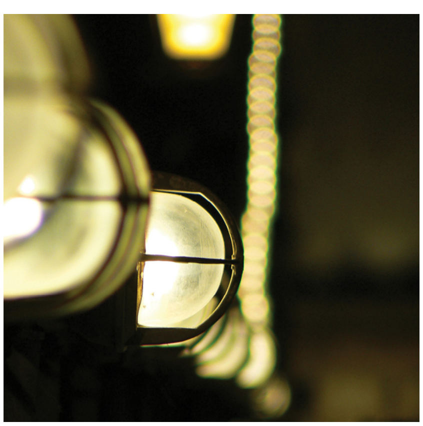
University of Saskatchewan

Smart Purchases Big Impact

Sustainable Purchasing Guide

Printing Ink

sustainability... your university, your world



UNIVERSITY OF SASKATCHEWAN

Printing Ink

Introduction

This section provides information on currently available options for ***printing ink*** that can help to move the University of Saskatchewan toward its sustainability goals. Living within the boundaries of our sustainability goals requires us to apply two main strategies:

Dematerialization requires that we reduce the amount of materials as much as possible; and that we continually move toward the use of 100% recycled content.

Substitution requires that we find less harmful materials to replace those that currently damage and are not recyclable.

Sustainable purchasing is about including social, environmental, financial and performance factors in a systematic way. It involves thinking about the reasons for using the product (the service) and assessing how these services could be best met. If a product is needed, sustainable purchasing involves considering how products are made, what they are made of, where they come from and how they will be used and disposed.

Finally, remember that this is an evolving document – it will change with new information as our understanding of sustainability impacts and potential solutions improves.

Purchasing Services

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Email: **purchasing.services@usask.ca**

Office of Sustainability

Tel: **(306) 966-1236**
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Smart Purchases Big Impact

Wherever possible **CHOOSE** products that employ a combination of characteristics listed in the left hand column, and **AVOID** products that demonstrate characteristic in the right-hand column.

CHOOSE	AVOID
• EcoLogo Certified	• Heavy metals
• Soy-based and vegetable-based inks	• Petroleum-based ink
• Water-less printing	
• Low VOC ink	

Option: Choose Soy-Based or Vegetable-Based Inks

Strategy: Substitution (SO 1, 2, 3, 4)

In soy inks, a portion of the petroleum oil that serves as the writing medium has been replaced by soybean or other vegetable oil. Most soy inks still have some proportion of petroleum in them. However, soy inks reduce the amount of volatile organic compounds (VOCs) that are released by petroleum oil inks.

Another factor of a print job will be the amount of clean-up required during the print run. While there is no difference in the volume of cleaners required for soy versus petroleum inks, the soy-based inks are conducive to cleanup with degradable and less toxic cleaners, thus reducing the amount of chemicals used.

Option: Choose Waterless Printing

Strategy: Substitution (SO 3)

Waterless printing, also referred to as dryography, is an offset lithographic printing process that eliminates the water or dampening system used in conventional printing. It uses a special silicone rubber coated printing plate, special ink, and typically a means of temperature control on press. In waterless printing the process of printing is changed from a chemical one to a simplified mechanical process. Instead of the press operator balancing the relationship between ink and water, waterless printing requires only a temperature range for transferring ink to the substrate. This process conserves a significant amount of water used in conventional printing and reduces the contamination of water systems with chemicals used in the printing process. It also eliminates the need for solvent-based press and blanket wash solutions.

Option: Avoid ink colour with pigments containing heavy metals

Strategy: Substitution – elimination of chlorine compounds (SO 2)

Some ink pigment colours contain heavy metals such as barium, copper, and zinc, while others do not. Choosing colours whose pigments contain no heavy metals lessens the potential accumulation of heavy metals in the biosphere and the associated health impacts. For example, colours to avoid include fluorescents, warm red and metallic colours.

Option: Electrophoretic Ink

Strategy: Substitution (SO 1, 2)

Electrophoretic inks can be corrected, edited, or updated if needed by momentarily applying an electric field. E-Readers commonly make use of this technology to simulate the appearance of ink on paper. This technology reflects light rather than backlighting the display (as in most laptops). This technology would eliminate many of the sustainability impacts of the current printing industry, such as the accumulation of chemicals, solvents and heavy metals used in petroleum-based inks. It does introduce new sustainability impacts, such as the introduction of new materials in the displays and an increased use of energy to produce the devices.

Arriving
at the currently preferred options

1. Identify the service

Inks are used to produce an image on a substrate (usually paper). Their primary function is to support communication for education, information or entertainment.

2. Assess the need

The University of Saskatchewan requires the ability to record, receive and send information. It uses printing ink primarily for printed and copied documents, envelopes, file folders and promotional materials.

3. Identify the contents

Printing inks are broken down into two subclasses: (1) ink for conventional printing, in which a mechanical plate comes in contact with or transfers an image to the paper or object being printed on; and (2) ink for digital non-impact printing, which includes ink-jet and electro-photographic technologies.

Printing inks are made up of three main components: the vehicle, pigments, and additives.

The ***vehicle*** is the most substantial component of printing ink and acts as a carrier medium for the pigment and binder to fix the pigment to the substrate. In most inks, the vehicle is made from heavy petroleum, but it can also be made from linseed oil or soybean oil.

The ***pigment*** is the solid colouring that is visible in ink. Most pigments are chemical compounds that may contain trace metals such as cadmium, barium, chromium, copper, or zinc, depending on the colour. Black ink is made using carbon black. White pigments, such as titanium dioxide, are used either by themselves or to adjust characteristics of color inks.

Inks also contain ***additives*** such as waxes, lubricants, drying agents, reducing oils and solvents, binding varnish antioxidants, and resins to modify printing performance and to impart desired special characteristics.

The equipment and processes used to perform the printing job, such as standard office printers and toner cartridges, are considered under a separate assessment of Electronic Equipment.

4. Identify sustainability impacts

i. ....systematically increasing concentrations of substances from the earth's crust?

- Barium, copper, zinc, cadmium and other ***heavy metals*** frequently used in ink pigments will systematically increase in concentrations in nature because of their dissipative use in printing. Heavy metals have a propensity to bio-accumulate. This also leads to negative human health impacts. When leached into the environment, heavy metals can also contaminate soil and groundwater.
- The ***feedstock*** for oil-based solvents in ink is generally non-renewable petroleum, which are extracted at a rate much greater than they are re-deposited back into the earth's crust.
- In addition to solvents and chemicals in the ink itself, numerous ***petroleum-based cleaners*** and other chemicals are used by commercial printers for cleaning purposes. The petroleum feedstock for these cleaners is extracted at a rate much greater than it is re-deposited back into the earth's crust.
- ***Fossil fuels*** are frequently combusted to provide energy during the extraction of raw materials, transportation, and the production of inks. The combustion of fossil fuels leads to an increase in biospheric concentrations of substances extracted from the earth crust (e.g. CO_2, CO and SO_x). Increasing concentrations of these substances in nature can contribute to a number of negative effects such climate change and acid rain, as well as associated negative human health impacts.

ii. ...systematically increasing concentrations of substances produced by society?

- ***Petroleum-based solvents*** used in many inks are ***volatile organic compounds*** (VOCs), which off-gas when drying. When used indoors, VOCs are a problem for indoor air quality. Outdoors, they can contribute to problems such as the development of ground-level ozone (i.e. smog). VOCs can also contribute to water contamination if the inks are not handled properly or released in large quantities.
- ***Petroleum-based cleaners*** also contain VOCs.
- The combustion of fossil fuels for energy during raw material extraction, manufacturing and transportation produces a number of chemical compounds (e.g. nitrogen oxides) that build up in the atmosphere.

iii. ...systematically degrading nature by physical means?

- A substantial amount of ***water*** is used by commercial printers, both during most printing processes (e.g. as a dampening solution) and for cleaning.
- Printer cartridges, and ink containers that go to ***landfill*** contribute to the physical degradation of nature through increasing amounts of land used for landfill.

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4. Identify sustainability impacts (con't)

- The extraction of fossil fuels and virgin metals/minerals may contribute to a systematic degradation of nature, especially in the case where land disturbed in ***mining*** is not reclaimed.

iv. …systematically undermining people's ability to meet their basic human needs?

- A number of ***VOCs*** are harmful to humans. As an example, toluene (***methyl benzene***), can affect the nervous system, kidneys, liver and heart. ***Formaldehyde***, a suspected carcinogen (substance that causes or promotes the development of cancer), can irritate the eyes, nose and throat during short exposures. These effects are of particular concern for employees of printing operations who are exposed to VOCs over long periods. Alcohols are also volatile solvents, but they are generally not as toxic as aromatic solvents.
- The bioaccumulation of ***heavy metals***, such as cadmium, can cause serious health impacts.
- A number of the compounds produced by the ***combustion of fossil fuels*** (e.g. nitrogen oxides, carbon monoxide, sulfur oxides, particulate matter) also have a negative effect on ***human health***.

5. Envision sustainable printing ink

Sustainable printing inks would not contribute to systematic increased build-up of substances from the earth's crust or of human-made substances. This means that the inks, instruments and processes used to print would either not contain any substances that would systematically increase in nature (e.g. heavy metals, persistent synthetic chemicals) or that they would be taken back and re-used entirely. Inks made from soy and agricultural resins could be fundamental to a sustainable printing service, provided they were harvested from sustainable agricultural processes.

It also means that neither negative human health effects nor physical degradation of nature would occur as a result of printing processes. Again, soy and vegetable-based inks have the potential to accomplish this goal provided they are produced sustainably. Sustainable commercial printing would either use no or minimal water or would recycle process water. Finally, to be sustainable, the entire printing process would either have to be powered by sustainable renewable energy or by energy produced in a carbon-neutral manner.

6. Identify and prioritize alternatives

Step 6 helps identify the product or service that offers the best pathway toward meeting all four of our Sustainability Objectives by using the following three criteria for assessment:

a) Does the product or service move us in the right direction with regards to our four Sustainability Objectives?

b) Does the product or service create a flexible platform for the next step toward sustainability?

c) Is the decision financially viable?

Resources
and Additional Information

1. EPA: Waste Reduction Evaluation of Soy-based Ink
   www.greenpressinitiative.org/documents/EPAinkStudy.pdf
2. Electrophoretic Displays
   http://electrophoretic.com/site/index.php?option=com_content&view=article&id=2&Itemid=3

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