Contaminant Reduction through Safer Product Chemistry – Minnesota’s Initiative

ISTC Sustainability Seminar
October 13, 2016

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MPCA Safer Product Chemistry Coordinator
Outline

- Background on green & safer chemistry in MN
- Pollution prevention projects:
  - BPA & BPS in thermally-printed paper
  - PAHs in pavement sealants
  - NPEs in detergents
  - (Salt in winter pavement maintenance)
MPCA actions and approach

- Moving in recent years to work proactively and preventively to reduce the use and presence of problematic chemicals in products

- Leverage and bolster drivers
Drivers

- Monitoring and study - more; more advanced
- Consumer awareness/activism
- Company-by-company “red” lists
- Major buyers – requiring disclosure
- Alliances of major buyers/brands
- Product testing – buyers, regulators, activists
- Buyer audits and third-party certifications
Key sectors

- Children’s – esp. with higher exposure potential
- Personal care
- Clothing (and fabric care)
- Home and office maintenance
- Building products and furnishings
- Food/beverage packaging
Connections to sustainability

- In general, consumer-facing firms have integrated more into sustainability programs
- Other sectors, not so visible vs. climate, water – or sometimes downplayed
- Rising population
- More products, more chemistry (96%)
- Legacy of toxics, especially PBTs
- Full impacts on humans and ecosystems are unknown, but changes are becoming evident
MPCA green & safer product chemistry

- Partners
- Projects
- Use data to set priorities
- Monitoring & compliance
- Reduce loadings, effects
- Education & capacity

Current chemistry

Future greener chemistry
Reduction of Bisphenol A (BPA) & Bisphenol S (BPS) in thermally-printed paper

Initial project supported in part by a grant from the U.S. EPA
BPA impacts

- Affects health of humans and aquatic life
- Endocrine active – mimics estrogen
- Linked to obesity, proliferation of breast cancer cells, attention and other developmental issues, early onset of puberty
- In aquatic species, reduces ability to reproduce (e.g. feminization of males)
- Emerging research on BPS – similar structure
BPA basics

- 14B lbs/year used in polycarbonate, resins, coatings
- Present in 95% of people
- Surface waters
  - Even remote lakes
  - Degrades, but pseudo-persistent due to continual inputs
- Groundwater
  - Leaking landfills
- Sediments
- Fish
  - With other compounds
How does thermal paper work?

[Diagram showing the components of thermal paper and the process of printing]

Science News
What we know

- Cashiers have more BPA in blood and urine
- Unbound on receipts
- Easily transferred to skin and absorbed
- Transfer and uptake are facilitated by moisture, alcohol sanitizers, lotions, grease
- 10-60% of BPA on hands will be absorbed
- Less chemical on unprinted side
- EPA DfE: no clearly-safer substitutes in 2014
- Businesses, employees and citizens can take steps to reduce use and exposure
Our concerns

- Most exposed populations
  - Cashiers

- Most vulnerable populations
  - Pregnant women & women of childbearing age (fetuses)
  - Nursing women (infants)
  - Children

- Environmental loadings over life cycle
Project approach

- Voluntary
- Hospitality sector
- Assistance with switch to digital receipts – $1000 grants
- Baseline metrics
  - Amount of paper used
  - Paper testing
- Exploration of other strategies
- Reach out to network of proactice companies
Green Chemistry and Design | BPA in thermal paper

www.pca.state.mn.us/receipts

If you are an employee who handles receipts (like a waiter, cashier or librarian) or you run a business that gives out receipts, you are likely using thermal paper and it almost assuredly is coated with either BPA or its chemical cousin, Bisphenol S (BPS). All of the 18 thermal papers we tested were coated with either BPA or BPS.

BPA is a hormone-disrupting chemical that is linked to a host of health problems, including obesity and attention disorders. The other commonly used chemical for thermal receipts, BPS, has been shown to have some similar effects.

Fortunately, you can take steps to reduce this problem:

1. Find out if your receipt paper is thermal. Click on FAQs below — How do I know if a receipt is thermal paper?
2. Educate employees and encourage them to adopt new receipt handling strategies. Click on the “Strategies” tab below. Read them and share with employees.
3. Ask customers “Do you want your receipt?” if they decline it, don’t print it! This simple step can cut paper use by around 30%.
4. Don’t print merchant copies of receipts if your system already keeps an electronic record. This can cut paper use by 50%.
5. Begin to offer digital or e-receipts. These use no paper at all and are the best step you can take currently, (So far, there are no clearly safer thermal receipt papers on the market.) Click on the Reports and POS tabs below to find case studies and e-receipt options.

NEW REPORT: Reducing use of BPA and BPS Thermal Paper in the Hospitality Sector

This whitepaper describes how assistance and education to businesses can reduce use of thermal paper receipts...

In this section:

- About the BPA in thermal paper project
- Case studies: BPA in Thermal Paper Project
- Working to reduce BPA exposure from receipts

Businesses go paperless

The idea of paperless receipts is catching on. Find out more about how Minnesota businesses are making the switch.

Sign up for email alerts

Sign up for Green Chemistry and Design emails.
Simple steps companies can take

- Minimize use
  - Ask customers: “Do you need a receipt?” or "Is an e-receipt OK?” Only print if needed
  - Do not print merchant copy if transaction is already kept electronically

- Minimize handling of thermal receipts
  - Minimize friction/wipe action, like crumpling
  - Minimize grip pressure; use two fingers only
  - Avoid moisture, grease, lotion, alcohol-based cleaners
  - Use gloves
Results of project actions

- Don’t automatically give receipts that aren’t wanted (8-37% reduction)
- Don’t print if receipts are kept electronically (50% or more reduction)
- Switch to e-receipt (2-18% paper reduction)
- Double-sided thermal paper (no chemical reduction; 40-50% less paper)
- Switch to a non-phenol paper (99.9% reduction; little or no paper reduction)
Small retail results

- Data from 8 small businesses: 7,300 pounds of paper and 109 pounds of BPA/BPS reduced - 10-30% reduction from their current practices
- 14 other small business partners could reduce 1,052 – 3,155 pounds of paper & 12-36 pounds of phenol
- Further promotion is planned: reducing thermal paper use and replacing with non-phenol
Large retailers

- MPCA worked with Best Buy which then pushed e-receipts and went non-phenol in US
- By reducing or replacing phenol papers, big stores could reduce BPA/BPS use by 2 to 5 tons (at 1.5% by weight; 1 million + rolls/year)
- MPCA estimates US thermal paper use ~146,000 tons annually - if similar 10-30% paper reduction:
  - 14,600 – 43,800 tons less paper
  - 219-657 tons less endocrine-active chemical use
Long-term metrics

- Environmental monitoring
- Bio-monitoring
- Monitor data on quantities used (EPA Chemical Data Reporting, other)
Reduction of Polycyclic Aromatic Hydrocarbons from Coal Tar-Based Pavement Sealcoats (CTS)

supported in part by a grant from the U.S. EPA Great Lakes Restoration Initiative (GLRI)
Sealcoat basics

- Black liquid spread on asphalt pavement
- Non-road surfaces
  - Driveways, parking lots, playgrounds, etc.
- Especially in suburban areas
- CTSs are NOT typically used on public roadways
- CTS used since ~1960 and peaked soon after 2000
- Used mostly east of the Rockies (coking process)
- 2007 data: 85 million gallons/year CTS sold in U.S.
  - At 5%+ PAH, over 50,000,000 lbs PAHs/year
  - Released by vaporization, weathering, tire wear, plowing
Major Sources of PAHs to Metro-Area Stormwater Pond Sediments
(MPCA, 4/17/2013)

- Coal Tar-Based Sealant Dust & Runoff Particles: 3.4%
- Vehicle Emissions (cars and trucks): 29.5%
- Pine Wood Burned in Fireplaces: 67.1%

Courtesy: Judy Crane, MPCA
- 40 years, 10,000 cubic yards, mostly near culverts
- Rule of thumb is $50/yard: sampling, digging, trucking to lined landfills, plus tipping fees
- If 10% of sediments in 20,000 MN ponds exceeds the top PAH reference value = $1 billion cost to Minnesota cities
Summarizing the Case for Action on CTS

- PAHs – potential for cancer and developmental impacts
- Stormwater ponds fill up with sediment, some high in PAHs
  - Tripled cost of clean-out and proper management in MN
- 50% or more of PAHs in urban sediment traced to CTS
- Coal tar sealant is still in use especially east of the Rockies
- **This source of PAHs is preventable AND safer substitutes exist which are comparable in performance and cost**
Outreach 2011 – 2014

- Primary manufacturers - no
- Elimination appeal to retailers, distributors
- Contractors-applicators – pledge not to apply CTS
  - Offer listing/mapping to connect them to buyers
- Guidance on safer alternatives and application
- Education/appeal to many buyers & groups
  - School district, shopping center, business, worship
- Municipalities, colleges (education and/or policy)
- Residents: indirect and direct through partners
Stormwater: Great Lakes coal tar sealcoat PAH reduction

This project supports reduction or phase-out of the use of coal tar-based sealcoats for asphalt pavement surfaces. Such actions will reduce loading of polycyclic aromatic hydrocarbons (PAHs) to surface waters and sediments in Great Lakes states and provinces, and reduce hazards to children and vulnerable adults playing, living or working near coal tar-sealed surfaces like drives, parking lots, and playgrounds.

This project was funded by a Great Lakes Restoration Initiative grant from the U.S. Environmental Protection Agency and was led by the Minnesota Pollution Control Agency (MPCA). Partners included Freshwater Future, the Michigan Department of Environmental Quality, the University of Wisconsin-Extension Solid and Hazardous Waste Education Center and the Great Lakes Regional Pollution Prevention Roundtable.

For more background or technical assistance, contact Al Innes, MPCA, alister.innes@state.mn.us, 651-757-2457.

(Map credit: Nations Online Project)

The following document lists some who have phased out coal tar sealcoats.

- [Summary of Coal Tar-based Sealant Bans/Restrictions in the United States](#)

Links to past and future efforts are available below.

- [Interactive map of companies certifying they will not apply coal tar sealcoat](#)
- [Company pledge/certification form](#)
Great Lakes area actions – October 2016

Full U.S. List at https://www.pca.state.mn.us/sites/default/files/tdr-g1-12.pdf
Lessons learned – and to be learned

- Where regulatory and market drivers are in place, providers are more responsive
- Where drivers not yet in place, need to start by educating pavement owners, purchasers, local gov’t
  - Educate citizen groups, who reinforce this messaging
  - MI municipalities and colleges were responsive
  - More education, appeals to hospitals/care facilities
- MPCA will provide some assistance in & outside MN
- New CTS sub (CAS #64742-90-1) may be 4,000 – 30,000 ppm PAH (air/week 1 water vs. air/sediment concern)
  - Compare to asphalt-based at 50 ppm and CTS at 50,000 ppm
Project metrics

- Project CTS reduction (13 respondents) 93,500 gal
- Mid-range of project PAH reduction 38.7 tons
  - If all 62 eliminated PAHs at same rate 223 tons
- Safer sealcoat use by pledgers
  - 2013 53 1.64M gallons (680,000 in Minnesota)
  - 2014 +13 1.16M gallons (outside Minnesota)
Long-term metrics

- Compliance, where restricted
- Follow-up sediment monitoring
  - as in Austin, Texas 2014 follow-up after 8 years of CTS ban – finding 58% decline of coal tar PAHs
Further Information

- MPCA page
  https://www.pca.state.mn.us/water/stormwater-great-lakes-coal-tar-sealcoat-pah-reduction

- Science: U.S. Geological Survey web page
  http://tx.usgs.gov/sealcoat.html

- For municipals: MPCA Restriction on Coal Tar Sealants
  https://www.pca.state.mn.us/water/restriction-coal-tar-based-sealants
Reduction of Nonylphenol Ethoxylates (NPEs) Use in Laundry Detergents
Nonylphenol ethoxylates (NPEs)

- surfactant in detergents
- degreasers
- dry cleaning aids
- petroleum dispersants
- emulsifiers
- wetting agents
- adhesives
- pesticides (indoor and row crop)
- cosmetics

- paper and textile processing formulations
- prewash spotters
- metalworking fluids
- oilfield chemicals
- paints and coatings
- dust control agents
- phosphate antioxidants for rubber & plastics
- miscellaneous uses, including lube oil additives

⚠️ Degrades to nonylphenol...
Nonylphenol effects

- Very high
- Medium
- Medium
- Medium
- Very high
- Very high
- Very high
- Very high
- High
- Medium
- Medium
- Medium
- Multiple

- Biomonitoring shows general exposure
- Extra concern for women and children

from pharosproject.net
Focus on NPEs in detergents

- While not regulated, gradually eliminated
  - By 1980s, from consumer detergents
- Industrial laundries/EPA stewardship initiatives
- EPA assessment finds feasible safer alternatives
- 2010: Industrial laundries commit to end use
  - MPCA survey in 2013 confirms that most major facilities had already eliminated NPEs
  - Only 2 smaller facilities had yet to eliminate
NPE reductions in Minnesota

- 12 MN facilities report 323 tons/year reduction of NPE
- 7 of the 12 discharge to Main Metro WWTP
  - 179 tons/yr reduced
  - but little change in Main Metro influent NPE
Other pieces of the NPE puzzle

- 2013 phone calls to large hotels near Mall of America showed many laundering in-house; some using NPEs
- 2015 tests show low levels in domestic WW
- Good removal at Metro Plant, but what about lesser treatment, septics, transfer to biosolids?
- 2016: began a project to try to understand other commercial/institutional detergents
2016 NPE detergents project

- 3 local college student interns – through May
- Surveys and/or phone interviews, e-mails
- Providers: manufacturers and distributors
- Users: hospitals, clinics, surgical centers, nursing homes, long-term care, hotels, others
- Associations of users; major health care systems and associations, hotel groups
2016 results: progress in recent years

- Little use by larger, centrally-managed hotels, hospitals, and long-term care systems
  - More attention in corporate sustainability, purchasing
- Isolated use by unaffiliated facilities or franchises, particularly outside the Twin Cities (follow-up?)
- One off-site laundering sector was missed: NAICS 812320; not “industrial” (follow-up?)
- One facility we assisted reduced ~120 lbs/year NPE, about 1.5 lbs per patient bed/year
- Smaller-scale total reductions but will retest influent
Long-term metrics

- Influent to WWTPs
- Environmental monitoring
- Monitor data on quantities used (EPA Chemical Data Reporting, other)
What could be next?

- surfactant in detergents
- degreasers
- dry cleaning aids
- petroleum dispersants
- emulsifiers
- wetting agents
- adhesives
- pesticides (indoor and row crop) ??
- cosmetics

- paper and textile processing formulations ??
- prewash spotters
- metalworking fluids
- oilfield chemicals
- paints and coatings
- dust control agents
- phosphate antioxidants for rubber & plastics
- miscellaneous uses, including lube oil additives

Returning to this list...
Thank you! Any questions?

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Thermal paper project:  www.pca.state.mn.us/receipts

Coal tar sealcoat:
https://www.pca.state.mn.us/water/stormwater-great-lakes-coal-tar-sealcoat-pah-reduction

NPEs in detergents:
https://www.pca.state.mn.us/quick-links/green-chemistry-and-design-npe-detergents-project
Reduction of Salt Use in Winter Maintenance

See:
Web page: https://www.pca.state.mn.us/water/road-salt-and-water-quality
Pre-test: is this enough salt?
2014 Twin Cities surface water chloride

Exceedance of chronic effects standard: 230 mg/L

Highest: 964 mg/L
2014 Minnesota groundwater chloride

EPA standard: 250 mg/L

27% of Twin Cities sand/gravel wells exceeded
Chloride sources

- **Direct discharge:**
  - Winter maintenance
  - Dust suppressants, fertilizers, land application

- **Indirect discharge:**
  - Municipal wastewater
  - Municipal water treatment
  - Industrial wastewater
  - Residential water softeners
Annual U.S. highway salt sales

Twin Cities winter total: 349,000 tons/year (2007 estimate)
Chloride issues

- Disruption of cellular processes in fish, invertebrates, some plant species
  - If high levels persist, can lead to stress and death
- Additives/contaminants such as phosphorus, cyanide, copper, zinc
- Persists, so concentrations build over time
- Not feasible to remove
- 78% of salt applied in Twin Cities is transported to surface and ground water (U of Minnesota)
Road salt and water quality

MPCA recommends a low-salt diet for Minnesota waters. Doctors tell us to stick to a low-salt diet. Our lakes and streams should follow the same advice. When winter comes and snow and ice build up on Minnesota roads, parking lots, and sidewalks, one of the most common reactions is to apply salt, which contains chloride, a water pollutant.

Salt pollutes. When snow and ice melts, the salt goes with it, washing into our lakes, streams, wetlands, and groundwater. It takes only one teaspoon of road salt to permanently pollute 5 gallons of water. Once in the water, there is no way to remove the chloride, and at high concentrations, chloride can harm fish and plant life. Less is more when it comes to applying road salt.

MPCA report: 30% of Twin Cities wells have too much chloride

The MPCA groundwater program released its report regarding the findings of their monitoring efforts. Chloride concentrations were above the water quality standards in 30% of the wells in the TCMA. Check out the full report.

New: Winter Maintenance Assessment tool (WMAt)

This new web-based tool will help winter maintenance organizations assess operations, identify opportunities to reduce salt use using proven BMPs and track progress. The goal is to maintain performance while reducing salt use and saving money.

What is MPCA doing to address this important issue?
Training program
(https://www.pca.state.mn.us/water/training)

- Smart Salting Level 1 for individuals
  - Roads class
  - Parking lot/sidewalk class
  - Certificate holders are listed
- Level 2 for organizations (public or private)
  - Complete an assessment
  - Does not require employees to be Level 1 certified
  - Certificate holders list, including private applicators
  - Maintain through annual updates

https://www.pca.state.mn.us/water/training
Post-test: Which is the right amount?
State agency opportunities

1. Buying from the State contracts for winter maintenance
2. Working with landlords and leased offices
3. Providing feedback to vendors and Plant Management staff
What about water softening?

Average chloride in effluent from 3 Twin Cities WWTPs ranges from 521 mg/L to 618 mg/L
Metrics

- Environmental monitoring
- Monitor data on quantities used