

# Plastics Processing and Manufacturing

## Process Description

Plastics are polymers with high molecular weights. Plastics are common in a wide range of products, from automotive interiors to pipes. Plastics processing and production involves three basic steps: 1) imparting certain characteristics to plastic resins with chemical additives, including lubricants, flame retardant agents, colorants and plasticizers; 2) converting raw materials (*plastic granules, pellets, sheets, fluids or preformed plastics*) into intermediate or final shapes; and 3) finishing the product through molding/forming processes, such as injection molding or extrusion. Injection molding involves heating granules or pellets to a fluid state and pressure injecting the fluid plastic into cold molds for setting. Extrusion involves pushing fluid plastic material through a die to create long, continuous forms, such as pipes or tubes.

## Waste Streams

Production facilities generate wastewater in three areas: contact cooling and heating processes; finishing processes; and, equipment maintenance activities. There is a potential for wastewater that comes in contact with process materials or equipment to pick up chemical additives and solvents used in production processes and routine maintenance. These include methanol, toluene, methyl ethyl ketone (MEK), dichloromethane, nitrate compounds, formaldehyde and N, N-dimethylformamide.

Air releases originate from molten plastics, solvent cleaners volatilizing and the surface coating of plastic components. Solid wastes originate from discarded cleanup materials and off specification materials unable to be reused.

## Pollution Prevention Opportunities

Plastics producers and processors can prevent and minimize impacts to the environment through materials substitution and conserving raw materials and cleaning chemicals.

Key substitution opportunities include: 1) replacing cleaning solvents with citric-based or other non-solvent cleaners to minimize releases relating to machine cleaning; 2) changing from solvent-based to aqueous-based surface coating, which provides similar results in the finishing stages of plastic production; and, 3) finding less environmentally-degrading chemical additives for lubricants (*aqueous/detergent-based for petroleum*) and blowing agents (*carbon dioxide for methylene chloride*).

Key work practices for preventing and minimizing impacts from undetected leaks and accidental spills include: 1) keeping all lids and covers closed; 2) having secondary containment to keep accidental spills from entering sanitary sewer systems or storm drains; 3) training employees in the proper handling and disposal of chemicals; 4) reusing or recycling waste or waste by-products, which reduces waste materials (*and material costs*); and, 5) keeping raw materials and

lubricating oils from coming in contact with the non-contact cooling and heating water (*which also can improve production efficiency*).

Key equipment cleaning and maintenance practices include: 1) removing production residue or by-product before it dries to reduce the amount of cleaning solution needed; 2) recycling process water using a sedimentation tank that removes suspended solids to allow the water to be reused before its discharged to the sanitary sewer; 3) reducing the amount of water used for cleaning using steam cleaners, high-pressure spray nozzles, or other low-volume, high-efficiency cleaning equipment; and, 4) adjusting temperature and pressure to reduce raw material usage, reduce the amount of waste materials generated and increase the overall efficiency of the extrusion process.

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### ***Pollution Prevention Checklist***

- Substitute solvents and other hazardous materials with water-based or less hazardous cleaners, colorants, lubricants and coatings.
- Increase production runs to reduce changeover and cleanup; process similar plastic components in sequence.
- Operate at the most efficient temperature and pressure during extruding to increase productivity and minimize releases.
- Train employees on the proper handling and disposal techniques for raw materials, waste by-products and wastes.
- Immediately clean equipment upon completion of a batch to reduce the amount of cleaning solution needed.
- Reuse and extend the life of process water by recycling it through a sedimentation tank designed to remove solids.
- Utilize steam cleaners or high pressure nozzles for equipment cleaning and spill cleanup if dry cleanup is not applicable.
- Use activated carbon to absorb chemicals from air and wastewater streams.
- Recover solvents from cleaning chemicals for reuse.
- Keep all lids and covers closed.