Environment Canada's Risk Management Strategy for Wet Processing Textile Industry Addressing Textile Mill Effluents and Nonylphenol and Its Ethoxylates under CEPA 1999

ENGO Response

September 2002

Part A Recommended Risk Management Strategy (Environment Canada) [1]

NPEs: The recommended risk management objective is a reduction in use of NPEs that reflects the best available techniques economically achievable (BATEA) in order to reduce the environmental risks associated with NPEs. Accordingly, it is expected that a 97% reduction could be achievable at modest cost.

TMEs: There are essentially two components of the risk management objective:

- **For mills that discharge to a municipal system with treatment with effluent volume more than 30 m^3 per day, the proposed strategy recommends that the effluent toxicity must be below acute lethal levels.** That is, the toxicity of TMEs must be reduced to a level equivalent to a volumetric median effective concentration (EC_{50}) of 13% prior to being discharged to the municipal wastewater collection system[2]. The effluent volume per unit of production will not be allowed to increase in order to avoid meeting the objective through dilution. This objective is considered to be achievable through existing pollution prevention technologies that may result in significant savings for textile mills.

- **For mills discharging directly to the environment or to a municipal system without treatment (4%, or 8 mills), effluent must satisfy section 36 (3) of the *Fisheries Act, which prohibits the discharge of deleterious substances in water frequented by fish. No specific risk management objectives are proposed.***

The core risk management instruments to meet the objectives for NPEs and TMEs (except for those that discharge directly to the environment) are pollution prevention planning complemented by technology transfer, financial incentives and reporting. It is proposed that the technology transfer and financial incentives components are to make use of an existing joint program from Environment Canada and Economic Development Canada[3]. Reporting will become necessary as the pollution prevention requirements will eventually sunset and Environment Canada must be able to assess whether TMEs are being managed adequately in Canada.

Pollution prevention planning as a first step in meeting the risk management objectives was considered a **more efficient instrument** on the basis of cost-benefit analysis than a

[1] Environment Canada, *Proposed Risk Management Strategy for the Wet Processing Textile Industry Addressing Textile Mill Effluents and Nonylphenol and its Ethoxylates Under CEPA 1999,* May 2002

[2] This objective is based on extensive review of available toxicity data for treated and untreated TMEs using a Microtox® acute toxicity test.

[3] This joint program is being implemented in the Quebec Region is known as EnviroClub^{OM}.

regulatory package in that the benefits of P2 planning would require mills to rethink their processes, provide flexibility, minimize potential incompatibilities with existing or future provincial or municipal regulations and allow for early action.
While the cost of regulations (instrument development, implementation, compliance promotion and enforcement) are estimated to be twice that of pollution prevention planning, the plausibility that regulation a **more effective instrument** is acknowledged[4]**.**

Part B Comments on Proposed Strategy and Instrument

Environment Canada has indicated specific interest in views and comments on the following:

1) Some mills have already started to substitute NPEs. In this regard, what would be the reference year for the percentage of reduction of NPEs use?
2) Water conservation efforts often have the effect of concentrating toxic substances in effluent. How can we take into account these efforts in the toxicity assessment of TMEs?
3) What would be the method to evaluate, in the longer term, how the risk management objectives have been achieved regarding i) NPEs, and ii) the toxicity of TMEs?

The following comments represent ENGOs perspectives on the three issues noted above:

- **Timelines:** The timelines to meet the toxicity risk management objective and **baseline or reference year, have not yet been determined** and are still under consideration and discussion with stakeholders. A period of five to ten years has been discussed, but this is too lax. Efforts should be made to achieve the objectives by a specific year, e.g. 2006. The reference year could be set at year 2000. A timeline beyond four to five years places us into a future where governments would have changed, new trade agreements would be in place, advancement in instrumentation and technologies, etc.

- **Water Conservation:** Water Conservation will not be an option in the next five to ten years. The relative scarcity of cheap fresh clean water may force industries to become more innovative in water recycling technologies. The proposed risk management objective needs to consider the effect of water conservation on the toxicity of TMEs. Many of the technologies and practices to reduce toxicity also reduce water use and may in many cases concentrate the effluent, making it even more toxic. An adjustment factor based on the reduction of water use is likely in order not to penalize mills with such water reduction projects.

- **Effluent volume:** This is a very important factor in meeting the toxicity risk management objective. Dilution of TME should not be allowed in order to meet the

[4] Proposed Risk Management Strategy for Wet Processing Textile Industry, Environment Canada May 2002

objective (for example, a mill should not be allowed to increase its water consumption to meet the objective). Therefore, the recommendation on the toxicity objective must be based on combining it with an objective that prevents the increase in effluent volume per unit of production. The mechanism for implementing such a measure should be one that can be enforced, whether through permits to mills or some other legal instrument.

While we have addressed the above questions, we are not limiting our comments to them alone. The consultations were limited to examining TMEs in water only. We were not allowed to consider the sludges produced by municipal wastewater treatment through which TMEs are flushed, nor the sludges produced by those companies which have their own water treatment facilities on site. It was pre-determined that regulation was not an option in this discussion. Although, when sludges are applied to the land, they ultimately end up in surface water or ground water. With those limitations in mind, we express the following additional concerns:

TMEs:

- TMEs are being considered as a whole. What is % composition of more prevalent compounds and their relative toxicity, the concentration range of NPEs? How variable is the composition of TMEs – is it process dependent?

- The toxicity recommendation is an EC_{50} of 13% based on Microtox testing. How valid is this form of testing in its ability to predict acute or chronic toxicity? Where else has it been used? Is the 13% appropriate? Is Microtox appropriate in low pH and marine receiving waters?

- No specific risk management objectives are proposed for TMEs discharged directly into the environment (or to a municipal system without treatment) other than continued compliance with the Fisheries Act. The application of the Fisheries Act is questioned as to its track record and whether it would be effective for those mills discharging untreated waste. In addition, the Department of Fisheries and Oceans does not have jurisdiction over all inland waters. Their enforcement record has not been an exemplary one. The toxicity of TMEs varies with the pH and salinity of the receiving waters (more toxic at lower pH's and in saline marine waters).

- There is a need to improve and consolidate data on each producer re, size, effluent volume, processing information, treatment and history – age, improvements/changes made, etc. This information is necessary to incorporate into P2 planning and track improvements.

- There are no provisions or plans for auditing or monitoring a mill's performance and/or compliance with their Pollution Prevention Plan. Nor is there any remedy proposed if a producer does not prepare a P2 Plan as requested by the Environment Canada.

- At what stage should an old mill be closed rather than continue to operate with some modifications?

- **Effluent volume**: The strategy applies to mills whose effluent volume is greater than **30m^3/day** on **average**. While this target volume may capture the majority of mills (possibly more than 80%) some questions arise, for example;

    1) variability in discharge volume on a daily basis from a specific mill

2) shut down periods affecting the average discharge rate
3) the number of mills not captured by this threshold, their effluent treatment and possible impact on the receiving environment

- The cumulative and local environmental impacts must be considered, not just volume of effluent from a specific mill.

- Mills should not be allowed to discharge directly into receiving waters, or be sent to MWWP that have no treatment. Why should the community at large be expected to provide the remedy i.e. secondary treatment to the industry, thus down-loading the costs to society? As it is, the burden of dealing with the more toxic sludges becomes a problem for the affected municipalities. Who pays for the contaminated aquifers and surface waters for those mills that release their effluent directly into receiving waters?

- While P2 is the recommended instrument there are many mills which rely on primary treatment. What efforts are going to be made to upgrade levels of treatment and how? Who pays?

- While pollution prevention seems like the cautious approach to risk management, interpretation of what is considered to be P2 activity varies and is subjective.

- Only declaration of P2 Plans and interim reports are mandatory. The risk management objectives of P2 planning are not enforceable. How is non-compliance by any mill to be handled?

- **Transparency of Information**: Access to P2 Plans will not be permitted to the public, only the Declarations. How is the public to be informed if mills are not preparing or properly implementing such plans?

- P2 planning requirements cease at the time of implementation of the Plan. What form of reporting and monitoring will be done to assess whether TMEs and NPEs are adequately being managed in Canada?

- **Reporting:** While some NPEs are reportable to the National Pollutant Release Inventory (NPRI), TMEs are not currently on the NPRI nor likely to be added in the near future. Therefore, there is no current monitoring mechanism for TMEs at a national level that could examine trends on, at minimum, an annual basis. What resources are being made available to ensure appropriate reporting and monitoring?

- **Regulation** or other mandatory measures were not chosen primarily on the basis of "cost-effectiveness". However, there are disadvantages of P2 plans that bear costs as well that need consideration in weighing the effectiveness of P2 planning versus regulation.

- Mills not in operation at the time the Pollution Prevention notice is published will not be required to prepare a P2 Plan unless a new notice is published by Environment Canada. If new notices are not likely to happen, then how are new mills to be assessed? If reliance for new mills is placed on local municipalities and provinces, how is national consistency possible?

- What is the definition of a "new" mill? Is it a modification of an old mill to some extent? How are new mills included in the strategy?

- What is the impact of imports and trade agreements on the Canadian textile mill industry? There are more Trade Agreements in the offing. The advantages of these Agreements to Canadian industry and the Citizens of Canada have yet to be demonstrated.

- What are potential risks from occupational exposure at mills?

- **MWWTPs:** More effort should be made to integrate with efforts by MWWTP regarding treatment and pollution prevention. Ultimately, it is important to prevent and/or input of toxic TMEs into our waters rather than after the fact, with the result being a toxic sludge.

- **Combined wastewater collection systems:** 41% of textile mills are connected to these systems, a legacy of old infrastructure. Such systems receive 44% of total TME flow[5]. They are liable to frequent overflow conditions when sewers reach capacity and the excess water or wastewater from storm drains escapes the collection system through overflow structures. The reliance on these systems is problematic from the point of view of pollution control of effluent.

- **Existing Legislation and Guidelines** (e.g., Sewer By-Laws - Toronto, and other areas in Canada, US, EU): How do they correlate in terms of their measure of toxicity and level of protection and P2 plans?

- Guidance documentation and training for the Industry is strongly recommended.

NPEs used in the Textile Mill industry, and their degradation products, are entirely anthropogenic and have demonstrated to have estrogenic effects on fish and other organisms when released into receiving waters. Although, NPEs originate from many sources, we are only considering those used in the textile industry at this point. Those concerns are as follows:

NPEs:

[5] Many water treatment facilities are combined collection systems, that is, they receive all wastewater in the same system. They are prone to lead to overflows from excess water added to sewage. In Quebec, which produces 72% of all TMEs in Canada, the TME flow is six times higher than Ontario.

- **Substitution of alternate substances to replace NPEs**: For example, OPs are much less prevalent, but are far more toxic with respect to estrogenicity than NPEs. Other alternatives are Alcohol Ethoxylates (AE) which are readily and ultimately degradable (NPEs are not biodegradeable). **ENGOs are concerned about their relative effectiveness and availability.** The cost of introducing alternatives was not seen as a major deterrent by the majority of stakeholders.

- Reductions in the use of NPEs in the order of 97% have been recommended by the strategy. Why not consider 100% within a specified time period and or a complete ban? A shorter time period for implementation is preferable.

- How does Environment Canada ensure that NPE use will decrease?

- Has the potential mutagenic and estrogenic activity of NPEs and its degradation products been considered in setting the objective?

NPEs are looked at in terms of **use** in Canada. What about fabrics and yarns that are imported and already treated with NPEs? What measure of control is considered on these materials? What is the impact on domestic fabrics and yarns? How much NPE and degradation products enter the environment from imported materials?

Backgrounder

i) CEPA 99 Declaration

The Ministers of the Environment and of Health published their final decision on the assessment of textile mill effluents (TMEs) and nonylphenol and its ethoxylates (NPEs) in the Canada Gazette on June 23rd, 2001 thereby notifying the public that they recommended TMEs and NPEs to be added to the List of Toxic Substances in Schedule 1 under the Canadian Environmental Protection Act, 1999 (These substances were found toxic under section 64, CEPA 99, in particular, section 64(a)[6]).

Under subsection 91(1) of CEPA 1999, the Minister of the Environment must propose a regulation or instrument respecting preventive or control actions to manage TMEs and NPEs no later than June 23rd 2003 and finalize the instrument by December 23rd 2004. CEPA risk management instruments include legislation/regulation, and voluntary measures such as controls, code of practice and Pollution Prevention (P2) plans.

ii) NPEs (as related to TMEs):

NPEs are part of a broader group of compounds known as alkylphenol ethoxylates (APEs). NPEs are a family of products widely used by Canadian textile mills as surfactants, detergents, wetting agents and drying agents. Appreciable quantities of NPEs are discharged from these mills primarily in effluents. Effluent composition varies considerably according to the source and degree and type of treatment.

While NPEs biodegrade during treatment, some of the biodegradation by-products are more persistent and more toxic than the parent NPE being discharged into the treatment plants. NPEs have been reported to cause endocrine disruption in a variety of organisms and are considered as Track 2 substances under TSME hereby requiring life cycle management.

The risk assessment report by Environment Canada on NPEs indicated that environmentally harmful concentrations of NPEs occur in untreated or partially-treated industrial mill effluents, including TMEs. Secondary- or tertiary-treated effluents generally have concentrations of NPEs below levels of environmental concern.

iii) Canadian Textile Mills and Effluents (TMEs):

Textile mill effluents (TMEs) are wastewater discharges from wet processing textile mills involved in activities such as scouring, neutralizing, desizing, mercerizing, carbonizing, fulling, bleaching, dyeing, printing and other wetfinishing processes. Effluents are not

[6] *Section 64 states that a substance is toxic if it is entering or may enter the environment in a quantity or concentration or under conditions that (a) have or may have an immediate or long-term effect on the environment or its biological diversity. Sections (b) and (c) are ones that relate to health.*

generated at dry processing (for example, carding, spinning, weaving and knitting), laundering or those that manufacture of synthetic fibres through chemical processes[7].

TMEs are complex combinations of chemicals and their composition varies over time and from one mill to another. TMEs may contain high levels of suspended solids, NPEs and other organic compounds, some of which are persistent and bioaccumulative.

TMEs are totally anthropogenic. All TMEs are ultimately released to the environment either prior to or after wastewater treatment. In the context of this study, TMEs do not include waste streams such as air emissions or solid waste.

Environment Canada's risk assessment on TMEs was based **on the impact of the effluent as a whole**, that is no attempt was made to determine the contribution of individual components of TME to toxicity or their environmental effects. The assessment indicated that untreated and primary-treated effluents are harmful to aquatic organisms while secondary- and tertiary-treated effluents are generally considered not likely to cause environmental harm.

iv) Location and Treatment of Effluent

Note: Information on Canadian mills was obtained from two surveys conducted by Environment Canada (EC) and the Canadian Textiles Institute. The 1997 survey was voluntary and resulted in a low response (35%) with considerable gaps. A ***mandatory survey*** (under a CEPA Section 16 notice issued by EC) in 1999 led to a near 100% response. This survey information has been updated in 2001[8]. Nevertheless, information and date gaps as well as inconsistencies remain. To all intents and purposes, this document assumes a total of 145 wet-processing mills in Canada and acknowledges that this total may not reflect the actual case as some mills may have shut down while there may be other facilities that have not been recorded.

Six mills (4%) rely completely on on-site treatment systems – one mill on primary and five mills on secondary treatment[9]. The remaining 139 wet processing mills (96%) discharge to municipal wastewater collection systems, 99% of which had some form of wastewater treatment. Two mills discharging untreated TMEs to MWW systems that have no treatment systems[10]. The highest percentage of TMEs received secondary treatment (61%), followed by primary (28%), tertiary (9%) and none (<1%).

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[7] The major categories of processes associated with these mills include: Carpet finishing - 9 mills; Knit fabric finishing: - 56 mills; Stock/yarn finishing: - 14 mills Non-woven fabric finishing - 7 mills; Wool finishing - 9 mills ; and Woven fabric finishing - 40 mills

[8] Information presented here has been further updated by a report done for Environment Canada (by Dessau-Soprin Inc.) 'Assessment of the Potential Risk of Direct Discharge of TMEs – Stage 1", Nov. 2001

[9] These mills are: PEI – 1, Nova Scotia – 2, New Brunswick – 2 and Quebec – 1.

[10] The two mills with no treatment are: Nova Scotia Textiles, Windsor, Nova Scotia discharging into the St. Croix River and Les Trois Godin, St-Anne-de-la-Pérade discharging into the Ste. Anne River. Details of treatment levels are in the above reference, Table 1.

The following table illustrates the location of these mills by province and the degree of treatment, that is, primary, secondary and tertiary (1999 data)[11]:

Province	**Number of Mills**	**% Total**	**Treatment**			
			None	Primary	Secondary	Tertiary
Quebec	84 [12]	58	1	36	44	3
Ontario	50	34		2	36	12
Nova Scotia	5	3	1		4	
New Brunswick	3	2		1	2	
British Columbia	2	1		2		
PEI	1	1			1	
Total	145	100	2	41	87	15

Approximately 100 000 m^3 of TMEs discharged daily to the Canadian environment. 90.5% of the total discharge is sent to municipal wastewater treatment plants, 9.5% is treated in the mills themselves while less than 0.1% is discharged into a watercourse untreated. [94% of the effluent ends in freshwater ecosystems. 5 mills discharge to estuarine environments and three to marine environments, with one case of septic field disposal.]

v) Composition of TMEs

Textile mills use a wide variety of chemicals to conduct wet processing operations. Those chemicals include acids, bases, salts, wetting agents, retardants, accelerators, detergents, oxidizing agents, reducing agents, developers, stripping agents and finishes. Many chemicals are not retained in the final product and are discarded in TMEs.

TMEs contain a wide range of chemicals and are known to have a range of pH, temperature, and colour and oxygen demand characteristics. Based on surveys done on these mills, several organic pollutants expected to be found in untreated TMEs in Canada include substituted alkylphenolics, NPEs and NPs, benzenes, naphthalene, phenol, substituted phenols and phthalates[13].

Organic pollutants identified in **untreated** TMEs from three mills in Atlantic Canada generally fell into one of five groups:
- Detergents/surfactants
- Plasticizers
- Dye carriers
- Mineral oils and
- Miscellaneous chemicals

[11] Environment Canada PSL2 Report, Appendix B, p.40 defines degree of treatment
[12] A number of mills (12) with primary treatment in Quebec are currently closed.
[13] For a more substantial list of pollutants, refer to Environment Canada's PSL Report – TMEs, p.7.

Metals measured in effluent discharges from Canadian textile mills include arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc, calcium, iron and manganese.

Dyes are used extensively in the textile industry. Furthermore, a substantial quantity of dye used is not fixed to fabric in dye baths.[14]. TMEs are characterized by high levels of colour caused by residual dyes that were not fixed to fibres in the dyeing process. In addition to residual dyes, process waters also typically contain auxiliary chemicals such as salts, surfactants, spent solvents, acids and bases.

Untreated TMEs are known to have extremes of pH (either alkaline or acidic, depending on the processes used) and temperature, high biological oxygen demand (BOD), high chemical oxygen demand (COD) and high concentrations of suspended solids (SS).

While the risk assessment done by Environment Canada was based on the impacts of whole effluents and did not attempt to determine the contribution of individual components of TMEs to toxicity or environmental effects, some effort was made to determine the environmental risk of nonylphenol and its ethoxylates in TMEs[15].

vi) Description of Effects Characterization and Toxicity

Whole effluent aquatic toxicity measures the total toxic effect of an effluent directly with a toxicity test on a sample of effluent that has not been treated to separate the toxic components based on volumetric concentrations. For example, a 96-hour LC_{50} for rainbow trout of 5% mean that a test solution of 5% of effluent being tested plus 95% dilution water is estimated to cause 50% of the test organisms (rainbow trout) to die after 96 hours of exposure. (Note: LC_{50} is median lethal concentration, IC_{25} is the inhibiting concentration estimated to cause a 25% effect).

Acute toxicity: EC_{50} is the median effective concentration for which 50% of the effect occurs after a specified time period. For "Microtox testing" testing an EC_{50} of 13% means that a test solution of 13% of effluent plus 87% dilution water is estimated to cause 50% of the test organisms (V.fischerei) to exhibit acute toxicity effect of luminescence within 15 minutes of exposure (this effect is the 'glow' exhibited by these organisms)[16]. The higher the percent of EC_{50}, the less toxic the effluent is, in other words, an EC_{50} of 100% is assumed non-toxic in that no effect is observed.

Thus an EC_{50} of 5% is more toxic, in that a test solution of 5% effluent requires 95% dilution water to cause 50% luminescence effect after 15 minutes (this represents a dilution of 20 of effluent sample is required to result in non-toxic effluent from MWWTP

[14]The degree of fixation is largely dependent on the type of dye used. For commonly used dyes, typical unfixed levels are as follows: disperse, 1–12%; direct, 4–36%; reactive, 3–45%; vat, 5–30%; sulphur, 5–40%; acid, 2–15%; basic, 1–4%; and metal complex, 2–18% (European Commission, 1996).

[15] This was due to the availability of information produced by concurrent PSL2 assessments for NPEs.

[16] 13% is based on effluent from mill (influent prior to entry into the MWWTP) to result in EC_{50} of 100% after treatment (that is, a non-toxic effluent). 13% represents a dilution factor of 7.5 in toxicity (100/7.5).

and would be unacceptable. A 20% EC_{50} means that the effluent requires less dilution (80%) and is thus less toxic.

vii) Municipal Waste Water Effluent (MWWE):

MWWE is one of the four priority sectors being addressed through the risk management of NPEs. The municipal sector is indicated as a large source of NPEs. Environment Canada is addressing the whole lifecycle of NPEs. By focusing the risk management on products containing NPEs, the releases of NPEs to the municipal wastewater treatment plants will be controlled. NPEs leaving these plants (in MWWE) will be addressed at a later date through the risk management of MWWE.

viii) Update on the National Pollutant Release Inventory (NPRI)

Currently the NPRI lists 3 nonyphenols, 10 NPEs and 1 octylphenol (OP). Environment Canada has recommended modifications to the NPRI for the 2003 Reporting Year that would require the listing of NP/NPE and OP/OPE as a group with a total threshold of 10 tonnes. Once the threshold is met, two separate reports would be required, one for NP/NPE as a group and the other for OP/OPEs. The NP/NPE group would include but not be limited to those presently listed on the NPRI (13) and 15 additional substances. Likewise the OP/OPE would include but not be restricted to the one currently on the NPRI and additional 5 substances [17].

For 2002, MWWTP with annual average discharge into surface waters greater than 10 000 m^3 per day will report on all NPRI listed substances upon triggering the reporting threshold **regardless of the number of employees**.

[17] OPs are currently less prevalent than NPEs, but their use increase as alternatives to NPEs. OP/OPEs exhibit 10 times more powerful estrogenic activity. That being the case, an alternate reporting threshold (e.g., 1 tonne) for OPs may need to be considered.

List of Acronyms

AEs	alcohol ethoxylates
BATEA	best available techniques economically achievable
CAS	Chemical Abstract Services
CEPA 1999	*Canadian Environmental Protection Act, 1999*
DSL	Domestic substance list
EC_{50}	median effective concentration
ENGO	environmental non-governmental organization
LC_{50}	median lethal concentration
MWWE	municipal wastewater effluent
MWWTP	municipal wastewater treatment plants
NPRI	National Pollutant Release Inventory
NPEs	nonylphenol and its ethoxylates
OPs	octylphenols
OPEs	octylphenol and its ethoxylates
P2	pollution prevention
TME	Textile Mill Effluent

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