACH OF CHILDREN |
|----------------------|--|

Section 8. Exposure Controls/Personal Protection

| | |
|--------------------------|--|
| Ventilation Requirements | No specific controls are needed. |
| Eye Protection | Avoid eye contact. Emergency responders should wear full eye protection. |
| Skin Protection | May cause skin irritation after prolonged or repeated use. |
| Respiratory Protection | Avoid breathing dust. |
| Other Protection | None required |
| Work/Hygienic Practices | Washing with soap and water after use is recommended as good hygienic practice to prevent possible eye irritation from hand contact. |

Section 9. Physical and Chemical Properties

| | | | |
|----------------------------|---------------------------|-------|---------------------------------------|
| Description | Solid. (Granular powder.) | Odor | Citrus (Lemon). Fresh scent (Regular) |
| pH | 11 [Basic.] | Color | White powder with blue speckles |
| Boiling/Condensation Point | Not applicable. | | |
| Specific Gravity | Not available. | | |
| Vapor Pressure | Not applicable. | | |
| Vapor Density | Not available. | | |

Continued on Next Page

**ELECTRASOL® AUTOMATIC DISHWASHER
DETERGENT, DUAL ACTION W/ BAKING
SODA - ALL SCENTS (POWDER)**

Page Number: 3

Viscosity Not available.
Solubility Complete.
Physical Chemical Comments Not available.

Section 10. Stability and Reactivity Data

Chemical Stability The product is stable.
Conditions of Instability Do not mix with anything but water.
Incompatibility with Various Substances None known.
Hazardous Decomposition Products None known.
Hazardous Polymerization None known.

Section 11. Toxicological Information

Exposure effects

Eye Contact Eye irritant.
Skin Contact Prolonged or repeated skin contact may result in skin irritation.
Inhalation None known.
Ingestion Harmful if swallowed. Can cause burning in mouth and throat. Difficulty swallowing, excessive salivating in infants. Reddening and swelling of mucous membranes of the mouth and throat.
Carcinogenicity Not listed as carcinogenic by OSHA, NTP or IARC.

Section 12. Ecological Information

Ecotoxicity Not available.

Section 13. Disposal Considerations

Waste Disposal Collect powder raising as little dust as possible. Discard small amounts of material with trash collection. Discard empty container in trash.
For large amounts of waste product, dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information

DOT Classification Not a DOT controlled material (United States).

Proper Shipping Name Not applicable.

DOT Identification Number Not applicable.

Packing Group Not applicable.

Time Transportation Not available.

Continued on Next Page

**ELECTRASOL® AUTOMATIC DISHWASHER
 DETERGENT, DUAL ACTION W/ BAKING
 SODA - ALL SCENTS (POWDER)**

| | |
|--|----------------------------------|
| Hazardous Substances Reportable Quantity | Not available. |
| Special Provisions for Transport | Not applicable. |
| TDG Classification | Not a TDG controlled material. |
| ADR Classification | Not applicable. |
| IMDG Classification | Not an IMDG Controlled Material. |
| IATA Classification | Not an IATA Controlled Material |

Section 15. Regulatory Information

| | |
|-------------------------------|---|
| Federal and State Regulations | SARA Title III, Section 313 Toxic Chemical Notification & Release Reporting: None California Proposition 65: This product contains the following ingredients which require a warning under the Safe Drinking Water & Toxic Enforcement Act: 1) Not applicable. |
| Other Classifications | WHMIS (Canada) Not controlled under WHMIS (Canada). |

Section 16. Other Information

| | | | | | | | | | | | | | | | | | | | |
|---|---|--------------------|-----------------|-------------|---|------------|---|-----------------|---|---------------------|---|---|--|--------|---|---|-------------|---|---|
| HMIS (U.S.A.) | <table border="1"> <tr> <td>Health Hazard</td> <td>2</td> </tr> <tr> <td>Fire Hazard</td> <td>0</td> </tr> <tr> <td>Reactivity</td> <td>0</td> </tr> <tr> <td>Specific hazard</td> <td>0</td> </tr> <tr> <td>Personal Protection</td> <td>R</td> </tr> </table> | Health Hazard | 2 | Fire Hazard | 0 | Reactivity | 0 | Specific hazard | 0 | Personal Protection | R | National Fire Protection Association (U.S.A.) | <table border="1"> <tr> <td>Health</td> <td>2</td> <td>0</td> </tr> <tr> <td>Fire Hazard</td> <td>0</td> <td>0</td> </tr> </table> | Health | 2 | 0 | Fire Hazard | 0 | 0 |
| Health Hazard | 2 | | | | | | | | | | | | | | | | | | |
| Fire Hazard | 0 | | | | | | | | | | | | | | | | | | |
| Reactivity | 0 | | | | | | | | | | | | | | | | | | |
| Specific hazard | 0 | | | | | | | | | | | | | | | | | | |
| Personal Protection | R | | | | | | | | | | | | | | | | | | |
| Health | 2 | 0 | | | | | | | | | | | | | | | | | |
| Fire Hazard | 0 | 0 | | | | | | | | | | | | | | | | | |
| Validated by Product Safety on 6/18/2001. | | NEPA Aerosol Level | Not applicable. | | | | | | | | | | | | | | | | |
| Printed 6/18/2001. | | | | | | | | | | | | | | | | | | | |

Notice to Reader

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MATERIAL SAFETY DATA SHEET

| | | | |
|--|---|-----------------------------|-------------------------|
| SECTION 1: IDENTIFICATION | | | |
| Material Name President's Choice Clear Automatic Dishwasher Detergent | | | |
| Manufacturer's Name KOREX Canada | | Supplier's Name | |
| Street Address 78 Triton Road | | Street Address | |
| City Toronto | Province Ontario | City | Province |
| Postal Code M8Z 2J8 | Emergency Telephone No. (416) 259-9214 | Postal Code | Emergency Telephone No. |
| Chemical Name | Chemical Family Dish Detergent | Chemical Formula Mixture | |
| Molecular Weight | Trade Name and Synonym ADD | Material Use | |

| Hazardous Ingredients | Approximate Concentration | C.A.S. No. or U.N. Numbers | Exposure Limits | LD 50 / LC 50 |
|------------------------------|---------------------------|----------------------------|---|---------------------------|
| | | | | Specify Species and Route |
| Sodium Carbonate | 25 - 45 | 479-19-8 | TLV 10 mg/m ³ (ACGIH) | Oral LD50 Rat 2,800 mg/kg |
| Sodium Silicate | 2 - 20 | 6834-92-0 | TLV 5 mg/m ³ (National Silicates) | Oral LD50 Rat 3,300 mg/kg |
| Sodium Dichloro Isocyanurate | 0.2 - 3.0 | 51580-86-0 | TLV 0.5 mg/m ³ (Monsanto) | Oral LD50 Rat 620 mg/kg |

| SECTION 2: PHYSICAL AND CHEMICAL PROPERTIES | | | | |
|--|--|------------------|------------------------------|--------------------------|
| Physical State Gas [] Liquid [] Solid [X] | Colour and Appearance White Granular powder (slight chlorine odour) | | Odour Threshold limit p.p.m. | Specific Gravity |
| Vapour Pressure (mm) | Vapour Density (Air=1) | Evaporation Rate | Boiling Point (C) | Freezing Point (C) |
| NAV | NAV | NAV | NAV | NAV |
| Solubility in Water (20 C) | % Volatile (by volume) | pH | Density (g/ml) | Coefficient of Oil/Water |
| | 5-15 | 10.5-11.5 | 1.0 +/- 0.1 | NAV |

| SECTION 3: FLAMMABILITY | | | |
|--------------------------------------|--|--|--|
| Flammability | If yes, under which condition? | | |
| Yes [] No [X] | | | |
| Means of extinction | | | |
| Special procedures | | | |
| Flashpoint (C) and Method NAV | Upper explosion limit (% by volume) NAV | Lower explosion limit (% by volume) NAV | |
| Auto Ignition Temperature (C) NAV | TDG Flammability Classification NAP | | Hazardous combustion products NAV |
| Explosion Data | Rate of Burning NAP | Explosive power NAP | Sensitivity to Static Discharge NAV |

| SECTION 4: REACTIVITY | |
|--|-------------------------------|
| Chemical Stability | If no, under which condition? |
| Yes [X] No [] | |
| Incompatibility to other substances | If so which ones? |
| Yes [X] No [] | Strong Acids |
| Reactivity and under what conditions? | |
| May evolve chlorine gas on contact with acids. | |
| Hazardous Decomposition Products | |
| Toxic gases given off in a fire, oxides of phosphorous, nitrogen and chlorine. | |

Material Name/Identifier

President's Choice Clear Automatic Dishwasher Detergent

SECTION 2: PHYSICAL AND CHEMICAL PROPERTIES OF PRODUCT

Route of Entry

Skin Contact Skin Absorption Eye Contact Inhalation Acute Inhalation Chronic Ingestion

Effects of Acute Exposure to Product

Irritation or burning of eyes, if ingested, burning of mouth and throat, nausea, vomiting. If inhaled irritation of respiratory tract.

Effects of Chronic Exposure to Product

Prolonged and repeated skin exposure may cause Dermatitis.

LD 50 of Product (Specify Species and Route)

NAV

Irritancy of Product

Irritation to eyes and skin

Exposure limits of Product

NAV

LC 50 of Product (Specify Species)

NAV

Sensitization to Product

NAP

Synergistic materials

NAV

Carcinogenicity Reproductive effects Teratogenicity Mutagenicity

SECTION 8: CONTROL MEASURES

Personal Protective Equipment

Respiratory (Specify)

3M 8710 Dust Mask

Eye (Specify)

Safety Glasses

Footwear (Specify)

Boots, if necessary

Gloves (Specify)

Cloth gloves

Other (Specify)

Eye wash fountains are recommended

Clothing (Specify)

Coveralls

Engineering Controls (e.g. ventilation, enclosed process, specify)

Local exhaust ventilation.

Leak and Spill Procedure

Small amounts should be flushed to sanitary sewers, if permitted by Local/Provincial Regulations

Waste Disposal

Landfill - Dispose according to appropriate regulations.

Handling Procedures and Equipment

Avoid ingestion & inhalation, wear P.P.E. & avoid generating dust.

Storage Requirements

Store in cool, dry place away from incompatible products.

Special Shipping Information

Skin

Avoid contact with skin and eyes.

Eye

Wash eyes for 15 minutes immediately after contact.

Inhalation

Move person to fresh air, if severe contact a physician.

Ingestion

Do not induce vomiting, give large amounts of water, contact physician.

General advice

NAP

SECTION 9: ADDITIONAL INFORMATION

Additional Information/Comments

The information on this MSDS relates only to specific material designated herein and does not relate to use in combination with any other material or any process.

Sources used

MSDS: Monsanto, General Chemical, National Silicates

Prepared by:

John Teloniatis

Phone number

(416) 259-9214 Ext 390

Date

January 2, 1999

The information on this Material Safety Data Sheet is provided by KOREX Canada free of charge. While believed to be reliable, it is intended for use by skilled persons at their own risk. KOREX Canada assumes no responsibility for events resulting or damages incurred from its use.

Telephone Contact Information:

Loblaws/President's Choice
@ Sunfresh Ltd. 416-967-2501
President's Choice Clear Choice Automatic Dishwashing Detergent

Unilever Canada
1-800-565-7273
Sunlight and All Brand ADD

Reckitt-Benckiser
1-800-888-0192
Phosphate levels provided for most detergents, except Electrasol Lemon Scent Gel ADD and
Electrasol Detergent Gel with Baking Soda.

Sobey's
Sobey's Ontario 416-238-1971 (ext. 4418)
Our Compliments Brilliance ADD and Smart Choice brand ADD

Reckitt-Benckiser (RB) Telephone Interview:

Introduction: Hi, my name is Ross Lashbrook. I am an environmental science student at Trent University in Peterborough, Ontario. Currently I am undertaking a research project for the Haliburton County Advisory Committee on the Environment. The advisory committee is very concerned with the use of phosphates in automatic dishwasher detergents. In my final report, I will discuss those automatic dishwashing detergents that contain the least amount of Phosphates, and those companies who have strived to lower the Phosphate concentrations.

Consent: The information you provide will be used in my final report, as details provided by your company. Individual names will be excluded, Is this acceptable? First attempt, office closed due to holiday (American Thanksgiving - Nov 22/01). Second attempt, Nov 28/01.

RB: Hold Please
 RB: What would you like to know?
 RL: next question...

Question: I was wondering if you could provide me with the phosphorus concentrations in the following products: **Electrasol Lemon Scent Gel ADD and Electrasol Detergent Gel with Baking Soda, as well as other ADD products.**

RB: This information is considered proprietary and is not given to the general public. It is only released to people with specific allergies provided they have their doctor contact us.

Question: If you cannot do so, why not? Phosphates have been proven to have a serious impact on aquatic environments. As an environmentally conscious manufacturer, surely your company recognizes that they have a responsibility to not only the consumer but to the environment to provide such information about their products. My report will not look favourably upon companies who do not appear to be environmentally conscious.

RB: This information is not even provided to us [the customer representative]

Question: What has your company done to lower the phosphate concentrations in your products?

RB: We would be happy to provide you with our 'school project kit' which provides information about our ingredients. Would you like that?
 RL: Yes.

Question: Is your company currently attempting to find replacements for phosphates?

RB: Our efforts are ongoing to constantly improve our products to meet consumer demands.

November 29/01. Letter: We do not have any information to provide to you. Phosphate levels are provided on our product label.

However, it is not on the product label. Returned call, attempting to reach the person who wrote the letter. December 11, 2001: Call, and I cannot directly speak with the person who wrote the letter. My question will be forwarded to the person, who will contact me in the next few days. Question was regarding phosphate levels not being on product labels - however, they are on labels in the U.S. Is there a different policy for Canada and the US?

President's Choice (PC) Telephone Interview:

Introduction: Hi, my name is Ross Lashbrook. I am an environmental science student at Trent University in Peterborough, Ontario. Currently I am undertaking a research project for the Haliburton County Advisory Committee on the Environment. The advisory committee is very concerned with the use of phosphates in automatic dishwasher detergents. In my final report, I will discuss those automatic dishwashing detergents that contain the least amount of Phosphates, and those companies who have strived to lower the Phosphate concentrations.

Consent: The information you provide will be used in my final report, as details provided by your company. Individual names will be excluded, Is this acceptable? First attempt: all representatives are busy, please leave a message and we will return your call (Nov 22/01). Call not returned (Nov 28/01), so I tried again.

PC: On Hold. Please leave a message, we will return call.

Call attempted again November 30.

PC: Darlene speaking.

RL: Question above posed.

PC: What questions do you have?

Question: I was wondering if you could provide me with the phosphorus concentrations in the following products: **President's Choice Clear Choice Automatic Dishwashing Detergent**

PC: Don't know because its manufactured by someone else, and they don't provide the information to us. The product formulation is kept by the product manufacturer and not released to us.

Question: Does the company which manufacturers your products not readily provide information regarding phosphates? Can this information be made available, if it is recognized that, while being 'proprietary information', it is in your interest as a retailer to have this information available for environmentally conscious customers?

PC: I am not sure that this information is available to us, even if we request it from the manufacturer. I will check with our product specialist and return your call. However, product formulation is not readily available.

* As of December 15th, call was not returned. (Request for response was repeated on December 10th).

At the end of the interview:

Thank you very much for your time. I appreciate it.

499-0012 2.7

Sobey's Telephone Interview:

Introduction: Hi, my name is Ross Lashbrook. I am an environmental science student at Trent University in Peterborough, Ontario. Currently I am undertaking a research project for the Haliburton County Advisory Committee on the Environment. The advisory committee is very concerned with the use of phosphates in automatic dishwasher detergents. In my final report, I will discuss those automatic dishwashing detergents that contain the least amount of Phosphates, and those companies who have strived to lower the Phosphate concentrations.

Consent: The information you provide will be used in my final report, as details provided by your company. Individual names will be excluded, is this acceptable?
SO: What is it you would like to know?

Question: I was wondering if you could provide me with the phosphorus concentrations in the following products: **Our Compliments 'Brilliance' and Smart Choice ADD.**

SO: we recognize that the use of phosphates is of concern, and we take that into consideration when looking into new product formulations. We also recognize that consumers may want to know the concentrations, however we do not provide that information to the public.

Question: If you cannot do so, why not? Phosphates have been proven to have a serious impact on aquatic environments. As an environmentally conscious manufacturer, surely your company recognizes that they have a responsibility to not only the consumer but to the environment to provide such information about their products. My report will not look favourably upon companies who do not appear to be environmentally conscious.

RL: I will mention in my report that Sobey's does not provide the consumer with product information.

SO: Please mention us as 'Sobey's Private Label' products. I regret that I am unable to help you.

Question: What has your company done to lower the phosphate concentrations in your products?

SO: We are always seeking to improve our product formulations, which are reviewed on a regular basis.

Question: Does the company which manufactures your products not readily provide information regarding phosphates? Can this information be made available, if it is recognized that, while being 'proprietary information', it is in your interest as a retailer to have this information available for environmentally conscious customers?

SO: I'm sorry, we cannot release such information.

At the end of the interview:

Thank you very much for your time, I appreciate it.

Unilever (UL) Telephone Interview:

Introduction: Hi, my name is Ross Lashbrook. I am an environmental science student at Trent University in Peterborough, Ontario. Currently I am undertaking a research project for the Haliburton County Advisory Committee on the Environment. The advisory committee is very concerned with the use of phosphates in automatic dishwasher detergents. In my final report, I will discuss those automatic dishwashing detergents that contain the least amount of Phosphates, and those companies who have strived to lower the Phosphate concentrations.

Consent: The information you provide will be used in my final report, as details provided by your company. Individual names will be excluded, is this acceptable? (put on hold)...

UL: will this report be published?

RL: yes

UL: proprietary information, please contact UL via letter. The information is proprietary, and would only be disclosed to an individual provided report is not made public.

RL: Many manufacturers disclose P levels in their products as something that should be available to consumers.

UL: It is not that we have anything to hide, but the appropriate channel is to contact UL on the University Letterhead and I'm sure they will be as helpful as possible. Sorry I could not help.

UL
 160 Bloor East
 St 300
 Toronto, M4W 3W3 fax: 416-415-3133

Interview ends.

Question: I was wondering if you could provide me with the phosphorus concentrations in the following products: **All and Sunlight**



Appendix 6.

TRENT UNIVERSITY

Peterborough, Ontario, Canada. K9J 7B8

Environmental and Resource Studies Program, Tel: (705)748-1011 x 1261, Fax: (705)748-1569

Company name here:
Address here:

Dear Sir or Madam:

I am writing to your company with regards to the automatic dishwashing detergents you sell under the following brand names: . Currently I am preparing a report, in my capacity as a Trent University student, for the Haliburton County Advisory Committee on the Environment. The Advisory Committee is very concerned with the amount of phosphates found in automatic dishwashing detergents, and their potential to have an impact on the aquatic environment. In preparation for the final report, which will be made public, I am seeking to identify those automatic dishwashing detergents that contain fewer phosphates, and those manufacturers who are taking a leading role in attempting to find suitable phosphate replacements. It would be greatly appreciated if you could provide information regarding the amount of phosphates in your products, as well as your company's involvement in the search for substitutes. It is probable that the Advisory Committee will fund laboratory testing for those products whose manufacturers do not release information. The information gathered will be used in an educational campaign, providing product information details and their potential to impact the environment.

I look forward to receiving your response,

Ross Lashbrook
Environmental and Resource Studies,
Trent University, Peterborough ON



RECKITT BENCKISER

November 29, 2001

Mr. Ross Lashbrook
112 Mc Donnell Street
Peterborough, ON K9H 2V8

Dear Mr Lashbrook:

Thank you for contacting us, and for your interest in Reckitt Benckiser.

Information regarding the phosphate content in our automatic dishwasher products is stated on the product label. We hope that the enclosed coupons will be helpful to you. Unfortunately, we do not have any additional written information to share with you at this time.

Best wishes with your school project. If you need further assistance or have any questions, please feel free to contact us again.

Sincerely,


Genevieve Ferrara
Consumer Relations

A102661660

Canadian- Free Household/Misc. Prod Cpn 3



SOBEYS CANADA INC.
304 THE EAST MALL, 7TH FLOOR
ETOBICOKE, ON
M9B 6B8

Appendix 7.2

November 20, 2001

Mr. Ross Lashbrook
Trent University 112 McDonnell Street
Peterborough, ON
K9H 2V8


Dear Mr. Lashbrook

Thank you for contacting Sobeys retail Brands concerning Our Compliments Brilliance and Smart Choice Automatic Dishwashing Detergent. We regret that we are unable to share with you the phosphate content of these products for competitive reasons. I am sure you will understand.

Please be assured that we are aware of the effect phosphates have on the environment and strive to produce products that are safe and of high quality.

Again, thank you for taking the time to share your thoughts.

Sincerely,


Claudette Levesque
Consumer Response Manager

Encl.
Ref. 10184



Procter & Gamble Inc.
Post Office Box 355
Station "A"
Toronto, Ontario
M5W 1C5
www.pg.com

Mr. R. Lashbrook
C/o Trent University
112 McDonnell St.
Peterborough, ON
K9H 2V8

December 7, 2001

Dear Ross,

As requested, please find below the information regarding the phosphorus content of our Cascade Dishwashing Detergent products. All values are expressed as wt% Phosphorus content. Please note that this information can also be found on most of our marketed packages of these products.

| | |
|--------------------------------|-------|
| Cascade Pure Rinse Powders: | 6.4% |
| Cascade Complete Powders: | 7.74% |
| Cascade Pure Rinse Gel: | 4.5% |
| Cascade Complete Gel: | 6.5% |
| Cascade Pure Rinse Power Tabs: | 8.7% |

I would also like to take this opportunity to provide you with some additional information regarding the use of phosphates in Automatic Dishwashing Detergents (ADD's), and their impact on the aquatic environment.

Phosphates are naturally occurring compounds, which contain phosphorus, oxygen, and other elements. Most brands of ADD's on the market today, both liquid and granular, contain phosphates.

The purpose of phosphates in these products is to tie up water hardness minerals (primarily calcium and magnesium), keeping food soil particles in suspension and preventing them from settling back on dishes. Even areas which legislate phosphate content in other cleaning products allow their use in ADD's. These products perform better with phosphates. However, we have greatly reduced the amount of phosphates in our dishwashing products over the years and we keep working at it.

Phosphorus, the key element in phosphates, is a nutrient needed by all living things. It's needed in lakes and streams to nourish plant organisms, which provide food for fish. But, sometimes aquatic plants can grow too fast when they have too much of the nutrients such as phosphorus and nitrogen, and when the waters are sufficiently slow moving and transparent to sunlight. When this happens, organisms such as blue-green algae can give water a bad appearance and odour. When algae die and decay, they use up oxygen needed by fish.

.../2

in some areas about the possible contribution of phosphates to this overgrowth of algae. This occurs in some lakes, but not most streams, rivers or oceans. Government agencies, and the detergent industry have studied the relationship between detergent and water quality for well over a decade. In general, these studies show that detergent contribute such a small fraction of the total phosphorus entering surface waters that they have little effect on water quality.


A report written for Environment Canada's Quebec Region entitled "The Impact of Phosphates Released from Automatic Dishwashing Detergents" indicates that the primary source of phosphates in the environment is from agriculture, which accounts for about 75% of the total phosphate loading. Municipal wastewaters account for about another 23% of the phosphate loading, the majority of this from human waste. Of the total, the report indicates that ADD's account for only about 2% of the total phosphate loading in Quebec. The report goes on to summarize that a minimum reduction of 20% is needed to produce a discernible effect on water quality, and that a regulation to limit the phosphate content of ADD's would have little or no effect on the total amount of phosphates released to the environment.

The report concludes that control of phosphates from agriculture is essential to prevent and eliminate the eutrophication of lakes and rivers in agricultural areas. It also recommends that providing wastewater and dephosphatation treatment to municipalities is the best solution to control phosphates released from municipal wastewaters. Secondary wastewater treatment can remove between 20 and 35% of phosphates, while dephosphatation can remove between 80 and 90% of the phosphates from municipal wastewaters.

Similar results to the report summarized above can also be found in the document entitled "Nutrients and Their Impact on the Canadian Environment" on Environment Canada's website at http://www.durable.gc.ca/group/group7/report/index_c.phtml. Page 23 of this document summarizes the sources of phosphorus in the municipal wastewater stream, with dishwashing detergents accounting for about 7% of this stream. Taking into account the approximate 75/25 split of agricultural vs. municipal wastewater sources from the Quebec region report, this also results in a phosphorus loading of about 2% from ADD's.

Additional phosphate information can also be obtained from Mr. Doug Sturch at Rhodia Canada Inc. (supplier of phosphate raw materials) at 905-664-9466.

Yours Sincerely,



John D. Hobbs
PROCTER & GAMBLE INC.
External Relations
ADD Project Manager

cc. D. Sturch

