

Pollution Prevention for Food Manufacturing

The food manufacturing industry plays a significant role in delivering food to consumers. However, the industry also uses significant amounts of chemicals, water and energy in the process. Pollution prevention (P2) is any practice that reduces, eliminates or prevents waste at the source. P2 activities can be implemented to reduce toxic substance use, conserve water and energy as well as improve practices to reduce waste.

Source Reduction

Several technologies exist that can be used in the food manufacturing industry to reduce waste at the source. As a cautionary note, the mentioned technologies can require changes such as the addition of new tools, a change in schedules and training for employees. These technologies include:

Toxic Substance Use Reduction

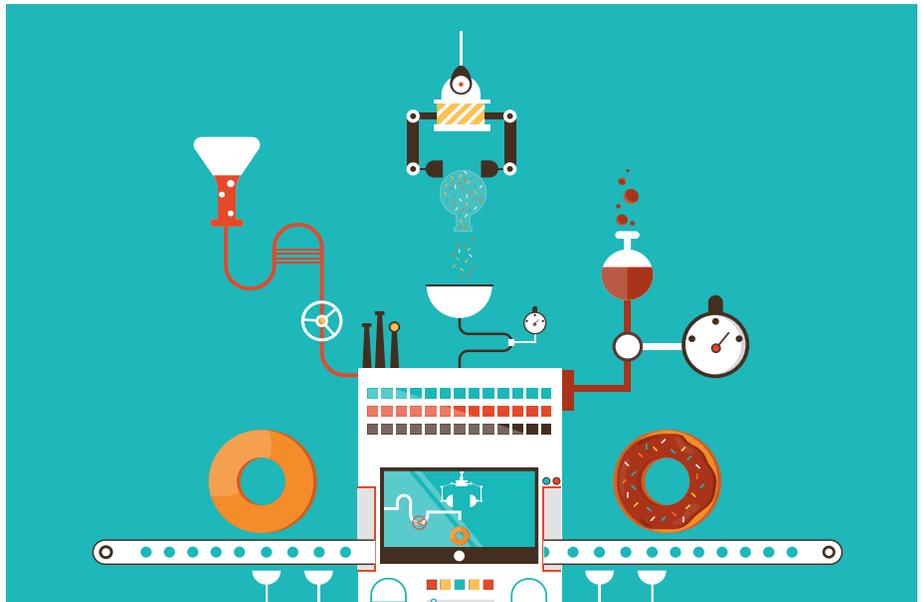
- Dry ice cleaning - a non-abrasive, non-toxic method that leaves no secondary waste and eliminates the need to manually scrub, reducing the use of water and chemicals. This technology can be used to clean-in-place resulting in cost savings, improved productivity and improved worker safety.¹
- Consider other hygienic alternatives that reduce the use of toxic substances such as sanitizing with ozone² or dry steam³ and disinfecting surfaces with ultra violet.⁴

Energy Conservation

- High hydrostatic pressure(HHP) - a non-thermal technology that can kill bacteria without the use of chemicals and is useful in the dairy industry.⁵
- Cold Plasma - an emerging (also non-thermal) technology that uses energetic, reactive gases to inactivate contaminating microbes in many foods including meats, fruits and vegetables.⁶

Hazardous Waste Reduction

- Deep-UV-C light-emitting diodes (DUV-LEDs) is a developing technology



that replaces the use of mercury lamps when inactivating organisms. The advantages include eliminating the potential for mercury leakage, a greater lifespan and a significant conservation of energy.⁷

Visit EPA's Safer Choice program for more information concerning alternative options to widely used chemical products.⁸

Additionally, see the Toxics Release Inventory (TRI) program's *TRI Pollution Prevention Profile: Food Manufacturing* to learn about food manufacturing facilities that reported to TRI and to find information on source reduction activities for toxic chemicals.⁹

Water Conservation

Water is an important substance in the food manufacturing industry. Not only is it used as an ingredient in food, it is used to clean and process products as well. Water conservation at your food manufacturing facility can be achieved by:

- Dry cleaning-up: Using brooms, scrapers and vacuum systems to clean floors and equipment instead of using water brooms or high -pressure hoses.¹⁰
- Looking into a closed-loop system to reuse process wastewater in other areas such as cooling purposes.

- Conducting general housekeeping such as fixing leaky valves, faucets and toilets and maintaining a detailed maintenance schedule for water lines.
- Considering an investment into a wastewater treatment unit that can enable water recycling at the facility by treating process water and reusing it.
- Upgrading areas where employee activity can impact water use such as bathrooms, break-rooms and kitchens. Minor changes like aerators and dual flush toilets can save the company significant amounts of water.¹¹ Considering using lean practices which can help you address water use at your facility by finding water waste on the manufacturing floor. See *EPA's Lean and Water Toolkit* for more information.¹²

Additional Information

To learn more about water conservation, visit EPA's WaterSense to identify best management practices that can help your facility use water efficiently.¹³

Other Ways to Reduce Energy

Energy conservation at a food manufacturing facility can be achieved through maintenance, upgrades and replacement of both small and large equipment. Other activities include:

- Conducting an energy audit at your facility to identify areas or processes that waste energy.
- Improving the building lighting, such as replacing current lighting with light-emitting diode (LED) lighting which can greatly improve your energy bill.
- Efficient Process Control — Use of advanced techniques to control specific portions of the manufacturing process to reduce wastes and increase productivity (e.g., Variable Frequency Drives for pumps).
- Replacing old machinery with more efficient models which can lead to electricity cost savings. Implement strict preventative maintenance on the new machinery to ensure efficiencies stay high.

See Energy Star's *Focus on Energy Efficiency in Food Processing*¹⁴ to find out how to improve manufacturing, use energy efficiently and reduce greenhouse gas emissions at your facility. For a more specific look into energy saving strategies for food manufacturing, see *Energy Star's Food Processing*.¹⁵

If refrigeration is used at your food manufacturing facility, preventative maintenance of ammonia based refrigeration systems not only reduces accidents but also prevents pollution. Check out EPA's Green Chill Partnership, which is specific to food retailers, but has useful information for all organizations using refrigeration.¹⁶ There you can find fact sheets, tools and calculators, guidelines and information on alternative technologies.¹⁷

P2 practices

P2 practices that contribute to reducing waste at the source include:

- Setting up baselines and goals, and comparing with the performance of other companies to identify improvement opportunities.
- Setting up budgets and deadlines for achieving process changes and getting equipment replacements, or upgrades accomplished.
- Minimizing raw material waste by practicing good inventory practices, sharing excess materials with sister companies or donating to trade colleges or non-profit organizations.
- Improving logistic operations by reducing greenhouse gas emissions and increasing supply chain efficiency. See EPA's *SmartWay* program to learn about sustainable transportation.¹⁸
- Reducing food waste in food manufacturing by donating to organizations that fight hunger or to farms that feed animals, composting food, or using scraps for anaerobic digestion.

Employee Education

Change employee behavior by embracing sustainability at the facility. Develop a P2 training program to educate employees on the benefits of continuous improvement and source reduction (less generation of pollutants). Incentivize waste reduction and P2 efforts by offering gift cards or recognizing employees who provide suggestions. Appoint a go-to person to be in charge of maintaining and advocating a P2 program. Allocate a budget to the P2 program to obtain the necessary tools and equipment required for P2 goals.

Lay maximum emphasis on source reduction, followed by reuse and recycling when no source reduction opportunities exist. Treatment and disposal of waste should be the least preferred action. Develop goals with measurable and attainable objectives. Encourage good practices like identifying and voicing ideas for improvement and reporting leaks and spills. Allow employees to play a part in water and energy conservation and reducing pollution whenever feasible.

References

- ¹ Manitoba Agriculture. *Dry Ice Blasting for the Food Processing Industry*.
- ² Manitoba Agriculture. *Ozonation in Food Applications*.
- ³ Food Safety Magazine. *Food Processing Surface Sanitation Using Chemical-Free Dry Steam*.⁴
- ⁴ National Center for Food Safety and Technology, Illinois Institute of Technology. *UV Light for Processing Foods*.
- ⁵ US National Library of Medicine. National Institute of Health. *High hydrostatic pressure technology in dairy processing: a review*.
- ⁶ *Cold Plasma: Emerging As the New Standard in Food Safety*.
- ⁷ American Society for Microbiology. *Fundamental Characteristics of Deep-UV Light-Emitting Diodes and Their Application To Control Foodborne Pathogens*.
- ⁸ EPA. *Safer Choice Program*.
- ⁹ TRI Pollution Prevention Profile: *Food Manufacturing*
- ¹⁰ Food Engineering. *Reducing Water Usage in Food and Beverage Processing*.
- ¹¹ Water Sense. *Best Management Practices*.
- ¹² EPA. *Lean and Water Toolkit*
- ¹³ EPA. *Water Sense Program*.
- ¹⁴ Energy Star. *Focus on Energy Efficiency in Food Processing*.
- ¹⁵ Bannon-Nilles, P. and Barnes, Laura. *Spotlight on U.S. EPA Region 5's Food Manufacturing and Processing Industry*.
- ¹⁶ EPA. *Green Chill Partnership*.
- ¹⁷ EPA. *Green Chill Resources and Reports*.
- ¹⁸ EPA. *SmartWay*.

Additional Resources

EPA. *Pollution Prevention Case Studies*.
 Energy Star. *Benchmark Energy Use*.
 Minnesota Technical Assistance Program. *Increasing Energy Efficiency in Food Processing Facilities*.