
ENVIRONMENTAL COMMISSION MEETING

Thursday, March 28, 2019

7:00 p.m.

Inver Grove Heights City Hall, Council Chambers

A G E N D A

1. CALL TO ORDER
2. PLEDGE OF ALLEGIENCE
3. ROLL CALL
4. APPROVAL OF COMMISSION MINUTES FOR FEBRUARY 28, 2019
5. APPLICANT REQUESTS
6. OTHER BUSINESS
 - a) **PROPOSED COMPOST INITIATIVE IN INVER GROVE HEIGHTS**
Christina Rademacher, Inver Grove Heights Resident & UMN Student
 - b) **GREENSTEP CITIES BEST PRACTICE #15: SUSTAINABLE PURCHASING**
Review progress and discuss feedback
7. ADJOURN

ENVIRONMENTAL COMMISSION MEETING
 Inver Grove Heights City Hall – Council Chambers
 February 28, 2019

1. Call to Order

Meeting called to order at 7:00 PM by Chair Trenzeluk

2. Pledge of Allegiance

3. Roll Call

Commissioners Present: Chair Ted Trenzeluk, Robert Heidenreich, Nichole Boehmke, Ken Johnson, Lauren DiGidio, and Aditya Jayam.

Commissioners Absent: Joan Gabriel (resigned 9/27/18); Patricia Todd and Sarah Brass (excused)

Staff Present: Ally Hillstrom, Environmental Specialist

4. Approval of Minutes

Commissioner Johnson moved to approve the minutes from January 24, 2019 as submitted, Commissioner Heidenreich seconded the motion. Motion to approve carried unanimously.

5. Applicant Requests

6. Other Business

a) GreenStep Cities Best Practice #15: Sustainable Purchasing. Review progress and discuss feedback.

Ms. Hillstrom stated the purpose of the meeting is to discuss GreenStep Cities Program Best Practice #15: Sustainable Purchasing in order to progress to Step 3 of the program. She stated she has completed background research on the topic and will present it to the Environmental Commission to receive feedback prior to presenting to the City Council. Ms., Hillstrom described Best Practice #15 as defined by the program.

Chair Trenzeluk requested Ms. Hillstrom state where the policy differs from other cities' policies when she reviews the policy.

Ms. Hillstrom stated at Action 15.1: Sustainable Purchasing Policy is the only required action for Best Practice #15. The City can consider completing the other optional actions. Best Practice #15.1 requires that the City adopt a Sustainable Purchasing Policy or set of administrative guidelines and at minimum include a requirement to purchase energy efficient equipment and recycled content paper. Ms. Hillstrom stated that the Finance Director recommends the City approach this by adopting a formal policy instead of adopting administrative guidelines. Because purchasing has budgetary impacts, a formal policy provides more structure than guidelines will.

Ms. Hillstrom presented the draft Sustainable Purchasing Policy developed from resources provided on the GreenStep Cities website including other cities' policies. She noted these policies are referred to as Sustainable Purchasing or Environmental Purchasing. Sustainable Purchasing

Policy has been selected to better reflect the City's commitment to sustainability which includes environmental, social and economic stewardship. Ms. Hillstrom noted that sustainable cities consciously avoid depletion of natural and financial resources in order to meet the needs of the community in the future.

Chair Trenzeluk stated he is in agreeance with including the financial component in the interpretation of sustainability. Ms. Hillstrom responded that some cities focus these policies on environmental stewardship more than the other factors discussed. Ms. Hillstrom stated if the policy is adopted for the City of Inver Grove Heights it is important for the City to make sure it does not exceed its financial ability to fund capital and operational costs of the sustainable purchase.

Ms. Hillstrom reviewed the policy purpose. The City does not currently have a purchasing policy and purchasing is decentralized. This policy is intended to provide structure and resources to those making purchases while promoting sustainable practices.

Commissioner Boehmke suggested when the policy lists example products it state "but not limited to" so that future product types are not excluded from the policy.

Ms. Hillstrom reviewed the policy scope. All departments and employees would receive education and would be responsible for upholding the policy. The Environmental Specialist would be the resource for staff.

Chair Trenzeluk asked how the purchases would be policed. Ms. Hillstrom stated that staff will be asked to submit their purchase data to the Environmental Specialist to track and evaluate the City's sustainable purchasing efforts. Supervisors may need verify the purchases first and then her data collection is followed.

Commissioner Jayam asked for a description of the City's purchasing process. Ms. Hillstrom stated that based on her position, her supervisor and grant requirement specify what she can and cannot purchase. She is required to submit invoices to the Finance Department who then pays the invoice. She said that she will verify if other purchasing processes are used.

Commissioner Jayam asked if a supervisor's approval is required for purchases over a certain amount. Ms. Hillstrom stated that all purchases are coded to an account number and only those with authority can expense items to the code. That employee and employee's supervisor receive an account summary to keep track of expenses and ensure the purchases are within the annual budget constraints.

Commission Jayam suggested that the policy's scope requires supervisors receive an annual review of the policy. He suggested the Environmental Specialist review the department's purchases and provide feedback on their purchasing behaviors.

Commission Jayam asked if there is a limit on how much more money can be spent on sustainable purchases. Ms. Hillstrom stated that the way the policy is currently written, all required products listed, aside from recycled content paper, should be purchased if the product is cost-effective; when the life-cycle costs are lower or equal to those of the non-sustainable product.

Chair Trenzeluk stated that recycled content paper does not meet the purpose to lower overall costs as stated in the policy. Ms. Hillstrom stated this is true. She stated this is the only state mandated requirement within the policy. The Minnesota Statue 16C.073 states that public entities

shall purchase 30% recycled content paper, if it is within a ten percent cost range of existing costs as defined by Minnesota Statute 16C.0725. Ms. Hillstrom noted that other cities have added constraints to this guideline. The City of Burnsville requires City Manager authorization for any purchases where the ten percent difference in cost exceeds \$1,000. Ms. Hillstrom stated this guideline would only apply to the recycled paper purchasing requirement as the other requirements have cost-effective defined as the purchasing guideline.

Chair Trenzeluk suggested this structure be added to this part of the policy and the City Council would be able to adjust the parameters.

Commissioner Boehmke asked if the City can seek out vendors that sell sustainable products at lower costs. Ms. Hillstrom stated that the State of Minnesota has sustainable purchasing goals for state departments and develops purchasing contracts. The City can purchase from these contracts which includes green purchasing contracts. The contracts tend to reduce costs of the items. Ms. Hillstrom stated there are other contract opportunities available to the City as well.

Commissioner Boehmke stated that staff with purchasing authority would have the flexibility to use these resources to find the most sustainable product at the lowest cost.

Commissioner Jayam suggested the alternative would be to allow purchases of sustainable products up to an amount based the remaining funds in the base budget. Ms. Hillstrom stated that selecting a specific dollar amount as a cap may require revisions in the future.

Chair Trenzeluk ask the Commission if they are in favor of a cap being set. Commissioner Heidenreich and Commissioner Johnson stated they are in favor. Ms. Hillstrom stated that as the policy is written, aside from recycled paper, sustainable purchasing products can only be purchased if they are less than or equal to the cost of the existing product.

Ms. Hillstrom stated based on the current usage and costs of paper, the City's cost for copy paper would increase by twelve percent if thirty percent recycled copy paper was purchased. The purchase would not be required based on how the policy is currently written because it exceeds a ten percent difference in current costs. The cost difference is \$771.75, which is less than the \$1,000 cap the Commission was discussing. The City could decide to allow for purchases under a specific dollar amount instead of the ten percent difference in current cost if the City thought this was a priority.

Commissioner Heidenreich suggested the policy require cost reduction strategies. He suggested Environmental Commission agenda packets are no longer printed and instead displayed on electronic devices. Ms. Hillstrom noted that other cities have implemented cost reduction strategies after adopting a Sustainable Purchasing Policy. Printers can be defaulted to double-sided printing and black ink. The City can educate staff to print only when necessary to reduce the paper usage. Ms. Hillstrom stated that reducing the environmental impact of meetings is a best practice within the GreenStep Cities Program, Best Practice 15.7.

Commissioner Boehmke noted that if the City is going to adopt a Sustainable Purchasing Policy the City will have to budget according. An additional expense needs to be added to the budget if this is required by the policy.

Commissioner DeGidio noted that costs would be reduced by printing less. Ms. Hillstrom responded it can be a cost-neutral change however it is unknown how much printing will be reduced by. The City can compare current printing behavior to the printing behavior after staff is

educated to determine how much printing was reduced. She stated this is an example of the data collection required by the policy as its currently written. She noted that cost reduction strategies can be added to a procedure section of the policy if the Commission feels this would be a critical component to making the efforts financially feasible.

Commissioner Heidenreich suggested showing the Council projected cost savings along with the recycled paper usage and cost data.

Commissioner Jayam noted that allowing for purchases within a ten percent cost difference or under a specific cap allows for a conversation to happen with staff. This could result in reallocating unspent funds from the base budget for the sustainable purchase. Ms. Hillstrom stated that other cities have created a similar process, where a Sustainability Fund is budgeted for and applied to selected sustainability projects throughout the year that need additional funding. The projects are selected based on their environmental benefit.

Chair Trenzulek stated conceptually a Sustainability Fund may be workable but he would not recommend this at this point in the process based on its budgetary impacts. He suggested Ms. Hillstrom update the draft policy with the thoughts presented this far.

Ms. Hillstrom stated that this is an internal policy that can be updated as needed by the Environmental Commission and City Council.

Commissioner Boehmke stated that the policy's financial parameters can be reviewed for update considerations by the Environmental Commission. Ms. Hillstrom suggested adding City Staff and the Environmental Commission will be responsible recommending policy revisions to the City Council for final approval.

Commissioner Jayam suggested noting that state laws supersede this policy.

Commissioner Johnson asked what chemicals would be looked for within cleaning products. Ms. Hillstrom stated green cleaning products would be selected based off certification standards so long as they effectively serve their purpose. She recommends City Staff research product effectiveness before purchasing.

Commissioner Boehmke asked if the policy should require contracted cleaning services to purchase green cleaning products. Ms. Hillstrom said she will research this. Chair Trenzulek suggested this could be added to the cleaning services contract instead of the policy.

Ms. Hillstrom noted the only requirement of the GreenStep Cities program for the Sustainable Purchasing Policy is to require purchases of energy efficient appliances and recycled paper content. Other items are listed to raise awareness of the products. These items would be purchased so long as they are equal to or less than the cost of the typical purchase.

Chair Trenzulek recommended Ms. Hillstrom update the draft policy with the thoughts presented. This will be reviewed at the next Environmental Commission meeting.

7. Adjourn

Commissioner DiGidio moved to adjourn at 8:05 pm. Commissioner Boehmke seconded the motion. Motion approved unanimously.



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GreenStep City Best Practices **Environmental Management**

Sustainable Purchasing

◀ no. 15 ▶



Adopt environmentally preferable purchasing policies and practices to improve health and environmental outcomes.

STEP 3 RECO CATEGORY A

All Category A completion of g

Category A an additional actio

Best Practice Actions [See action tools, guidance, city reports]

1. Adopt a sustainable purchasing **policy** or administrative guidelines/practices directing that the city purchase at least:
 - a. **EnergyStar** certified equipment and appliances and
 - b. **Paper** containing at least 30% post-consumer recycled content.
2. Purchase energy used by city government - via green tags, community solar garden, 3rd party - with a **higher renewable percentage** than required by Minnesota law.
3. Establish a **local purchasing** preference and, working with a local business association, develop a list of locally-produced products and suppliers for common purchases.
4. Require purchase of U.S. EPA **WaterSense**-certified products.
5. Set minimum standards for the percentage of **recycled-content material** in asphalt and roadbed aggregate or other construction materials, and for compost and warm mix asphalt use.
6. Require **printing services** to be purchased from companies certified by Minnesota Great Printers or by the Sustainable Green Printing Partnership.
7. Lower the environmental footprint of **meetings and events** in the city.
8. Use state and national green **standards/guidelines** for at least 3 categories of purchasing/investments such as electronics, cleaning products, flooring/coatings.

SUMMARY

Sustainable pu
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- Benefic
- Water-c
- Recycle
- Minimiz
- Plant-bi
- Locally
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BENEFITS

- **Green purchasing standards, benefit calculators** and more are available on the [U.S EPA's greener products and services](#) page. Benefits include cost, environmental and improved worker productivity and improved public health.
- See [benefit calculators](#) for paper, electronics and ENERGY STAR-certified products.



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Spec

- Ductile iron pipe for drinking water mains has stronger walls allowing a larger inside diameter reducing friction and thus saving energy. According to St. Cloud's Pumping Cost Study (July 2014), the city's use of ductile iron pipe (certified under the [SMaRT standard](#)) results in an annual savings of \$210,530 compared to competing pipe, measuring power cost, pump efficiency, and head loss.

**CONNECTION**

- Cities in use pay of 30% and full environ practice [Environ](#)
- The Ne establis decreas electrici by 2025
- Cities a [product](#) [adverse](#) Minnes [Venture](#)



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GreenStep City Best Practices **Environmental Management**

Sustainable Purchasing

◀ no. 15 ▶



Adopt environmentally preferable purchasing policies and practices to improve health and environmental outcomes.



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Best Practice Action 1

[1 2 3 4 5 6 7 8]

[all actions]

Adopt a sustainable purchasing policy or administrative guidelines/practices directing that the city purchase at least:

- EnergyStar** certified equipment and appliances and
- Paper** containing at least 30% post-consumer recycled content.

Implementation Tools

Star-level Examples

Who's doing it



Have a written policy/guidelines/practices specifying at minimum the purchase of Energy Star equipment/appliances and recycled-content paper (at least 30% post-consumer). Report street lighting/traffic signal policy/purchases under action 4.2; vehicle policy/purchases under 13.2 and 13.3



Have a formal policy adopted by the city council; note if this includes centralized purchasing into one office/person.



For the city's top 10 categories of spend, track the purchases of sustainable products/services purchased annually compared to non-sustainable products/services purchased; join with other cities in joint purchasing of environmentally preferable products and summarize EPP purchases.

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S

GreenStep City Best Practices **Environmental Management**

Sustainable Purchasing

◀ no. 15 ▶



Adopt environmentally preferable purchasing policies and practices to improve health and environmental outcomes.



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Best Practice Action 7

[1 2 3 4 5 6 7 8] [all actions]

Lower the environmental footprint of meetings and events in the city.

Implementation Tools

Star-level Examples

Who's doing it



Adopt a policy or adopt practices for meetings and events hosted by city government addressing issues such as solid waste generated (e.g., paperless city council packets), transit/carpooling to meetings/events. This could include distributing educational materials about holding a no-waste event for use at city-supported events such as National Night Out / Night to Unite. Report broader multi-topic educational material distributed at events under action 24.4

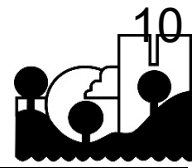


Have a policy for meetings and events taking place on city property, including parks and libraries; include healthy/local/organic food elements.



Work with at least the largest private venue in the city (such as a conference center) to cut waste generation by at least 1/3 and to increase recycling by at least 1/3; adopt internal departmental carbon fees.

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SUSTAINABLE PURCHASING POLICY (SPP)

I. PURPOSE

The purpose of this policy is to encourage sustainable procurement to demonstrate the City's commitment to environmental, economic and social stewardship. This policy is created to provide City employees with clear and consistent instructions on how to consider and make purchases of Sustainable Purchasing Policy (SPP) preferred items when appropriate.

This policy is adopted in order to promote sustainable practices such as;

- Conserving natural resources, including water and energy
- Minimizing the city's environmental impacts, such as pollution
- Supporting strong recycling markets
- Minimizing waste and associated costs
- ~~Lowering overall costs by a~~Addressing full life-cycle cost accounting (including the procurement, operation, maintenance, longevity of service, disposal, staff time, and labor) to promote lowering overall costs when possible
- Creating a model for successfully purchasing SPP preferred products that encourages other purchasers in the community to adopt similar goals

II. SCOPE AND PROCESS

This policy applies to all City departments and employees. All City departments are responsible for implementation of this policy and ensuring their respective employees are fully aware and supportive of the City's policy.

A) City staff will:

- Review provided resources to determine the extent to which SPP preferred products may be used by the department.
- Use provided tools to determine the cost-effectiveness of the SPP preferred products prior to purchasing.
- Review provided purchasing resources to find the SPP preferred product at the lowest cost.
- ~~Facilitate~~Facilitate data collection, if requested, on purchases of designated SPP preferred products by the department in order to track and evaluate the City's sustainable purchasing efforts.

B) Environmental Specialist will:

- Provide education and resources on sustainable purchasing and cost reduction strategies to staff as needed.
- Use data collected by staff to evaluate the City's sustainable purchasing efforts.
- Provide an annual update to Department Heads and the Environmental Commission on sustainable purchasing efforts.
- Review policy for update considerations based on evaluation of sustainable purchasing efforts.

C) Environmental Commission will:

- Review policy for update considerations based on evaluation of sustainable purchasing efforts. Provide recommended policy revisions to the City Council for final approval.

III. POLICY

The following SPP preferred products shall be purchased by the City of Inver Grove Heights using the following guidelines, provided the SPP preferred products are practicable and the meet additional requirements stated below:

A) Energy Saving Products

All appliances and products purchased by the City will meet U.S. Environmental Protection Agency (EPA) EnergyStar certification when such products are available, cost-effective and financially feasible. This includes products such as, but not limited to; lighting systems, exhaust fans, water heaters, computers, exit signs, refrigerators, dishwashers, and microwave ovens.

B) Recycled Paper Products and Recycled-Content Products

Per Minnesota Statue 16C.073, the City will purchase recycled content paper as required for public entities when such products are available and financially feasible as defined by this policy and the purchasing guidelines of Minnesota Statue 16C.0725. The City should purchase other products made with recycled material whenever available, cost-effective and financially feasible.

C) Water Saving Products

All fixtures and products that use water purchased by the City will meet U.S. EPA WaterSense certification when such products are available, cost-effective and financially feasible. This includes products such as, but not limited to; pre-rinse spray valves, showerheads, toilets, urinals, and upgraded irrigation controllers.

D) Waste Minimization

The City will buy in bulk whenever the option is available, cost-effective and financially feasible. Packaging that is reusable, recyclable, or compostable is preferred, when suitable uses, proper waste management programs and practicable storage space exists.

E) Cleaning Products

Cleaning products purchased by the City will meet the Green Seal, EcoLogo, and/or U.S. EPA Safer Choice cleaning product standards when such products are available, cost-effective and financially feasible.

IV. DEFINITIONS

- **Cost-Effective:** A SPP preferred product has a lower or equal to life-cycle cost than non-SPP preferred product.
- **Energy Efficient Product:** A product that is in the upper 25% of energy efficiency for all similar products or achieves an EnergyStar label/certification (www.energystar.gov).
- **EnergyStar:** The US EPA's energy efficiency product labeling program (described at www.energystar.gov).
- **Financially Feasible:** The City must be able to sufficiently fund all expenditures. The funding source could be the City Budget, grant donation, or another planned revenue source.

Planning for payment prior is required to ensure the City resources are not depleted beyond budgeted capacity.

- **EcoLogo:** An independent environmental labeling organization. EcoLogo certification is based on multiattribute, life cycle–based standards. All products certified to an EcoLogo standard must meet or exceed each of the listed criteria before receiving the mark. EcoLogo certification is classified as an ISO (International Organization for Standardization).
- **Green Seal:** An independent, non-profit environmental labeling organization. Green Seal standards for products and services meet the U.S. EPA’s criteria for third-party certifiers. The Green Seal is a registered certification mark that may appear only on certified products.
- **Life-Cycle Cost:** The comprehensive accounting of the total cost of a product including procurement, operation, maintenance, longevity of service, disposal, staff time, and labor.
- **Practicable:** Whenever feasible and compatible with State and Federal law, without reducing safety, quality, or effectiveness of City operations.
- **U.S. EPA Safer Choice:** Safer Choice is EPA’s label for safer chemical-based products. Through this program the EPA labels products that are safer for families, pets, workplaces, neighborhoods and the environment.
- **Water-Saving Product:** Product in the upper 25% of water conservation for all similar products or achieves a WaterSense label/certification.
- **WaterSense:** The US EPA’s water efficiency product labeling program (described at www.epa.gov/watersense).

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16C.073 PURCHASE AND USE OF PAPER STOCK; PRINTING.

Subdivision 1. **Definitions.** (a) The definitions in this subdivision apply to this section.

(b) "Copier paper" means paper purchased for use in copying machines.

(c) "Office paper" means notepads, loose-leaf fillers, tablets, and other paper commonly used in offices.

(d) "Postconsumer material" means a finished material that would normally be discarded as a solid waste, having completed its life cycle as a consumer item.

(e) "Practicable" means capable of being used, consistent with performance, in accordance with applicable specifications, and availability within a reasonable time.

(f) "Printing paper" means paper designed for printing, other than newsprint, such as offset and publication paper.

(g) "Public entity" means the state, an office, agency, or institution of the state, the Metropolitan Council, a metropolitan agency, the Metropolitan Mosquito Control District, the legislature, the courts, a county, a statutory or home rule charter city, a town, a school district, another special taxing district, or any contractor acting pursuant to a contract with a public entity.

(h) "Soy-based ink" means printing ink made from soy oil.

(i) "Uncoated" means not coated with plastic, clay, or other material used to create a glossy finish.

Subd. 2. **Purchases.** (a) Whenever practicable, a public entity shall:

(1) purchase uncoated copy paper, office paper, and printing paper;

(2) purchase recycled content copy paper with at least 30 percent postconsumer material by weight and purchase printing and office paper with at least ten percent postconsumer material by weight;

(3) purchase copy, office, and printing paper which has not been dyed with colors, excluding pastel colors;

(4) purchase recycled content copy, office, and printing paper that is manufactured using little or no chlorine bleach or chlorine derivatives;

(5) use reusable binding materials or staples and bind documents by methods that do not use glue;

(6) use soy-based inks;

(7) purchase printer or duplication cartridges that:

(i) have ten percent postconsumer material; or

(ii) are purchased as remanufactured; or

(iii) are backed by a vendor-offered program that will take back the printer cartridges after their useful life, ensure that the cartridge is recycled, and comply with the definition of recycling in section [115A.03, subdivision 25b](#);

(8) produce reports, publications, and periodicals that are readily recyclable; and

(9) purchase paper which has been made on a paper machine located in Minnesota.

(b) Paragraph (a), clause (1), does not apply to coated paper that is made with at least 50 percent postconsumer material.

(c) A public entity shall print documents on both sides of the paper where commonly accepted publishing practices allow.

Subd. 3. **Public entity purchasing.** (a) Notwithstanding section [365.37](#), [375.21](#), [412.311](#), or [473.705](#), a public entity may purchase recycled materials when the price of the recycled materials does not exceed the price of nonrecycled materials

by more than ten percent. In order to maximize the quantity and quality of recycled materials purchased, a public entity also may use other appropriate procedures to acquire recycled materials at the most economical cost to the public entity.

(b) When purchasing commodities and services, a public entity shall apply and promote the preferred waste management practices listed in section [115A.02](#), with special emphasis on reduction of the quantity and toxicity of materials in waste. A public entity, in developing bid specifications, shall consider the extent to which a commodity or product is durable, reusable, or recyclable and marketable through the applicable local or regional recycling program and the extent to which the commodity or product contains postconsumer material. When a project by a public entity involves the replacement of carpeting, the public entity may require all persons who wish to bid on the project to designate a carpet recycling company in their bids.

History: [1Sp1989 c 1 art 18 s 2](#); [1991 c 337 s 3](#); [1992 c 464 art 1 s 7](#); [1992 c 593 art 1 s 2](#); [1993 c 249 s 2](#); [1994 c 465 art 1 s 1](#); [1995 c 247 art 1 s 1](#); [2013 c 85 art 5 s 1](#); [2014 c 196 art 1 s 5](#); [1Sp2015 c 4 art 4 s 3](#); [2016 c 189 art 13 s 20](#)

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16C.0725 PURCHASE OF RECYCLED, REPAIRABLE, AND DURABLE MATERIALS.

The commissioner shall take the recycled content and recyclability of commodities to be purchased into consideration in bid specifications. When feasible and when the price of recycled materials does not exceed the price of nonrecycled materials by more than ten percent, the commissioner, and state agencies when purchasing under delegated authority, shall purchase recycled materials. In order to maximize the quantity and quality of recycled materials purchased, the commissioner, and state agencies when purchasing under delegated authority, may also use other appropriate procedures to acquire recycled materials at the most economical cost to the state.

When purchasing commodities and services, the commissioner, and state agencies when purchasing under delegated authority, shall apply and promote the preferred waste management practices listed in section [115A.02](#), with special emphasis on reduction of the quantity and toxicity of materials in waste. The commissioner, and state agencies when purchasing under delegated authority, in developing bid specifications, shall consider the extent to which a commodity or product is durable, reusable, or recyclable and marketable through the state resource recovery program and the extent to which the commodity or product contains postconsumer material.

History: [1Sp1989 c 1 art 18 s 1](#); [1992 c 514 s 3](#); [1992 c 593 art 1 s 1](#); [1993 c 249 s 1](#); [2014 c 196 art 1 s 5](#)

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Annual Paper Usage and Cost Data: 8.5" x 11" copy paper

Updated 3/21/2019

Table 1: Paper Units
1 Case = 10 reams
1 Ream = 500 sheets

Table 2: IGH Printing Rate in 2018	
Paper Type	IGH Average Annual Purchase
8.5" x 11" copy paper	172 cases = 1720 reams = 860,000 sheets

Table 3: Cost/Case of Non-Recycled vs. Recycled (2019)	
8.5" x 11" copy paper	
Paper Type	Cost/Case
Non-Recycled Paper	\$32.99/case
Recycled Paper (30% Recycled)	\$37.40/case
Percent Difference =	12.53%

Table 4: IGH Cost/Year of Non-Recycled vs. Recycled (2019)		
8.5" x 11" copy paper		
Paper Type	Cost/Case	Annual Expense
Current Cost/Year	172 cases x \$32.99/case =	\$ 5,674.28
Estimated Cost/Year (Recycled)	172 cases x \$37.40/case =	\$ 6,432.80
Annual Cost Difference =		\$ 758.52

Table 5: Estimated Cost Reductions/Year from Printing Less 8.5" x 11" copy paper				
Estimated Reduction from 2018 Printing Rates (%)	Estimated Reduction in Sheets/Year	Estimated Reduction in # of Cases/Year	Estimated Reduction in Costs/Year	Estimated Reduction in # of Sheets/Month per 25 employees
1.5%	12,900	2.6	\$ 96.49	10.75
3%	25,800	5.2	\$ 192.98	21.50
5%	43,000	8.6	\$ 321.64	35.83
10%	86,000	17.2	\$ 643.28	71.67
15%	129,000	25.8	\$ 964.92	107.50
20%	172,000	34.4	\$ 1,286.56	143.33
25%	215,000	43.0	\$ 1,608.20	179.17
30%	258,000	51.6	\$ 1,929.84	215.00

Annual Paper Usage and Cost Data: 11" x 17" copy paper*Updated 3/21/2019*

Table 1: Paper Units
1 Case = 10 reams
1 Ream = 500 sheets

Table 2: IGH Printing Rate in 2018	
Paper Type	IGH Average Annual Purchase
11" x 17" copy paper	8 cases = 80 reams = 40,000 sheets

Table 3: Cost/Case of Non-Recycled vs. Recycled (2019)	
11"x 17" copy paper	
Paper Type	Cost/Case
Non-Recycled Paper	\$41.95/case
Recycled Paper (30% Recycled)	\$58.71/case
Percent Difference =	33.30%

Table 4: Cost/Year of Non-Recycled vs. Recycled (2019)		
11"x 17" copy paper		
Paper Type	Cost/Case	Annual Expense
Current Cost/Year	8 cases x \$41.95/case =	\$ 335.60
Estimated Cost/Year (Recycled)	8 cases x \$58.71/case =	\$ 469.68
Annual Cost Difference =		\$ 134.08

Table 5: Estimated Cost Reductions/Year from Printing Less				
11"x 17" copy paper				
Estimated Reduction from 2018 Printing Rates (%)	Estimated Reduction in Sheets/Year	Estimated Reduction in # of Cases/Year	Estimated Reduction in Costs/Year	Estimated Reduction in # of Sheets/Month per 25 employees
1.5%	600	0.1	\$ 7.05	2.00
3%	1,200	0.2	\$ 14.09	4.00
5%	2,000	0.4	\$ 23.48	6.67
10%	4,000	0.8	\$ 46.97	13.33
15%	6,000	1.2	\$ 70.45	20.00
20%	8,000	1.6	\$ 93.94	26.67
25%	10,000	2.0	\$ 117.42	33.33
30%	12,000	2.4	\$ 140.90	40.00



Estimated environmental impacts were calculated using the Environmental Paper Network's Paper Calculator. When used publicly, this information must be properly cited. For more information and to view the required citation, please visit www.papercalculator.org.

	NON-RECYCLED PAPER (2018 Printing Rate)	30% RECYCLED PAPER
Paper Type:	Uncoated - 8.5" x 11" copy paper	Uncoated - 8.5" x 11" copy paper
Quantity:	860,000 Sheets (2018 Printing Rate)	860,000 Sheets (2018 Printing Rate)
% Recycled:	0%	30%
	17.2 U.S. short tons	12 U.S. short tons <i>5.2 U.S. short tons less</i>
	110 million BTUs	96.6 million BTUs <i>13.4 million BTUs less</i>
	77,300 pounds CO ₂ equiv.	63,900 pounds CO ₂ equiv. <i>13,400 pounds CO₂ equiv. less</i>
	92,000 gallons	89,500 gallons <i>2,500 gallons less</i>
	5,060 pounds	4,960 pounds <i>100 pounds less</i>
NITROGEN OXIDES (NO _x)	4,210 O ₃ equiv/m ³ *	4,100 O ₃ equiv/m ³ * <i>110 less</i>
PURCHASED ENERGY	62.4 million BTUs	63.6 million BTUs <i>1.2 million BTUs more</i>
PARTICULATES	1,370 PM _{2.5} equiv/m ³ *	1,290 PM _{2.5} equiv/m ³ * <i>80 less</i>
SULFUR DIOXIDE (SO ₂)	35.3 pounds	34.6 pounds <i>0.7 pounds less</i>
VOLATILE ORGANIC COMPOUNDS (VOCs)	0.6 pounds	0.5 pounds <i>0.09 pounds less</i>
TOTAL REDUCED SULFUR (TRS)	0.5 pounds	0.5 pounds <i>0.05 pounds less</i>
HAZARDOUS AIR POLLUTANTS (HAPs)	6.9 pounds	6.6 pounds <i>0.3 pounds less</i>
CHEMICAL OXYGEN DEMAND (COD)	81.9 pounds	91.3 pounds <i>9.4 pounds more</i>
BIOCHEMICAL OXYGEN DEMAND (BOD)	39 pounds	41.3 pounds <i>2.3 pounds more</i>
TOTAL SUSPENDED SOLIDS (TSS)	74.1 pounds	71.8 pounds <i>2.3 pounds less</i>
FOREST DISTURBANCE	1.6 acres	1.1 acres <i>0.5 acres less</i>
THREATENED SPECIES	9 species	6 species <i>3 less</i>

OCEAN ACIDIFICATION	12,900 pounds H ₂ CO ₃	10,700 pounds H ₂ CO ₃ <i>2,200 pounds less</i>
MERCURY EMISSIONS	156 milligrams	147 milligrams <i>9 milligrams less</i>
DIOXIN EMISSIONS	13,700 micrograms	12,700 micrograms <i>1,000 micrograms less</i>
FRESHWATER DISTURBANCE	See below	See below
HERBICIDES	See below	See below
OCEAN WARMING	See below	See below
WETLAND DISTURBANCE	See below	See below

Explanation of Data Values



Wood use measures the amount of wood required to produce a given amount of paper. Results are reported in fresh/green U.S. short tons of wood. The methodology does not include the forest residues left behind during pulpwood harvest in the forests (i.e., slash, roots). If forest residues were included it could be twice the number, as roughly 50% of biomass is left after harvest.

- Non-recycled Paper (2018) uses 17.2 U.S. short tons, made from about 103 trees
- 30% Recycled Paper uses 12 U.S. short tons, made from about 72.1 trees
- 30% Recycled Paper uses 5.2 U.S. short tons less, a difference of 30.9 trees



Total energy measures all energy required over the paper's life cycle, including all renewable and nonrenewable resource use, including black liquor and all wood sources.

- Non-recycled Paper (2018) uses 110 million BTUs, equivalent to 130 residential refrigerators operated/year
- 30% Recycled Paper uses 96.6 million BTUs, equivalent to 115 residential refrigerators operated/year
- 30% Recycled Paper uses 13.4 million BTUs less, a difference of 15 residential refrigerators operated/year



Greenhouse gases/climate change impacts measures carbon dioxide or CO₂ from burning fossil fuels, methane from paper decomposing in landfills and short-lived climate pollutants (such as black carbon and organic carbon) which contribute to climate change by trapping energy from the sun in the earth's atmosphere. This impact category also includes forest carbon storage loss from logged forests.

- Non-recycled Paper (2018) produces 77,300 pounds of CO₂ equiv., equivalent to 7.02 cars/year
- 30% Recycled Paper produces 63,900 pounds of CO₂ equiv., equivalent to 5.8 cars/year
- 30% Recycled Paper produces 13,400 pounds CO₂ equiv. less, a difference of 1.2 cars/year



Water consumption measures the amount of process and cooling water that is consumed or degraded throughout the life cycle of the paper product.

- Non-recycled Paper (2018) uses 92,000 gallons, equivalent to 66.3 clothes washers operated/year
- 30% Recycled Paper uses 89,500 gallons, equivalent to 64.6 clothes washers operated/year
- 30% Recycled Paper uses 2,500 gallons less, a difference of 1.7 clothes washers operated/year



Solid waste measures sludge and other wastes generated during pulp and paper manufacturing, and used paper disposed of in landfills and incinerators.

- Non-recycled Paper (2018) produces 5,060 pounds of solid waste, equivalent to 1,160 people generating solid waste/day
- 30% Recycled Paper produces 4,960 pounds of solid waste, equivalent to 1,130 people generating solid waste/day
- 30% Recycled Paper produces 100 pounds less, a difference of 30 people generating solid waste/day

Nitrogen oxides/ground level ozone (NO_x, which includes NO and NO₂) measures products of the combustion of fuels that contain nitrogen. NO_x can react with volatile organic compounds and sunlight in the lower atmosphere to form ozone, a key

component of urban smog. NO_x forms ozone and can also, in parallel, lead to acid rain. *The measurement of NO_x in this calculator is a complex equation that takes into account human exposure across a sample of locations of pulp and paper mills. For more information please see the *Methodology* document under the Resources tab of this website (<https://c.environmentalpaper.org/pdf/SCS-EPN-PC-Methods.pdf>).

- Non-recycled Paper (2018) produces 4,210 persons x hrs. x pounds O_3 equiv/ m^3 , equivalent to 5.3 gasoline powered passenger cars/year
- 30% Recycled Paper produces 4,100 persons x hrs. x pounds O_3 equiv/ m^3 , equivalent to 5.2 gasoline powered passenger cars/year
30% Recycled Paper produces 110 persons x hrs. x pounds O_3 equiv/ m^3 less, a difference of 0.1 gasoline powered passenger cars/year

Purchased energy is a subset of total energy, and measures how much energy comes from purchased electricity and other fuels.

- Non-recycled Paper (2018) uses 62.4 million BTUs, equivalent to 74.3 residential refrigerators operated/year
- 30% Recycled Paper uses 63.6 million BTUs, equivalent to 75.7 residential refrigerators operated/year
30% Recycled Paper uses 1.2 million BTUs more, a difference of 1.4 residential refrigerators operated/year

Particulates/ $\text{PM}_{2.5}$ impacts measures the effect of particulate matter (PM) emissions from pulp/paper production, contributing to smog. Particulates are small airborne particles generated during combustion, and pose a range of health risks, including asthma and other respiratory problems, when inhaled. *The measurement of particulates in this calculator is a complex equation that takes into account human exposure across a sample of locations of pulp and paper mills. For more information please see the *Methodology* document under the Resources tab of this website (<https://c.environmentalpaper.org/pdf/SCS-EPN-PC-Methods.pdf>).

- Non-recycled Paper (2018) produces 1,370 persons x hrs. x pounds $\text{PM}_{2.5}$ equiv/ m^3 , equivalent to 51.9 gasoline powered passenger cars/year
- 30% Recycled Paper produces 1,290 persons x hrs. x pounds $\text{PM}_{2.5}$ equiv/ m^3 , equivalent to 48.6 gasoline powered passenger cars/year
30% Recycled Paper produces 80 persons x hrs. x pounds $\text{PM}_{2.5}$ equiv/ m^3 less, a difference of 3.3 gasoline powered passenger cars/year

Sulfur Dioxide (SO_2) and other acidifying emissions/regional acidification measures chemical compounds such as sulfur dioxide, nitrogen oxides, and other acids (e.g. ammonia) that are produced when boilers burn fuel containing sulfur and other acid-producing substances. Of the fuels used in the paper industry, oil and coal generally contain the highest quantities of sulfur. These acidifying emissions contribute to air pollution problems like acid rain and smog. This category includes SO_2 emissions, but also other acids and emissions like NO_x .

- Non-recycled Paper (2018) produces 35.3 pounds SO_2 equiv., equivalent to 11.5 eighteen-wheelers/year
- 30% Recycled Paper produces 34.6 pounds SO_2 equiv., equivalent to 11.2 eighteen-wheelers/year
30% Recycled Paper produces 0.7 pounds SO_2 equiv. less, a difference of 0.3 eighteen-wheelers/year

Volatile organic compounds (VOCs) measure a broad class of organic gases, such as vapors from solvent and gasoline. VOCs react with nitrogen oxides (NO_x) in the atmosphere to form ground-level ozone, the major component of smog and a severe lung irritant.

- Non-recycled Paper (2018) produces 0.6 pounds, equivalent to 2,630 miles driven in a car/year
- 30% Recycled Paper produces 0.5 pounds, equivalent to 2,260 miles driven in a car/year
30% Recycled Paper produces 0.09 pounds less, a difference of 370 miles driven in a car/year

Total reduced sulfur (TRS) measures emissions of the compounds that cause the odor associated with kraft pulp mills. Exposure to TRS emissions has been linked to symptoms including headaches, watery eyes, nasal problems, and breathing difficulties.

- Non-recycled Paper (2018) produces 0.5 pounds
- 30% Recycled Paper produces 0.5 pounds
30% Recycled Paper produces 0.05 pounds less

Hazardous air pollutants (HAPs) measures any of a group of 188 substances identified in the 1990 U.S. Clean Air Act amendments because of their toxicity. Two of the most common occurring in air are formaldehyde and acrolein.

- Non-recycled Paper (2018) produces 6.9 pounds, equivalent to 1.4 passenger cars/year

- 30% Recycled Paper produces 6.6 pounds, equivalent to 1.3 passenger cars/year
- 30% Recycled Paper produces 0.3 pounds less, a difference of 0.05 passenger cars/year

Chemical oxygen demand (COD) measures the amount of oxidizable organic matter in the mill's effluent. Since wastewater treatment removes most of the organic material that would be degraded naturally in the receiving waters, the COD of the final effluent provides information about the quantity of more persistent substances discharged into the receiving water.

- Non-recycled Paper (2018) produces 81.9 pounds COD, equivalent to 0.5 homes/year
- 30% Recycled Paper produces 91.3 pounds COD, equivalent to 0.6 homes/year
- 30% Recycled Paper produces 9.4 pounds more, a difference of 0.06 homes/year

Biochemical oxygen demand (BOD) measures the amount of oxygen that microorganisms consume to degrade the organic material in the wastewater. Discharging wastewater with high levels of BOD can result in oxygen depletion in the receiving waters, which can adversely affect fish and other organisms.

- Non-recycled Paper (2018) produces 39 pounds BOD, equivalent to 0.2 homes/year
- 30% Recycled Paper produces 41.3 pounds BOD, equivalent to 0.2 homes/year
- 30% Recycled Paper produces 2.3 pounds more, a difference of 0.01 homes/year

Total Suspended Solids (TSS)/Freshwater eutrophication measures solid materials suspended in mill effluent, which can adversely affect bottom-living organisms upon settling in receiving waters and can carry toxic heavy metals and organic compounds into the environment.

- Non-recycled Paper (2018) produces 74.1 pounds TSS, equivalent to 0.4 homes/year
- 30% Recycled Paper produces 71.8 pounds TSS, equivalent to 0.3 homes/year
- 30% Recycled Paper produces 2.3 pounds less, a difference of 0.01 homes/year

Forest disturbance measures the impact of paper production on forest ecosystems and biodiversity. The indicator compares the ecosystem integrity of a harvested site to intact forests over 80 years old in the region, using on-the-ground measurements. It also considers the recovery potential which would be possible on the site if harvesting were halted, reflecting the long-term implication of forest management at suppressing ecosystem integrity.

- Non-recycled Paper (2018) disturbs 1.6 acres, equivalent to the size of 1.2 football fields
- 30% Recycled Paper disturbs 1.1 acres, equivalent to the size of 0.8 football fields
- 30% Recycled Paper uses 0.5 acres less, a difference of 0.4 football fields

Threatened species measures the possible number of species affected by logging for paper production in the North American region that are listed as Critically Endangered, Endangered, or Vulnerable in the IUCN Red List of Threatened Species (<http://www.iucnredlist.org>), though the exact impact will vary by forest of origin. The number of species is based on correlation with logging threats assessed by IUCN and the fiber basket of pulp and paper mills in the region. For more information see the Methodology Document (<https://c.environmentalpaper.org/pdf/SCS-EPN-PC-Methods.pdf>).

- Non-recycled Paper (2018) impacts 9 species
- 30% Recycled Paper impacts 6 species
- 30% Recycled Paper impacts 3 less

Ocean acidification measures increased ocean acidity caused by CO₂, which has detrimental consequences for many marine organisms. This indicator considers CO₂ emitted during the production of pulp and paper, but also evaluates the amount of CO₂ that could be sequestered in trees if forest harvests used for papermaking were halted.

- Non-recycled Paper (2018) produces 12,900 pounds H₂CO₃, equivalent to 3.3 cars/year
- 30% Recycled Paper produces 10,700 pounds H₂CO₃, equivalent to 2.8 cars/year
- 30% Recycled Paper produces 2,200 pounds H₂CO₃ less, a difference of 0.6 cars/year

Mercury emissions measure the amount of emissions during the production of pulp and paper. Mercury is a very toxic substance that persists in the environment for long periods of time. Emissions can therefore lead to contamination in the environment, including freshwater bodies and oceanic systems, subsequently exposing flora and fauna to elevated concentrations.

- Non-recycled Paper (2018) produces 156 milligrams, equivalent to 39 compact fluorescent lights
- 30% Recycled Paper produces 147 milligrams, equivalent to 36.7 compact fluorescent lights
- 30% Recycled Paper produces 9 milligrams less, a difference of 2.3 compact fluorescent lights

Dioxin emissions measure the amount of dioxin emissions that are released to air and water from pulp and paper mills. Dioxins are persistent and bioaccumulative, and even small amounts of emission can contaminate local waterways and

bioaccumulate in fish.

- Non-recycled Paper (2018) produces 13,700 micrograms
- 30% Recycled Paper produces 12,700 micrograms
30% Recycled Paper produces 1,000 micrograms less

Freshwater disturbance measures the number of freshwater systems possibly affected by logging. Logging can impact streams, rivers and creeks by increasing erosion, removing riverside vegetation and removing large woody debris that many fish species require for habitat. Although this impact is important and relevant, no data is currently available to calculate results. Reflecting the critical nature of this impact category, it is reported here as relevant to pulp/paper production, although results cannot be evaluated at this time.

Herbicides measures the amount of toxic herbicides used in growing trees for paper production. Herbicides are applied to control the spread of non-desirable species. Although this impact is important and relevant, no data is currently available to calculate results. Reflecting the critical nature of this impact category, it is reported as relevant to pulp/paper production, although results cannot be evaluated at this time.

Ocean warming measures increased ocean temperatures linked to emissions of greenhouse gases. Although this impact is important and relevant to emissions and foregone growth from logging, no algorithm is currently available to calculate results. Reflecting the critical nature of this impact category, it is reported as relevant to pulp/paper production, although results cannot be evaluated at this time.

Wetland disturbance measures the acreage of wetlands possibly affected by logging. Logging can increase erosion, which will cause changes in the sediment, temperature and other characteristics of wetlands. Although this impact is important and relevant, no data is currently available to calculate results. Reflecting the critical nature of this impact category, it is reported as relevant to pulp/paper production, although results cannot be evaluated at this time.

If you have questions or would like more information about Paper Calculator V4.0, please see the Life Cycle Assessment Methodology document under the "Resources" tab of this website (<https://c.environmentalpaper.org/resources.html>) or contact us at info@environmentalpaper.org.



Estimated environmental impacts were calculated using the Environmental Paper Network's Paper Calculator. When used publicly, this information must be properly cited. For more information and to view the required citation, please visit www.papercalculator.org.

	1.5% LESS THAN 2018 PRINTING RATES	3% LESS THAN 2018 PRINTING RATES	5% LESS THAN 2018 PRINTING RATES
	<i>About 11 sheets less per month per 100 employees</i>	<i>About 22 sheets less per month per 100 employees</i>	<i>About 36 sheets less per month per 100 employees</i>
Paper Type:	Uncoated - 8.5" x 11" copy paper	Uncoated - 8.5" x 11" copy paper	Uncoated - 8.5" x 11" copy paper
Quantity:	129 Pounds = 12,900 Sheets	258 Pounds = 25,800 Sheets	430 Pounds = 43,000 Sheets
% Recycled:	0%	0%	0%
	0.3 U.S. short tons	0.5 U.S. short tons <i>0.3 U.S. short tons more</i>	0.9 U.S. short tons <i>0.6 U.S. short tons more</i>
	1.6 million BTUs	3.3 million BTUs <i>1.7 million BTUs more</i>	5.5 million BTUs <i>3.8 million BTUs more</i>
	1,160 pounds CO ₂ equiv.	2,320 pounds CO ₂ equiv. <i>1,160 pounds CO₂ equiv. more</i>	3,860 pounds CO ₂ equiv. <i>2,700 pounds CO₂ equiv. more</i>
	1,380 gallons	2,760 gallons <i>1,380 gallons more</i>	4,600 gallons <i>3,220 gallons more</i>
	76 pounds	152 pounds <i>76 pounds more</i>	253 pounds <i>177 pounds more</i>
NITROGEN OXIDES (NO _x)	63.2 O ₃ equiv/m ³ *	126 O ₃ equiv/m ³ * <i>62.8 more</i>	211 O ₃ equiv/m ³ * <i>147.8 more</i>
PURCHASED ENERGY	0.9 million BTUs	1.9 million BTUs <i>0.9 million BTUs more</i>	3.1 million BTUs <i>2.2 million BTUs more</i>
PARTICULATES	20.6 PM _{2.5} equiv/m ³ *	41.2 PM _{2.5} equiv/m ³ * <i>20.6 more</i>	68.7 PM _{2.5} equiv/m ³ * <i>48.1 more</i>
SULFUR DIOXIDE (SO ₂)	0.5 pounds	1.06 pounds <i>0.5 pounds more</i>	1.8 pounds <i>1.2 pounds more</i>
VOLATILE ORGANIC COMPOUNDS (VOCs)	0.009 pounds	0.02 pounds <i>0.009 pounds more</i>	0.03 pounds <i>0.02 pounds more</i>
TOTAL REDUCED SULFUR (TRS)	0.008 pounds	0.02 pounds <i>0.008 pounds more</i>	0.03 pounds <i>0.02 pounds more</i>
HAZARDOUS AIR POLLUTANTS (HAPs)	0.1 pounds	0.2 pounds <i>0.1 pounds more</i>	0.3 pounds <i>0.1 pounds more</i>
CHEMICAL OXYGEN DEMAND (COD)	1.2 pounds	2.5 pounds <i>1.2 pounds more</i>	4.1 pounds <i>2.9 pounds more</i>
BIOCHEMICAL OXYGEN DEMAND (BOD)	0.6 pounds	1.2 pounds <i>0.6 pounds more</i>	1.9 pounds <i>1.4 pounds more</i>
TOTAL SUSPENDED SOLIDS (TSS)	1.1 pounds	2.2 pounds <i>1.1 pounds more</i>	3.7 pounds <i>2.6 pounds more</i>
FOREST DISTURBANCE	0.02 acres	0.05 acres <i>0.02 acres more</i>	0.08 acres <i>0.06 acres more</i>
THREATENED	9 species	9 species	9 species

SPECIES		<i>the same</i>	<i>the same</i>
OCEAN ACIDIFICATION	193 pounds H ₂ CO ₃	386 pounds H ₂ CO ₃ <i>193 pounds more</i>	643 pounds H ₂ CO ₃ <i>450 pounds more</i>
MERCURY EMISSIONS	2.3 milligrams	4.7 milligrams <i>2.3 milligrams more</i>	7.8 milligrams <i>5.5 milligrams more</i>
DIOXIN EMISSIONS	206 micrograms	412 micrograms <i>206 micrograms more</i>	687 micrograms <i>481 micrograms more</i>
FRESHWATER DISTURBANCE	See below	See below	See below
HERBICIDES	See below	See below	See below
OCEAN WARMING	See below	See below	See below
WETLAND DISTURBANCE	See below	See below	See below

Explanation of Data Values



Wood use measures the amount of wood required to produce a given amount of paper. Results are reported in fresh/green U.S. short tons of wood. The methodology does not include the forest residues left behind during pulpwood harvest in the forests (i.e., slash, roots). If forest residues were included it could be twice the number, as roughly 50% of biomass is left after harvest.

- 1.5% LESS THAN 2018 PRINTING RATES uses 0.3 U.S. short tons, made from about 1.5 trees
- 3% less than 2018 Printing Rates uses 0.5 U.S. short tons, made from about 3.09 trees
3% less than 2018 Printing Rates uses 0.3 U.S. short tons more, a difference of 1.5 trees
- 5% less than 2018 Printing Rates uses 0.9 U.S. short tons, made from about 5.2 trees
5% less than 2018 Printing Rates uses 0.6 U.S. short tons more, a difference of 3.6 trees



Total energy measures all energy required over the paper's life cycle, including all renewable and nonrenewable resource use, including black liquor and all wood sources.

- 1.5% LESS THAN 2018 PRINTING RATES uses 1.6 million BTUs, equivalent to 2.0 residential refrigerators operated/year
- 3% less than 2018 Printing Rates uses 3.3 million BTUs, equivalent to 3.9 residential refrigerators operated/year
3% less than 2018 Printing Rates uses 1.7 million BTUs more, a difference of 2.0 residential refrigerators operated/year
- 5% less than 2018 Printing Rates uses 5.5 million BTUs, equivalent to 6.5 residential refrigerators operated/year
5% less than 2018 Printing Rates uses 3.8 million BTUs more, a difference of 4.6 residential refrigerators operated/year



Greenhouse gases/climate change impacts measures carbon dioxide or CO₂ from burning fossil fuels, methane from paper decomposing in landfills and short-lived climate pollutants (such as black carbon and organic carbon) which contribute to climate change by trapping energy from the sun in the earth's atmosphere. This impact category also includes forest carbon storage loss from logged forests.

- 1.5% LESS THAN 2018 PRINTING RATES produces 1,160 pounds of CO₂ equiv., equivalent to 0.1 cars/year
- 3% less than 2018 Printing Rates produces 2,320 pounds of CO₂ equiv., equivalent to 0.2 cars/year
3% less than 2018 Printing Rates produces 1,160 pounds CO₂ equiv. more, a difference of 0.1 cars/year
- 5% less than 2018 Printing Rates produces 3,860 pounds of CO₂ equiv., equivalent to 0.4 cars/year
5% less than 2018 Printing Rates produces 2,700 pounds CO₂ equiv. more, a difference of 0.2 cars/year



Water consumption measures the amount of process and cooling water that is consumed or degraded throughout the life cycle of the paper product.

- 1.5% LESS THAN 2018 PRINTING RATES uses 1,380 gallons, equivalent to 1.0 clothes washers operated/year
- 3% less than 2018 Printing Rates uses 2,760 gallons, equivalent to 2.0 clothes washers operated/year
3% less than 2018 Printing Rates uses 1,380 gallons more, a difference of 1.0 clothes washers operated/year
- 5% less than 2018 Printing Rates uses 4,600 gallons, equivalent to 3.3 clothes washers operated/year
5% less than 2018 Printing Rates uses 3,220 gallons more, a difference of 2.3 clothes washers operated/year



Solid waste measures sludge and other wastes generated during pulp and paper manufacturing, and used paper disposed of in landfills and incinerators.

- 1.5% LESS THAN 2018 PRINTING RATES produces 76 pounds of solid waste, equivalent to 17.3 people generating solid waste/day
- 3% less than 2018 Printing Rates produces 152 pounds of solid waste, equivalent to 34.7 people generating solid waste/day
3% less than 2018 Printing Rates produces 76 pounds more, a difference of 17.4 people generating solid waste/day
- 5% less than 2018 Printing Rates produces 253 pounds of solid waste, equivalent to 57.8 people generating solid waste/day
5% less than 2018 Printing Rates produces 177 pounds more, a difference of 40.5 people generating solid waste/day

Nitrogen oxides/ground level ozone (NO_x , which includes NO and NO_2) measures products of the combustion of fuels that contain nitrogen. NO_x can react with volatile organic compounds and sunlight in the lower atmosphere to form ozone, a key component of urban smog. NO_x forms ozone and can also, in parallel, lead to acid rain. *The measurement of NO_x in this calculator is a complex equation that takes into account human exposure across a sample of locations of pulp and paper mills. For more information please see the *Methodology* document under the Resources tab of this website (<https://c.environmentalpaper.org/pdf/SCS-EPN-PC-Methods.pdf>).

- 1.5% LESS THAN 2018 PRINTING RATES produces 63.2 persons x hrs. x pounds O_3 equiv/ m^3 , equivalent to 0.08 gasoline powered passenger cars/year
- 3% less than 2018 Printing Rates produces 126 persons x hrs. x pounds O_3 equiv/ m^3 , equivalent to 0.2 gasoline powered passenger cars/year
3% less than 2018 Printing Rates produces 62.8 persons x hrs. x pounds O_3 equiv/ m^3 more, a difference of 0.08 gasoline powered passenger cars/year
- 5% less than 2018 Printing Rates produces 211 persons x hrs. x pounds O_3 equiv/ m^3 , equivalent to 0.3 gasoline powered passenger cars/year
5% less than 2018 Printing Rates produces 147.8 persons x hrs. x pounds O_3 equiv/ m^3 more, a difference of 0.08 gasoline powered passenger cars/year

Purchased energy is a subset of total energy, and measures how much energy comes from purchased electricity and other fuels.

- 1.5% LESS THAN 2018 PRINTING RATES uses 0.9 million BTUs, equivalent to 1.1 residential refrigerators operated/year
- 3% less than 2018 Printing Rates uses 1.9 million BTUs, equivalent to 2.2 residential refrigerators operated/year
3% less than 2018 Printing Rates uses 0.9 million BTUs more, a difference of 1.1 residential refrigerators operated/year
- 5% less than 2018 Printing Rates uses 3.1 million BTUs, equivalent to 3.7 residential refrigerators operated/year
5% less than 2018 Printing Rates uses 2.2 million BTUs more, a difference of 2.6 residential refrigerators operated/year

Particulates/ $\text{PM}_{2.5}$ impacts measures the effect of particulate matter (PM) emissions from pulp/paper production, contributing to smog. Particulates are small airborne particles generated during combustion, and pose a range of health risks, including asthma and other respiratory problems, when inhaled. *The measurement of particulates in this calculator is a complex equation that takes into account human exposure across a sample of locations of pulp and paper mills. For more information please see the *Methodology* document under the Resources tab of this website (<https://c.environmentalpaper.org/pdf/SCS-EPN-PC-Methods.pdf>).

- 1.5% LESS THAN 2018 PRINTING RATES produces 20.6 persons x hrs. x pounds $\text{PM}_{2.5}$ equiv/ m^3 , equivalent to 0.8 gasoline powered passenger cars/year
- 3% less than 2018 Printing Rates produces 41.2 persons x hrs. x pounds $\text{PM}_{2.5}$ equiv/ m^3 , equivalent to 1.6 gasoline powered passenger cars/year
3% less than 2018 Printing Rates produces 20.6 persons x hrs. x pounds $\text{PM}_{2.5}$ equiv/ m^3 more, a difference of 0.8 gasoline powered passenger cars/year
- 5% less than 2018 Printing Rates produces 68.7 persons x hrs. x pounds $\text{PM}_{2.5}$ equiv/ m^3 , equivalent to 2.6 gasoline powered passenger cars/year
5% less than 2018 Printing Rates produces 48.1 persons x hrs. x pounds $\text{PM}_{2.5}$ equiv/ m^3 more, a difference of 1.8 gasoline powered passenger cars/year

Sulfur Dioxide (SO_2) and other acidifying emissions/regional acidification measures chemical compounds such as sulfur

dioxide, nitrogen oxides, and other acids (e.g. ammonia) that are produced when boilers burn fuel containing sulfur and other acid-producing substances. Of the fuels used in the paper industry, oil and coal generally contain the highest quantities of sulfur. These acidifying emissions contribute to air pollution problems like acid rain and smog. This category includes SO₂ emissions, but also other acids and emissions like NO_x.

- 1.5% LESS THAN 2018 PRINTING RATES produces 0.5 pounds SO₂ equiv., equivalent to 0.2 eighteen-wheelers/year
- 3% less than 2018 Printing Rates produces 1.06 pounds SO₂ equiv., equivalent to 0.3 eighteen-wheelers/year
3% less than 2018 Printing Rates produces 0.5 pounds SO₂ equiv. more, a difference of 0.2 eighteen-wheelers/year
- 5% less than 2018 Printing Rates produces 1.8 pounds SO₂ equiv., equivalent to 0.6 eighteen-wheelers/year
5% less than 2018 Printing Rates produces 1.2 pounds SO₂ equiv. more, a difference of 0.4 eighteen-wheelers/year

Volatile organic compounds (VOCs) measure a broad class of organic gases, such as vapors from solvent and gasoline. VOCs react with nitrogen oxides (NO_x) in the atmosphere to form ground-level ozone, the major component of smog and a severe lung irritant.

- 1.5% LESS THAN 2018 PRINTING RATES produces 0.009 pounds, equivalent to 39.4 miles driven in a car/year
- 3% less than 2018 Printing Rates produces 0.02 pounds, equivalent to 78.9 miles driven in a car/year
3% less than 2018 Printing Rates produces 0.009 pounds more, a difference of 39.5 miles driven in a car/year
- 5% less than 2018 Printing Rates produces 0.03 pounds, equivalent to 131 miles driven in a car/year
5% less than 2018 Printing Rates produces 0.02 pounds more, a difference of 91.6 miles driven in a car/year

Total reduced sulfur (TRS) measures emissions of the compounds that cause the odor associated with kraft pulp mills. Exposure to TRS emissions has been linked to symptoms including headaches, watery eyes, nasal problems, and breathing difficulties.

- 1.5% LESS THAN 2018 PRINTING RATES produces 0.008 pounds
- 3% less than 2018 Printing Rates produces 0.02 pounds
3% less than 2018 Printing Rates produces 0.008 pounds more
- 5% less than 2018 Printing Rates produces 0.03 pounds
5% less than 2018 Printing Rates produces 0.02 pounds more

Hazardous air pollutants (HAPs) measures any of a group of 188 substances identified in the 1990 U.S. Clean Air Act amendments because of their toxicity. Two of the most common occurring in air are formaldehyde and acrolein.

- 1.5% LESS THAN 2018 PRINTING RATES produces 0.1 pounds, equivalent to 0.02 passenger cars/year
- 3% less than 2018 Printing Rates produces 0.2 pounds, equivalent to 0.04 passenger cars/year
3% less than 2018 Printing Rates produces 0.1 pounds more, a difference of 0.02 passenger cars/year
- 5% less than 2018 Printing Rates produces 0.3 pounds, equivalent to 0.07 passenger cars/year
5% less than 2018 Printing Rates produces 0.2 pounds more, a difference of 0.05 passenger cars/year

Chemical oxygen demand (COD) measures the amount of oxidizable organic matter in the mill's effluent. Since wastewater treatment removes most of the organic material that would be degraded naturally in the receiving waters, the COD of the final effluent provides information about the quantity of more persistent substances discharged into the receiving water.

- 1.5% LESS THAN 2018 PRINTING RATES produces 1.2 pounds COD, equivalent to 0.007 homes/year
- 3% less than 2018 Printing Rates produces 2.5 pounds COD, equivalent to 0.01 homes/year
3% less than 2018 Printing Rates produces 1.2 pounds more, a difference of 0.007 homes/year
- 5% less than 2018 Printing Rates produces 4.1 pounds COD, equivalent to 0.02 homes/year
5% less than 2018 Printing Rates produces 2.9 pounds more, a difference of 0.02 homes/year

Biochemical oxygen demand (BOD) measures the amount of oxygen that microorganisms consume to degrade the organic material in the wastewater. Discharging wastewater with high levels of BOD can result in oxygen depletion in the receiving waters, which can adversely affect fish and other organisms.

- 1.5% LESS THAN 2018 PRINTING RATES produces 0.6 pounds BOD, equivalent to 0.003 homes/year
- 3% less than 2018 Printing Rates produces 1.2 pounds BOD, equivalent to 0.006 homes/year
3% less than 2018 Printing Rates produces 0.6 pounds more, a difference of 0.003 homes/year
- 5% less than 2018 Printing Rates produces 1.9 pounds BOD, equivalent to 0.01 homes/year
5% less than 2018 Printing Rates produces 1.4 pounds more, a difference of 0.007 homes/year

Total Suspended Solids (TSS)/Freshwater eutrophication measures solid materials suspended in mill effluent, which can adversely affect bottom-living organisms upon settling in receiving waters and can carry toxic heavy metals and organic compounds into the environment.

- 1.5% LESS THAN 2018 PRINTING RATES produces 1.1 pounds TSS, equivalent to 0.005 homes/year

- 3% less than 2018 Printing Rates produces 2.2 pounds TSS, equivalent to 0.01 homes/year
3% less than 2018 Printing Rates produces 1.1 pounds more, a difference of 0.005 homes/year
- 5% less than 2018 Printing Rates produces 3.7 pounds TSS, equivalent to 0.02 homes/year
5% less than 2018 Printing Rates produces 2.6 pounds more, a difference of 0.01 homes/year

Forest disturbance measures the impact of paper production on forest ecosystems and biodiversity. The indicator compares the ecosystem integrity of a harvested site to intact forests over 80 years old in the region, using on-the-ground measurements. It also considers the recovery potential which would be possible on the site if harvesting were halted, reflecting the long-term implication of forest management at suppressing ecosystem integrity.

- 1.5% LESS THAN 2018 PRINTING RATES disturbs 0.02 acres, equivalent to the size of 0.02 football fields
- 3% less than 2018 Printing Rates disturbs 0.05 acres, equivalent to the size of 0.04 football fields
3% less than 2018 Printing Rates uses 0.02 acres more, a difference of 0.02 football fields
- 5% less than 2018 Printing Rates disturbs 0.08 acres, equivalent to the size of 0.06 football fields
5% less than 2018 Printing Rates uses 0.06 acres more, a difference of 0.04 football fields

Threatened species measures the possible number of species affected by logging for paper production in the North American region that are listed as Critically Endangered, Endangered, or Vulnerable in the IUCN Red List of Threatened Species (<http://www.iucnredlist.org>), though the exact impact will vary by forest of origin. The number of species is based on correlation with logging threats assessed by IUCN and the fiber basket of pulp and paper mills in the region. For more information see the Methodology Document (<https://c.environmentalpaper.org/pdf/SCS-EPN-PC-Methods.pdf>).

- 1.5% LESS THAN 2018 PRINTING RATES impacts 9 species
- 3% less than 2018 Printing Rates impacts 9 species
3% less than 2018 Printing Rates impacts the same
- 5% less than 2018 Printing Rates impacts 9 species
5% less than 2018 Printing Rates impacts the same

Ocean acidification measures increased ocean acidity caused by CO₂, which has detrimental consequences for many marine organisms. This indicator considers CO₂ emitted during the production of pulp and paper, but also evaluates the amount of CO₂ that could be sequestered in trees if forest harvests used for papermaking were halted.

- 1.5% LESS THAN 2018 PRINTING RATES produces 193 pounds H₂CO₃, equivalent to 0.05 cars/year
- 3% less than 2018 Printing Rates produces 386 pounds H₂CO₃, equivalent to 0.1 cars/year
3% less than 2018 Printing Rates produces 193 pounds H₂CO₃ more, a difference of 0.05 cars/year
- 5% less than 2018 Printing Rates produces 643 pounds H₂CO₃, equivalent to 0.2 cars/year
5% less than 2018 Printing Rates produces 450 pounds H₂CO₃ more, a difference of 0.1 cars/year

Mercury emissions measure the amount of emissions during the production of pulp and paper. Mercury is a very toxic substance that persists in the environment for long periods of time. Emissions can therefore lead to contamination in the environment, including freshwater bodies and oceanic systems, subsequently exposing flora and fauna to elevated concentrations.

- 1.5% LESS THAN 2018 PRINTING RATES produces 2.3 milligrams, equivalent to 0.6 compact fluorescent lights
- 3% less than 2018 Printing Rates produces 4.7 milligrams, equivalent to 1.2 compact fluorescent lights
3% less than 2018 Printing Rates produces 2.3 milligrams more, a difference of 0.6 compact fluorescent lights
- 5% less than 2018 Printing Rates produces 7.8 milligrams, equivalent to 1.9 compact fluorescent lights
5% less than 2018 Printing Rates produces 5.5 milligrams more, a difference of 1.4 compact fluorescent lights

Dioxin emissions measure the amount of dioxin emissions that are released to air and water from pulp and paper mills. Dioxins are persistent and bioaccumulative, and even small amounts of emission can contaminate local waterways and bioaccumulate in fish.

- 1.5% LESS THAN 2018 PRINTING RATES produces 206 micrograms
- 3% less than 2018 Printing Rates produces 412 micrograms
3% less than 2018 Printing Rates produces 206 micrograms more
- 5% less than 2018 Printing Rates produces 687 micrograms
5% less than 2018 Printing Rates produces 481 micrograms more

Freshwater disturbance measures the number of freshwater systems possibly affected by logging. Logging can impact streams, rivers and creeks by increasing erosion, removing riverside vegetation and removing large woody debris that many fish species require for habitat. Although this impact is important and relevant, no data is currently available to calculate results. Reflecting the critical nature of this impact category, it is reported here as relevant to pulp/paper production, although results cannot be evaluated at this time.

Herbicides measures the amount of toxic herbicides used in growing trees for paper production. Herbicides are applied to control the spread of non-desirable species. Although this impact is important and relevant, no data is currently available to calculate results. Reflecting the critical nature of this impact category, it is reported as relevant to pulp/paper production, although results cannot be evaluated at this time.

Ocean warming measures increased ocean temperatures linked to emissions of greenhouse gases. Although this impact is important and relevant to emissions and foregone growth from logging, no algorithm is currently available to calculate results. Reflecting the critical nature of this impact category, it is reported as relevant to pulp/paper production, although results cannot be evaluated at this time.

Wetland disturbance measures the acreage of wetlands possibly affected by logging. Logging can increase erosion, which will cause changes in the sediment, temperature and other characteristics of wetlands. Although this impact is important and relevant, no data is currently available to calculate results. Reflecting the critical nature of this impact category, it is reported as relevant to pulp/paper production, although results cannot be evaluated at this time.

If you have questions or would like more information about Paper Calculator V4.0, please see the Life Cycle Assessment Methodology document under the "Resources" tab of this website (<https://c.environmentalpaper.org/resources.html>) or contact us at info@environmentalpaper.org.
