Pollution Prevention (P2) for Indiana Businesses

Indiana Department of Environmental Management

Office of Program Support

Pollution Prevention and Compliance Assistance Section

Compliance and Technical Assistance Program

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E101 – P2 Module Overview

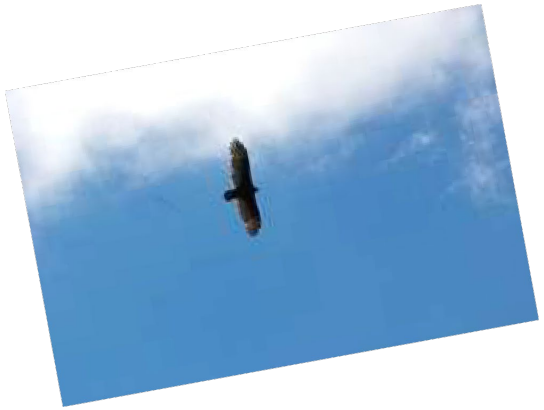
- Introduction to IDEM, Office of Program Support, and CTAP
- Understanding Pollution Prevention (P2) and Sustainability
- P2 Regulation and the Pollution Prevention Act
- Exploring the Potential Benefits of P2
- Bird's-eye View of Business P2
- Initiating and Developing a P2 Program
- The P2 Process – Facility Preliminary Assessment
- 12 Steps to P2 Success – The P2 Project Process
- P2 Strategies
- P2 Resources
- ESP Success Stories
- Exercise 1 – The Fun Factory
- Exercise 2 – P2 Cost Calculator (presented by Owen Yonce, IDEM Intern from IUPUI)

Introduction to IDEM

- In 1985, the Indiana General Assembly created the Indiana Department of Environmental Management (IDEM) under Title 13 of the Indiana Code. The agency began operating on April 1, 1986.
- The legislation set forth divisions for air pollution control, water pollution control, solid waste management, administrative services, pollution prevention, and established a technical and compliance assistance program to assist the regulated community.

IDEM's Mission

To implement federal and state regulations to **protect human health and the environment while allowing the environmentally sound operations of industrial, agricultural, commercial, and governmental activities** vital to a prosperous economy.



Introduction to IDEM

- IDEM ensures protection of Hoosiers and our environment by implementing and enforcing environmental laws and regulations.
- The agency drafts, administers, and implements rules adopted by the Environmental Rules Board and the Underground Storage Tank Financial Assurance Board.
- IDEM also develops rules when the federal government passes new environmental regulations with which Indiana must comply.

IDEM - Agency Structure

- Office of Air Quality (OAQ)
- Office of Water Quality (OWQ)
- Office of Land Quality (OLQ)
- **Office of Program Support (OPS)**
- Office of the Chief of Staff (OCS)
- Office of Legal Counsel (OLC)

IDEM Compliance and Technical Assistance Program

Compliance and Technical Assistance Program

Indiana Department of Environmental Management

Helping Indiana businesses one step at a time

CTAP
"Empowering Indiana Businesses with Environmental Compliance Assistance"

Contact CTAP

1 **Northwest Regional Office**:
- Charles Breitenfeldt, (219) 250-0119

2 **Northern Regional Office**:
- Joseph Neuklis, (574) 245-4879

3 **Indianapolis Central Office**:
HOTLINE (800) 988-7901 or (317) 232-8172
- Edward Clements
- Hani Sharaya
- Mark Stoddard
- Chrystal Wagner

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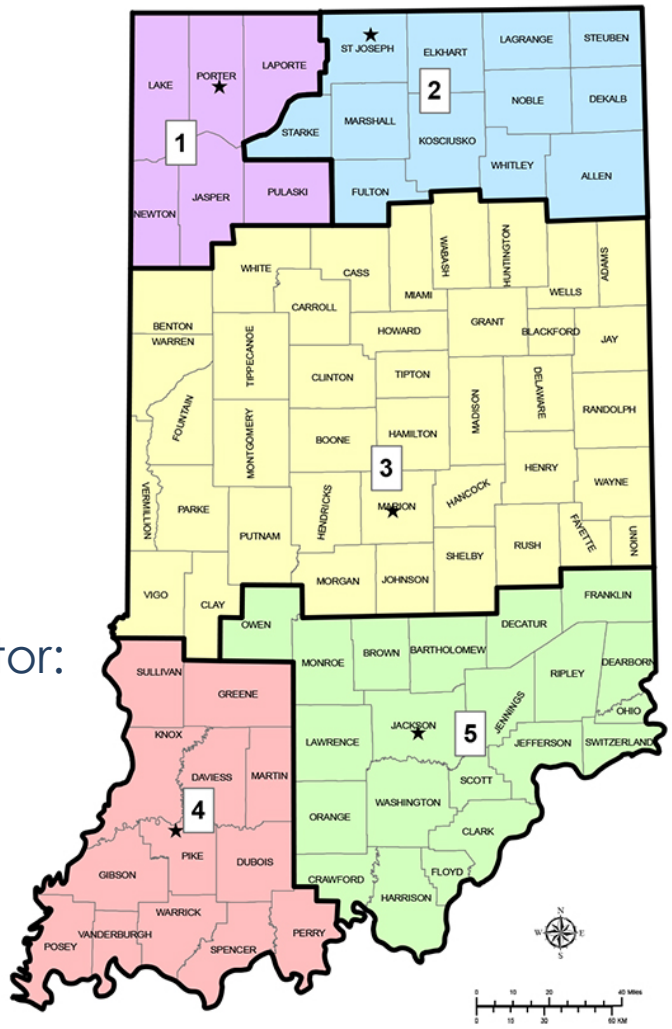
4 **Southwest Regional Office**:
- Tammy Haug, (812) 380-2303

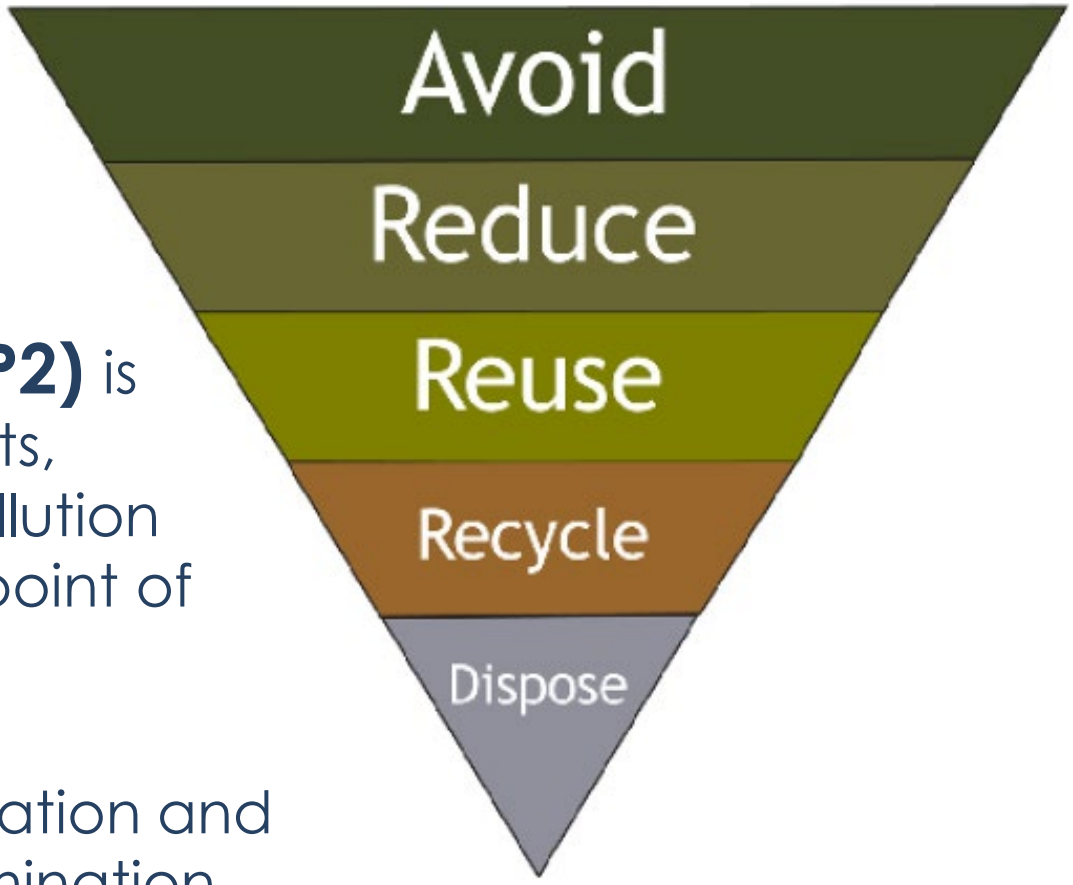
5 **Southeast Regional Office**:
- Nick Carr, (812) 358-2027



Email: CTAP@idem.IN.gov **Website:** www.idem.IN.gov/ctap

Pollution Prevention (P2) Defined

The Pollution Prevention Hierarchy



Pollution Prevention (P2) is any practice that prevents, reduces, or eliminates pollution and waste at its source (point of origin).

The focus of P2 is conservation and waste minimization or elimination.

P2 Defined

Pollution Prevention (P2) includes:

- **Source reduction**, which is any practice that:
  - Reduces the amount of any hazardous[1] substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and
  - Reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

[1] Hazardous is used in a broad sense to include federally or state regulated pollutants, including Clean Air Act criteria pollutants and Clean Water Act toxic and priority pollutants, but excludes items generally considered of low hazard and frequently recyclable or divertible, such as paper products, cans, iron and steel scrap, and construction waste.

P2 Defined

Pollution Prevention (P2) includes:

- Equipment or technology modifications
- Process or procedure modifications
- Product reformulation or redesign
- Substitution of raw materials (including substituting less harmful substances for hazardous ones)
- Improvements in housekeeping, maintenance, training, or inventory control

Pollution Prevention Act of 1990, United States Code Title 42
The Public Health and Welfare, Chapter 133, Pollution Prevention

P2 Defined

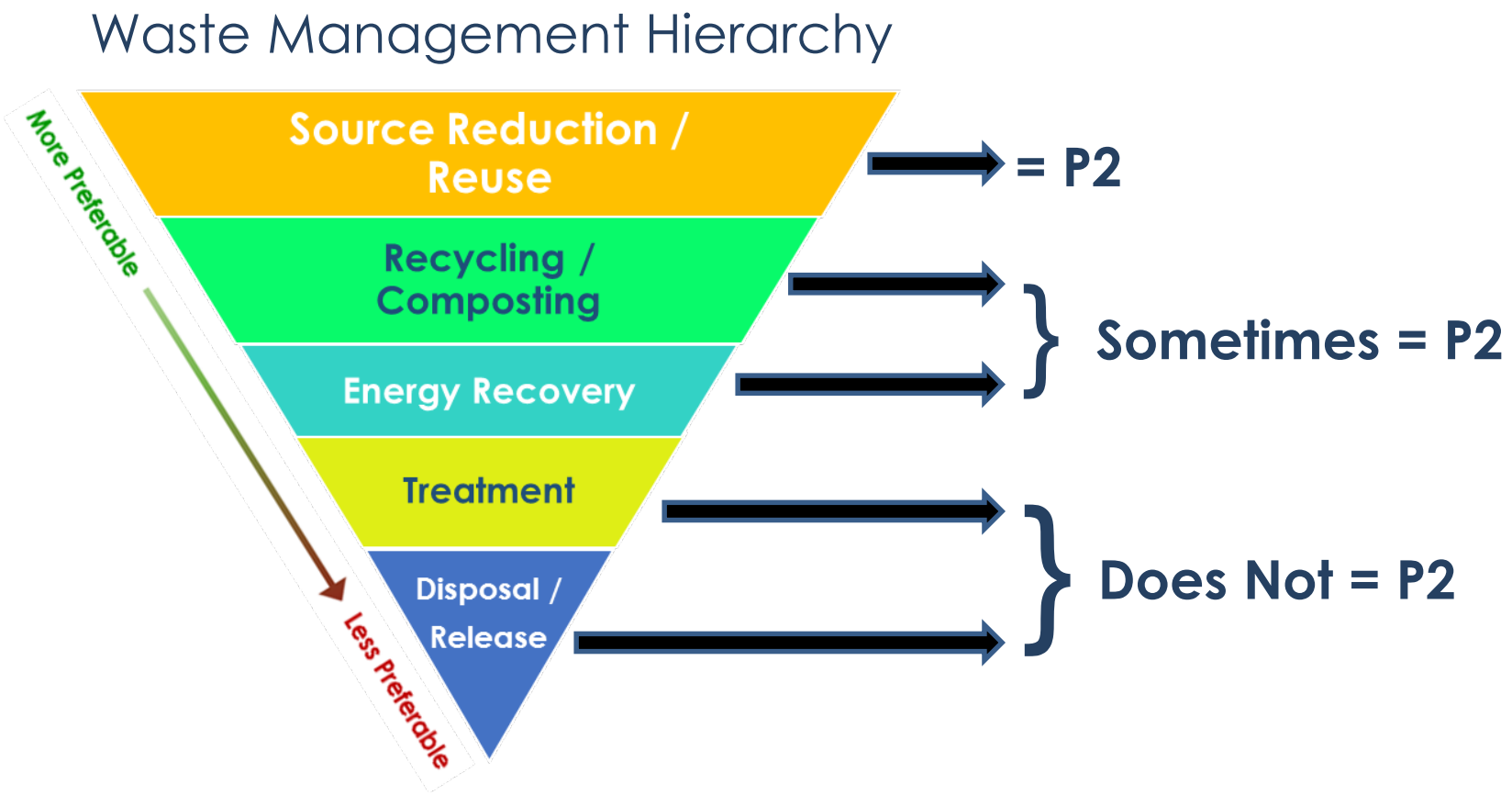
Pollution Prevention (P2) includes:

- Other practices that reduce or eliminate the creation of pollutants through:
  - Increased efficiency in the use of raw materials, energy, water, or other resources (includes some "in-process" recycling or energy recovery methods)
  - Reuse of products in their original forms
  - Use of repairable, refillable, and durable products resulting in a longer useful life
  - Protection of natural resources by conservation

P2 Defined

- **Reuse** means putting an item to use again after it has fulfilled its original function.
  - Can either serve its original function again or a different use
  - Does not change the original form of the product or materials (requires no alterations prior to reintroduction into a manufacturing process)
  - Prolongs the useful life
  - Does not harm the environment in any way
  - Saves energy (as no new energy is consumed in order for reuse)

P2 Defined



Generally, actions taken after waste has been generated, including recycling, composting, treatment, concentration, or dilution are **NOT** considered P2.

What P2 Does NOT Include

- Recycling (unless "in-process"/"closed-loop")
- Energy recovery (unless "in-process"/"closed-loop") or waste-to-energy incineration
- Treatment of a waste stream
- Disposal, incineration, or release
- Any practice that alters a hazardous substance, pollutant, or contaminant once it is generated
- A practice that is not necessary for production
- Practices that create new risks to human health or the environment

What P2 Does NOT Include

Recycling

- To recycle = a process in which waste material is transformed into new or usable materials.
- Recycling requires handling, energy use, and reprocessing.
  - General recycling can be thought of as "out-of-process recycling" and is not considered a form of P2.
  - Materials that are sent to the recycler represent lost revenues because they are not becoming part of a product or service.
  - However, if markets are available, it makes both economic and environmental sense to recycle a material rather than dispose of it.

In-process / Closed-loop Exception

Recycling

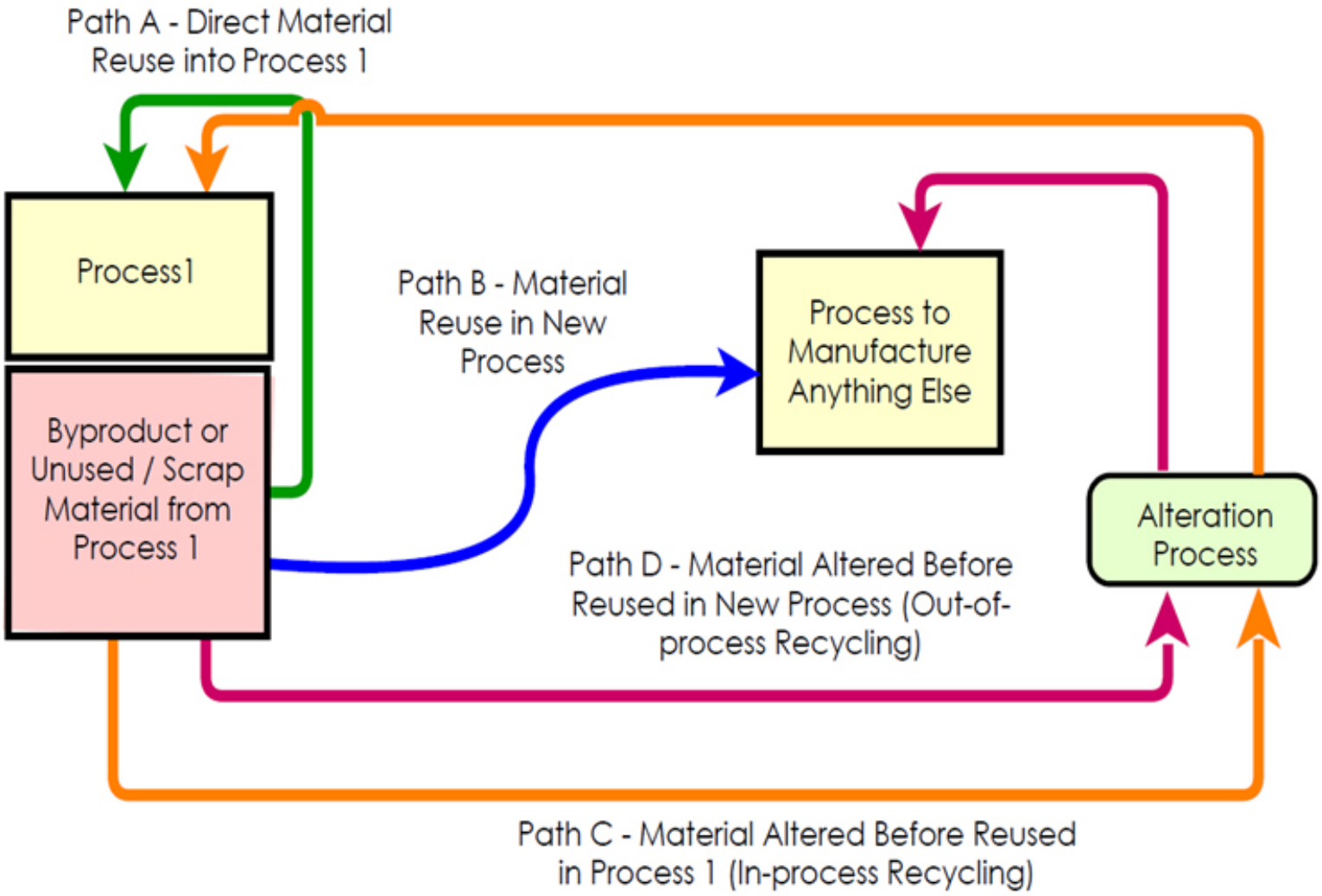
- P2 **does include** "closed-loop" recycling, which is commonly called "in-process" recycling.

  In order to consider "in-process" recycling a P2 activity:

  — It must serve a productive function with the making of the commercial product

  — It must be an integral part of that process (i.e., the production process cannot function without the recycling process)

Material Pathways
Reuse and Recycling



See Illustration 2, pages 8 and 9 of manual

What P2 Does NOT Include

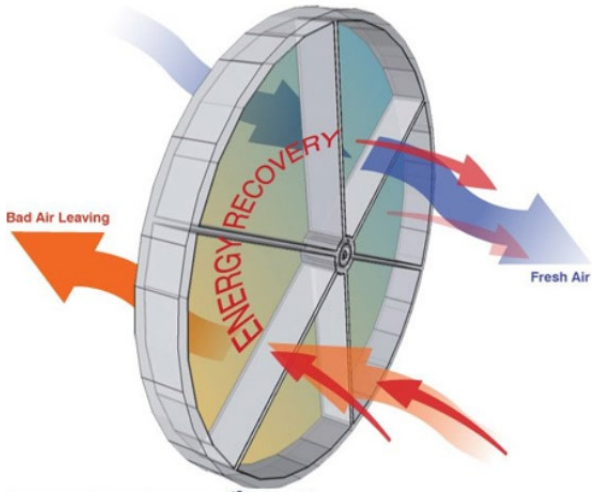
Energy Recovery

- Energy recovery is a waste treatment process that generates energy in the form of electricity, heat, or fuel. There are three types of energy recovery technologies:
  - **Thermo-chemical**: extracts energy from waste through high temperatures or combustion.
  - **Chemical**: extracts energy through esterification (chemical reaction between alcohols and acids).
  - **Bio-chemical**: extracts energy using bio-decomposition of waste (biogas, bio-hydrogen, and bio-ethanol).

In-process / Closed-loop Exception

Energy Recovery

- Can be P2 if it is direct capture and reuse of energy (a closed-loop system) without alteration or additional waste streams to convert energy from waste products.



For instance, buildings or infrastructure projects may recover the heat from used air or water for heating or pre-heating other buildings systems.

This P2 effort results in reduced emissions, energy use, and monetary savings.

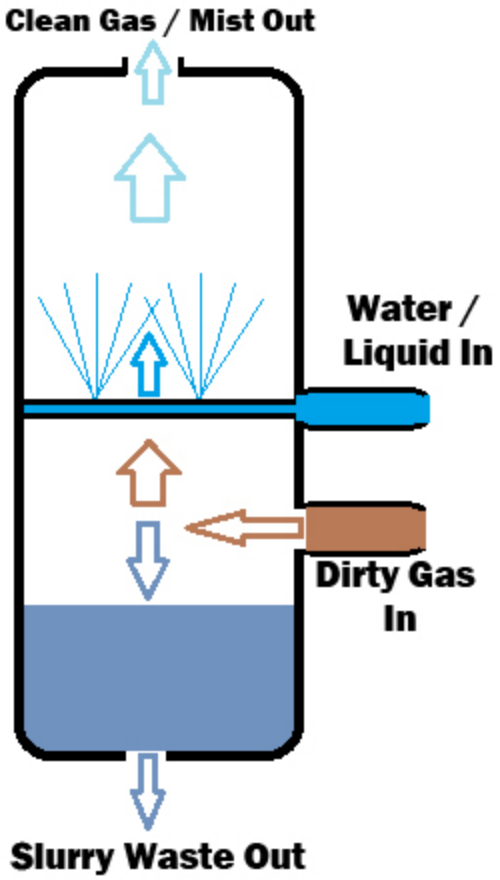
What P2 Does NOT Include

Pollution Control and Treatment

- The use of control devices or conversions (chemical or biological) on a waste stream to reduce or eliminate the release of pollutants into the environment

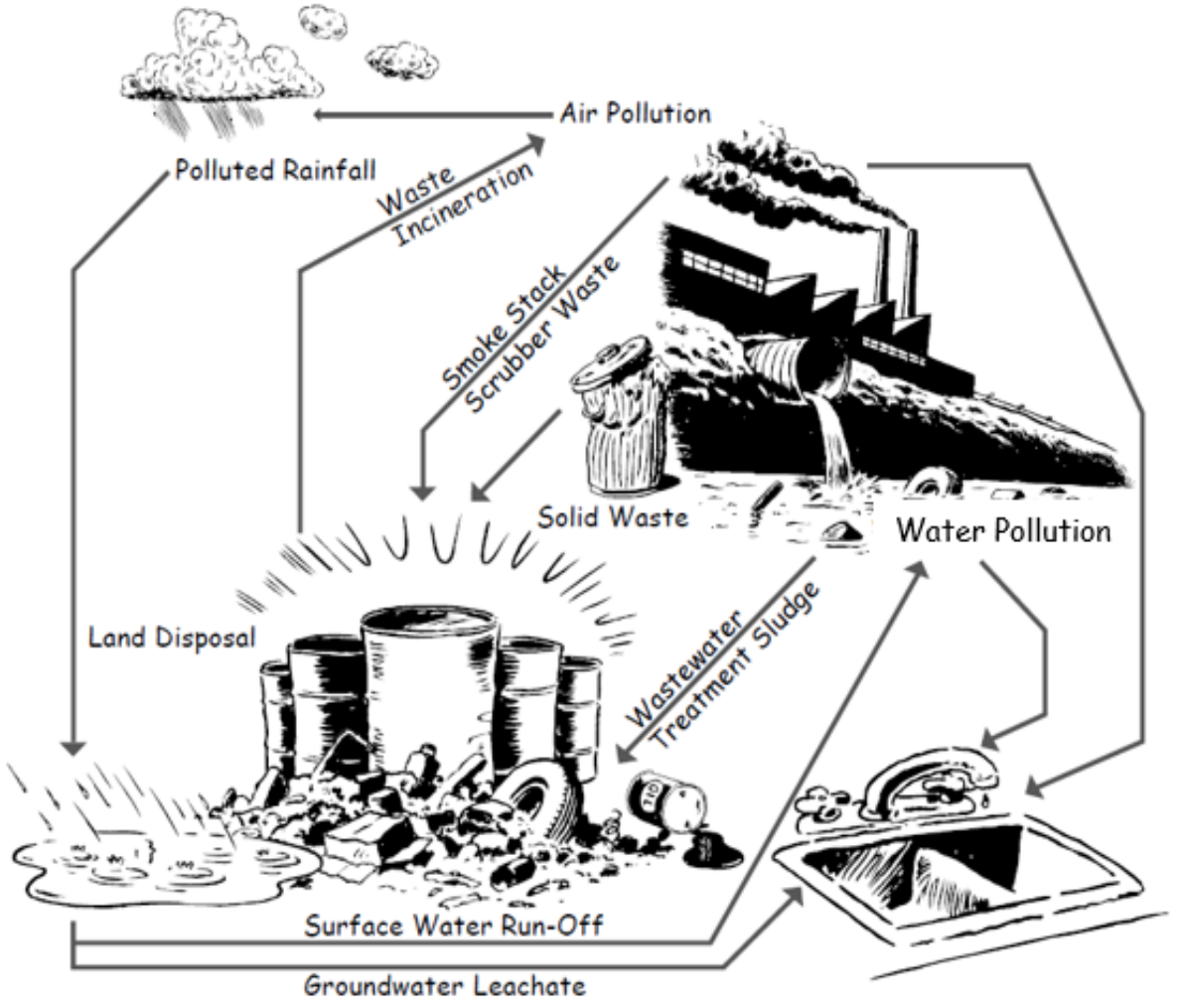
Pollution control and treatment are not forms of P2 because the same amount of waste is **created**, but it is simply **moved** from one place in the environment to another (from one media [air, water, land] to another media).

Air Scrubber



From One Media to Another

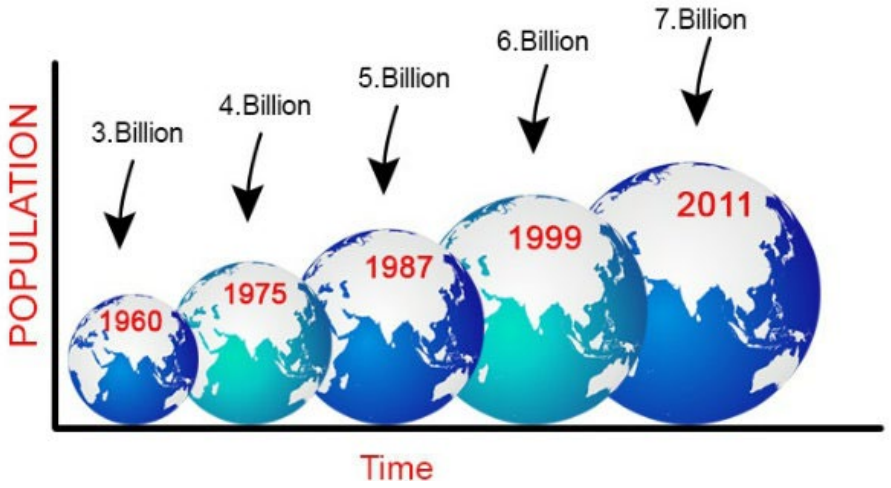
This is what is known as the **cross-media transfer** of waste



The P2 & Sustainability Movement

Population growth has led to:

- Greater and more concentrated use of resources
- Increases in waste generation and pollution

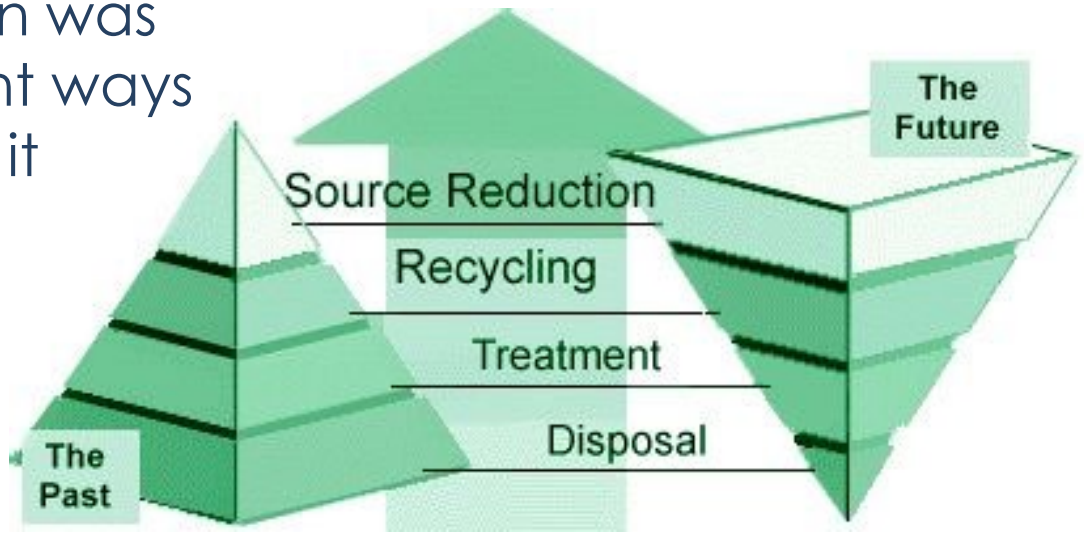


Similarly, economic growth requires increasing quantities of energy, materials, and natural resources. This too leads to more waste creation, toxic substance releases, and other forms of environmental pollution. Consumption is typically seen as being good for the economy.

The P2 & Sustainability Movement

In the past, when pollution was generated, people sought ways to control and dispose of it

Wastes that are thrown away do not go away, and there is no "away" with hazardous wastes



Source reduction is fundamentally different and more desirable than waste management and pollution control

Avoiding the generation of pollution is the most effective way to protect the environment and promote sustainability

The P2 & Sustainability Movement

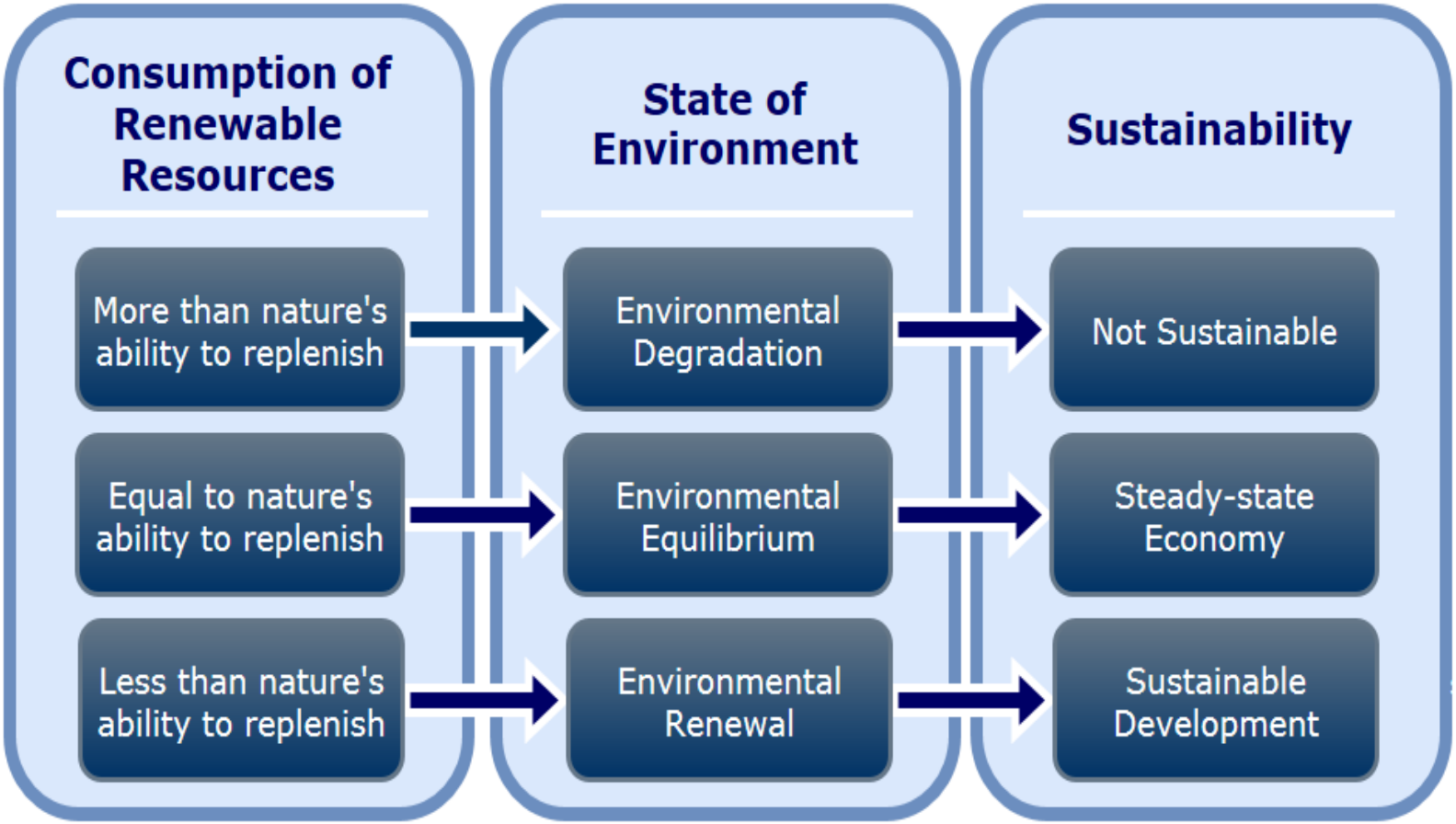
Sustainability is based on a simple principle:

"***Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment***." U.S. EPA

P2 is a cornerstone of the sustainability movement, which strives to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations

The P2 & Sustainability Movement

Sustainability is about finding the balance point among population, consumption, and waste assimilation



The P2 & Sustainability Movement

Communities are interrelated webs of many overlapping variables

Sustainability implies responsible and proactive decision-making and innovation that minimizes negative impact and maintains balance between ecological resilience, economic prosperity, political justice, and cultural vibrancy

The P2 & Sustainability Movement

The concept of environmental sustainability was introduced into public policy in the U.S. in 1969 through the National Environmental Policy Act (NEPA)

Title I of this policy committed our nation to sustainability by requiring the federal government to use all practicable means

"to create and maintain conditions under which humans and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans"

The P2 & Sustainability Movement

- Making better use of resources is a test of ingenuity and is more likely to result in sustained economic growth through the creation of better products

- Businesses can become more competitive and individual consumers more prosperous by using resources more efficiently and creating less waste

- Although traditional pollution control will remain an important part of societal practices, the paradigm shift in favor of P2 must occur in order to increase sustainability in all communities

The Pollution Prevention Act

United States Code Title 42—The Public Health And Welfare Chapter 133, Pollution Prevention

The Pollution Prevention Act of 1990 establishes a national policy that U.S. EPA implements:

> "The Congress hereby declares it to be the national policy of the United States that **pollution should be prevented or reduced at the source whenever feasible**;
>
> Pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible;
>
> Pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible;
>
> Disposal or other release into the environment should be employed **only as a last resort** and should be conducted in an environmentally safe manner."

The Pollution Prevention Act

- Defines "source reduction" (slide 12)
- Establishes the activities outlining U.S. EPA's authorities and functions related to P2
- Directs U.S. EPA to:
  - Develop and implement a strategy to promote source reduction
  - Collect and disseminate P2 information
  - Provide financial assistance (grants) to states to promote the use of source reduction techniques by businesses
  - Create an office within the agency to carry out the functions established by the act – currently is the Office of Pollution Prevention and Toxics (OPPT)

The Pollution Prevention Act

U.S. EPA's functions related to P2:

- Establishes **standard methods of measurement** of source reduction
- Coordinates and **promotes source reduction activities** and techniques in federal agencies and businesses
- Improves coordination of, streamlines, and **assures public access to data** collected under federal environmental statutes
- Establishes a training program on multimedia source reduction opportunities
- Makes recommendations to Congress to **eliminate barriers to source reduction** including the use of incentives and disincentives

The Pollution Prevention Act

U.S. EPA's functions related to P2 (cont.):

- Develops and disseminates **model source reduction auditing procedures** designed to highlight source reduction opportunities
- Establishes an **advisory panel of technical experts** comprised of representatives from industry, the states, and public interest groups, to advise U.S. EPA on ways to improve collection and dissemination of data
- Establishes an **annual award program** to recognize companies operating outstanding or innovative source reduction programs
- Facilitates the adoption of source reduction techniques by businesses – Strategy includes the use of the Source Reduction Clearinghouse and state matching grants

The Pollution Prevention Act

U.S. EPA's Source Reduction Clearinghouse

These links offer access to U.S. EPA's information and outreach materials on pollution prevention:

- Pollution Prevention Information Clearinghouse (PPIC)
- PPIC Calendar
- Pollution Prevention Resource Exchange (P2RX)
- Newsletters
- U.S. EPA P2 publications
  - General P2 information and P2 technical assistance
- A-Z Subject Index
- Case Studies

The Pollution Prevention Act

The Toxics Release Inventory (TRI) is a publicly available database containing information on toxic chemical releases by covered industry groups.

TRI was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and was expanded by the Pollution Prevention Act of 1990 to include P2 information and activities.

TRI Program P2 Resources assist industrial facilities with reporting P2 information, accessing and analyzing P2 data, and promoting P2 best practices.

TRI's P2 Search Tool now helps identify P2 successes and compare P2 performance at both the facility and corporate level.

Indiana P2 Law

Indiana Code, Title 13, Article 27, Industrial Pollution Prevention and Safe Materials (IC 13-27)

- Establishes Indiana's Division of Pollution Prevention and Technical Assistance within IDEM and the functions it serves
- Similar to the federal P2 act – outlines directives for IDEM to facilitate P2 practices and ensure public access to relative information
- Programs developed under this article are implemented based on voluntary participation by businesses
- Indiana's P2 program provides outreach and develops technical resources to help companies reduce waste

Potential Benefits of P2

P2 is about increasing operational efficiencies, reducing risk, and effectively meeting environmental responsibilities

It is a business strategy from which any company, regardless of size or type, can benefit.

Unlike most pollution control strategies, P2 offers important **economic**, **regulatory**, **environmental**, **and social benefits** that can often result in a more competitive business

Potential Benefits of P2

Why do P2?

The Benefits are **3P**

Planet

People

Profits

Potential Benefits of P2

The Planet

Successful P2 efforts result in positive environmental impacts that are beneficial immediately and in the long run, such as:

- Conserved landfill space / disposal capacity
- Conserved energy (reduced need for energy generation)
- Conserved natural resources (reduced extraction & refining)
- Decreased pollution

Potential Benefits of P2

People – *Workers, Consumers, Communities*

A facility that commits to an effective P2 policy can help ensure the quality of life for all people:

Workers

- Improved health, safety, and operational conditions for workers
- Improved employee morale
- Improved productivity and innovation
- Company receives and gives recognition

Potential Benefits of P2

People

Consumers

- Reduced risk to consumers
- Improved public relations, enhanced public image, new market base potentials

Surrounding Communities

- Improved public health
- Supported economic development potential
- Improved societal and cultural development

Potential Benefits of P2

Profits

One of the greatest benefits of implementing P2 strategies at a business is the associated financial gains:

- Improved regulatory compliance and reduced regulation
- Reduced waste generation, storage, treatment, and disposal costs
- Reduced present and future liability costs
- Reduced raw material consumption / material costs
- Improved process efficiency, expanded production, improved company profits
- Expanded markets

Why do P2?

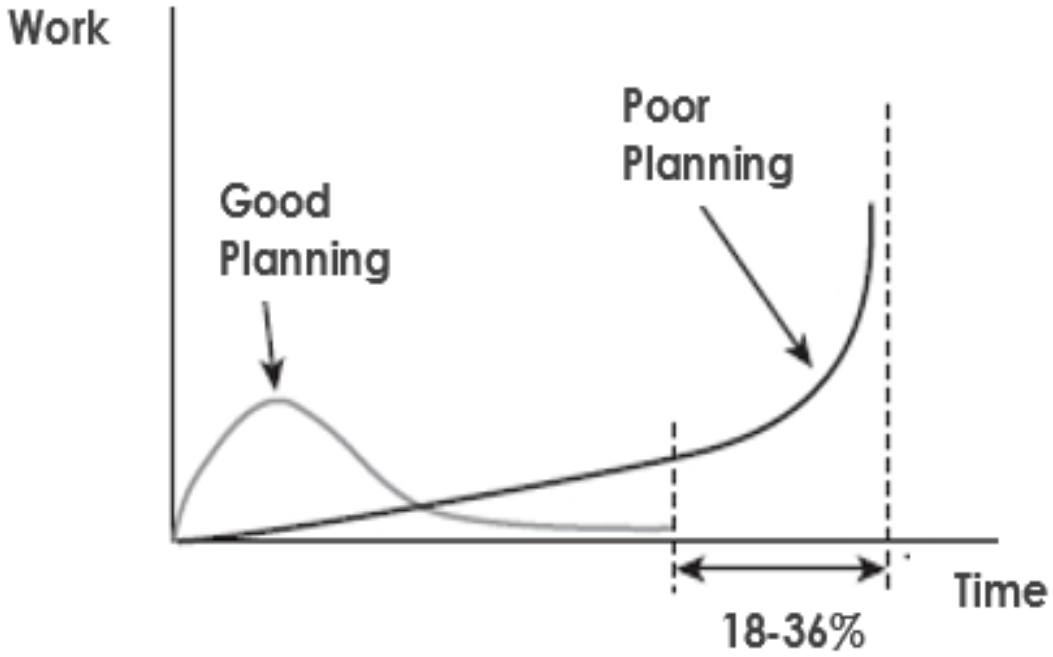
Because it is the right thing to do?

Because it is the right thing to do!

Examples of companies that implement P2 even when there are no monetary gains

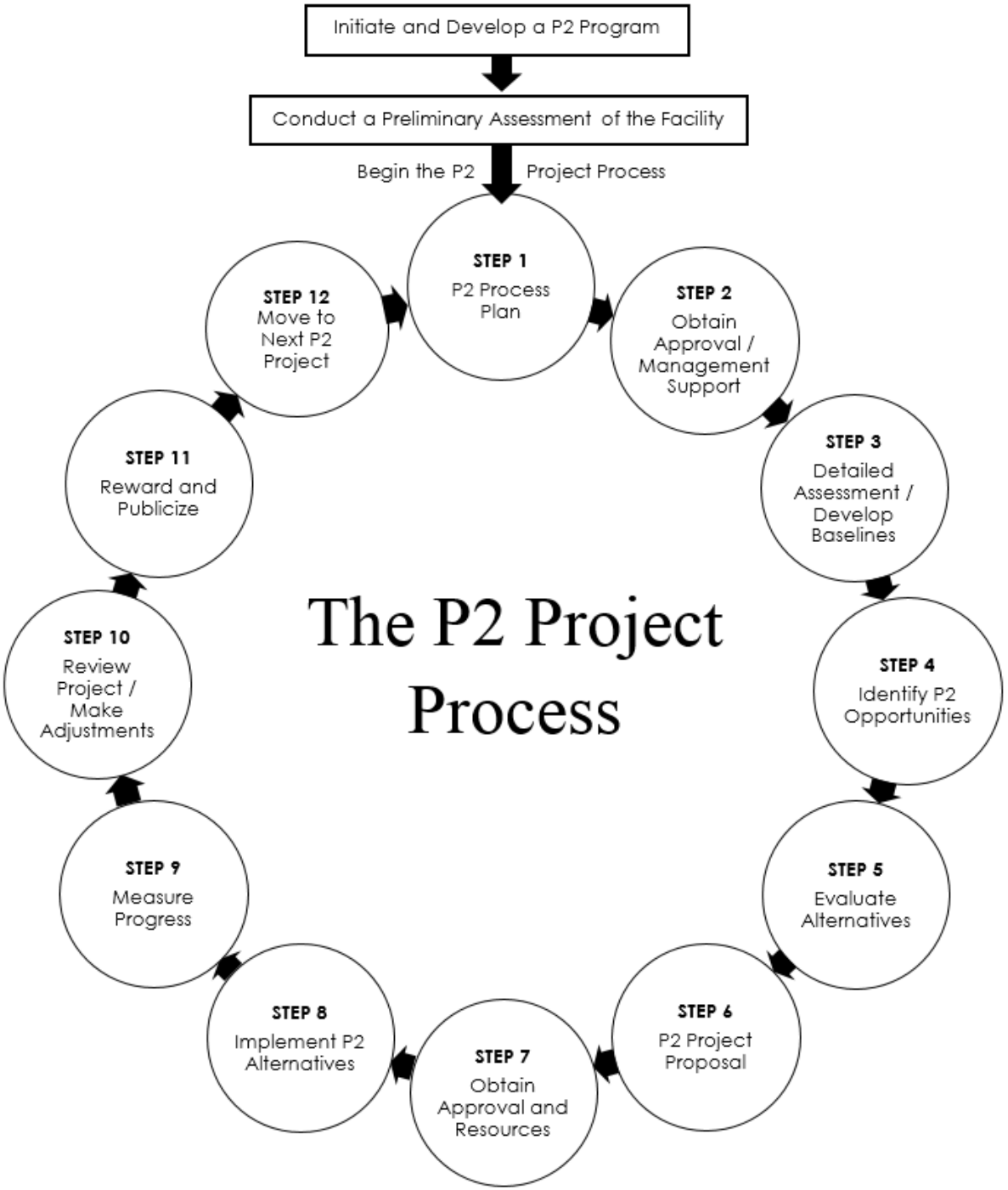
Planning for Program Development and Project Implementation

One common component of successful P2 execution is **good planning**



Good Planning =

- Time savings
- Fewer complications
- Less work overall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Conduct a Preliminary Assessment of the Facility
Begin the P2 Project Process
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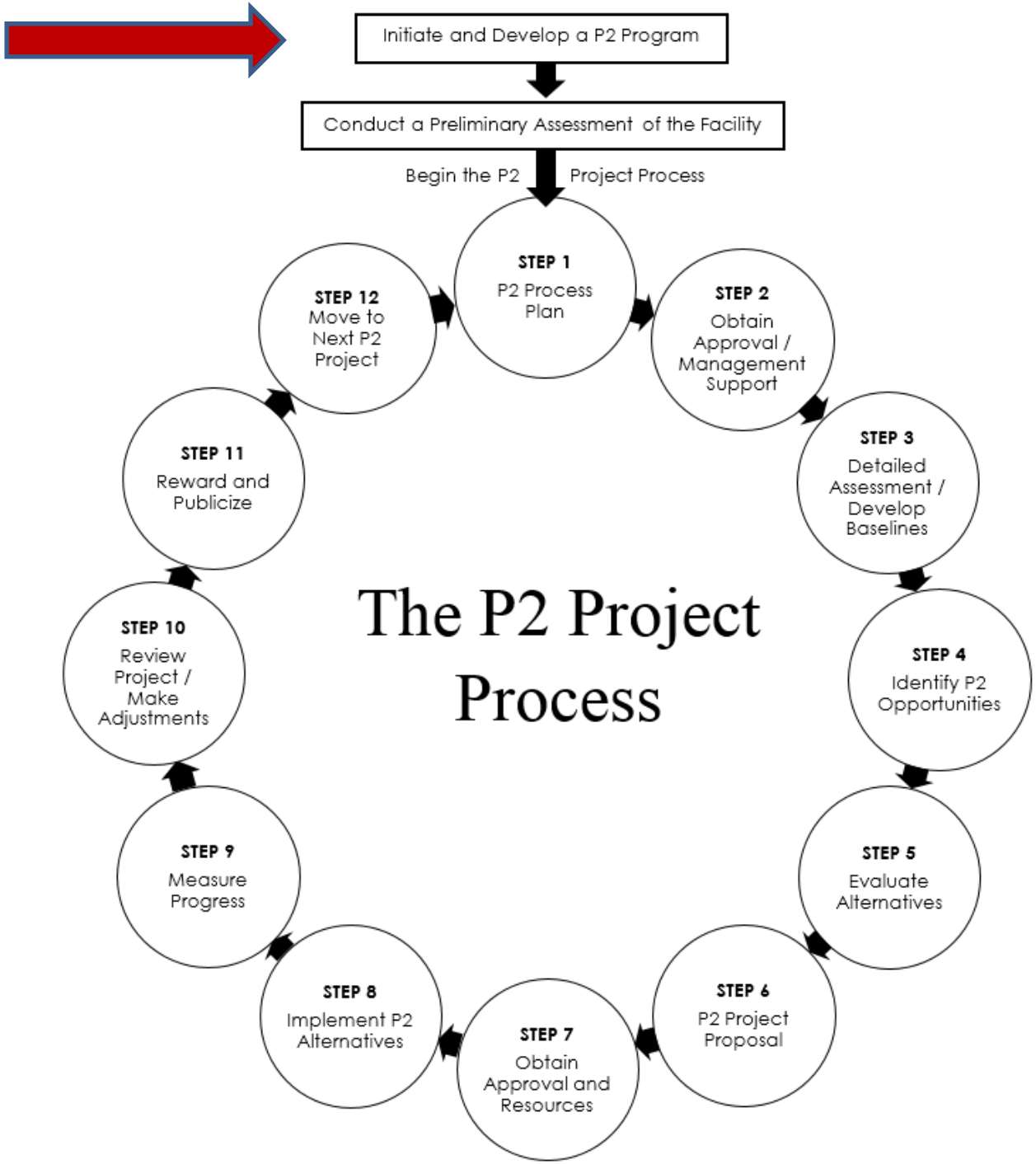
STEP 1
P2 Process Plan
STEP 2
Obtain Approval / Management Support
STEP 3
Detailed Assessment / Develop Baselines
STEP 4
Identify P2 Opportunities
STEP 5
Evaluate Alternatives
STEP 6
P2 Project Proposal
STEP 7
Obtain Approval and Resources
STEP 8
Implement P2 Alternatives
STEP 9
Measure Progress
STEP 10
Review Project / Make Adjustments
STEP 11
Reward and Publicize
STEP 12
Move to Next P2 Project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Move to Next P2 Project

Initiate and Develop a P2 Program

- A P2 program facilitates an ongoing and comprehensive examination of the operations at a company or facility with the goals of minimizing raw material usage, waste products, and hazards associated with production
- An effective P2 program is the key to reducing negative environmental impacts from business operations and realizing the many benefits of P2 efforts

Building a basic P2 program requires four steps…

Initiate and Develop a P2 Program

1
Obtain Management Support / Company Commitment

P2 Program Development

Obtain Management Support / Company Commitment

Provide managers with the information they need to make decisions:

- Reasons for a P2 program and Potential Benefits to the Business
- Detailed Elements of the P2 Process
- Required Resources for a Sustainable P2 Program and P2 Process Implementation

1
Obtain Management Support / Company Commitment

P2 Program Development

Reasons for a P2 program and Potential Benefits to the Business

Justify a P2 program by gathering information to demonstrate that P2 opportunities exist and should be explored

- Present potential P2 benefits that align with the company's current missions and values
- Provide detailed examples of source reductions and P2 accomplishments of other organizations
- Identify specific and attainable reduction goals envisioned for the facility's P2 program
- Note areas where losses are suspected to be occurring and possible opportunities for cost savings

1
Obtain Management Support / Company Commitment

P2 Program Development

Detailed Elements of the P2 Process

It is important for management to understand the elements of a P2 program and how the P2 Project Process works

- Sharing the content outlined in this training may prove effective
- Many technical resources available for resource use/ waste generation audits and P2 assessment methods
- The P2 program structure can be tailored to meet the specific needs of the company and the P2 process can be adapted

1
Obtain Management Support / Company Commitment

P2 Program Development

Required Resources for a Sustainable P2 Program and P2 Process Implementation

It costs a company money to carry out a P2 program (capital costs, staff salaries, external consultation services, production downtime) and initial costs must be allocated from existing budgets

Present sound reasoning in order to obtain management support!

— Emphasize that when the company reduces the amount of money spent on managing waste, those monies become available for research and development, facility improvements, and social programs

1
Obtain Management Support / Company Commitment

P2 Program Development

Many of the resulting P2 financial gains can more than sustain a P2 program!

- Reduced raw material consumption / material costs
- Reduced waste generation, storage, treatment, and disposal costs
- Improved regulatory compliance / decreased regulatory costs
- Enhanced process efficiency
- Reduced potential liability
- Improved public relations
- Improved staff productivity and worker safety
- Increased market share, sales, company profits

2

Create Mission Statement and Formal P2 Policy

P2 Program Development

Create a Mission Statement and Formal P2 Policy

Management should convey P2 commitment to all employees through the creation of a **P2 mission statement** and a formal P2 policy

- Build a consensus among management and employees; P2 is good for business
- Mission statements are most effective when prepared in cooperation with staff
- They give importance to the P2 program and help define the new company P2 policy

2

Create Mission Statement and Formal P2 Policy

P2 Program Development

Example Mission Statements

"We make a commitment to proactively protect the environment by reducing the wastes we generate through our use and disposal of products."

"At Subaru of America we are committed to the vitality of our people, to the health of our planet, and to enhancing the communities where we live and work. Our corporate responsibility efforts and philanthropic commitments address the issues our employees, customers and communities are passionate about and we strive to address these issues in ways that allow us to create positive change – within our operations and beyond our four walls."

Patagonia's Mission Statement – "Build the best product, cause no unnecessary harm, use business to inspire and implement solutions to the environmental crisis."

2

Create Mission Statement and Formal P2 Policy

P2 Program Development

Establishing a formal **P2 policy** is a way to integrate P2 into corporate planning

The P2 policy supports the mission statement(s), promotes the company's philosophy toward P2 practices, outlines specific goals for the organization, and gives directives for the P2 program

The policy should clearly state:

1) Why a P2 program is being established (i.e., to fulfill the mission statements)
2) What is to be accomplished (i.e., company goals)
3) Who will do it (i.e., all company staff)
4) How it will be accomplished (i.e., through the SOPs outlined in the P2 management plan)

2

Create Mission Statement and Formal P2 Policy

P2 Program Development

Work with Management to Establish Challenging & Obtainable P2 Policy Goals

Goals can be qualitative, quantitative, or both

Example company goals

- Reduce halogenated solvent use on the parts cleaning line by 25% by the end of the fiscal year.
- Identify five (5) pollution prevention projects for implementation by December 31, 2019.
- Reduce our company carbon emissions by 50% in comparison with base year of 2009.
- Expand our use of green electricity to 40% by 2020.
- Purchase and use paper products in our offices that are sourced from sustainably managed forests only.

2

Create Mission Statement and Formal P2 Policy

P2 Program Development

Management is very influential in creating a culture where P2 is not only accepted but is celebrated in its applications

Programs will falter if management support is not strong, visible, and **subject to accountability**

Senior management should sign a formal policy statement that expresses approval for the P2 program and authority for the staff to develop and implement the P2 process

2

Create Mission Statement and Formal P2 Policy

P2 Program Development

Announcing authorization for the P2 program development and associated P2 efforts is an extremely important step, regardless of the size of the facility

- Promote the P2 program and activities
- Hold a kickoff event to describe the P2 goals
- Highlight the benefits for the business and staff
- Use posters or signs to get the word out to employees; place signs in areas where P2 activities should happen

3

Construct P2 Management Plan

P2 Program Development

Construct P2 Management Plan

A P2 management plan outlines the functional elements of the P2 program and P2 process, including:

- P2 program and process organization
- A detailed program description
- Standard operating procedures (SOPs)
- Any other appropriate details or practices

3

Construct P2 Management Plan

P2 Program Development

Suggested Outline for the P2 Management Plan

- P2 Program Scope
- P2 Teams, Roles, and Responsibilities
- Facility/Process Assessments and P2 Project Process Steps
- Measurement Guidelines
- Reporting Requirements
- Prioritized Methods of Data Management, Approved Calculations/Conversions, Records & Tracking Preferences
- Financial Approval Process

3

Construct P2 Management Plan

P2 Program Development

Suggested Outline for the P2 Management Plan

- Evaluation Timelines, Performance Measures, and Continuous Improvement Mechanisms
- Employee Education and Involvement
- Employee Incentive Mechanisms
- P2 Promotions/Outreach

Each of the suggested outline components of the P2 management plan is described in detail within the *Pollution Prevention (P2) for Indiana Businesses* manual

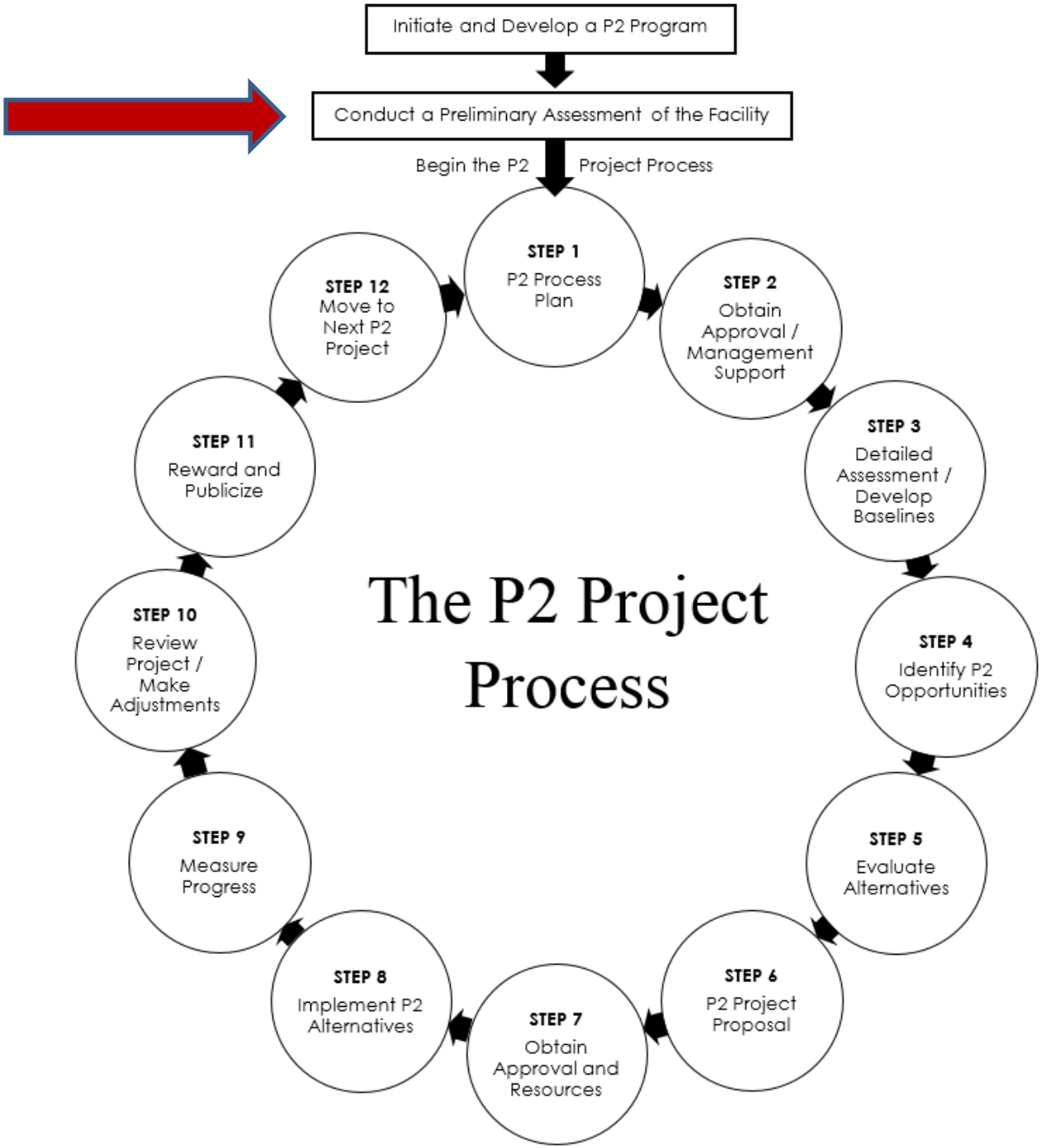
4

Obtain P2 Program Resources

P2 Program Development

Obtain P2 Program Resources

- Management must be willing to commit the resources necessary to support the P2 program
- Can be creation of permanent positions for the P2 program, allocation of staff hours, or procurement of consulting services
- Formal authority for the staff to conduct assessments and implement the P2 process must be provided (if no policy)


Initiate and Develop a P2 Program
Conduct a Preliminary Assessment of the Facility
Begin the P2 Project Process
The P2 Project Process
STEP 1
P2 Process Plan
STEP 2
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STEP 3
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Review Project / Make Adjustments
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Reward and Publicize
STEP 12
Move to Next P2 Project

Conduct a Preliminary Assessment of the Facility

Provides an overall evaluation of the facility's operations to understand the relationships between the operations

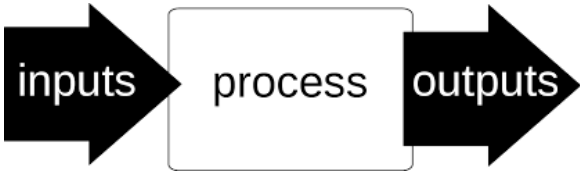
Assess materials used, wastes generated, and the management of waste streams

Employee involvement and cooperation is **crucial**:

- Notify facility staff about the assessment
- Explain why it is important
- Encourage staff to provide expertise when questions arise
- Assure staff that they will not be punished if poor operating practices are found in their departments

Preliminary Facility Assessment

The approach should consider both **inputs and outputs** so that the overall flow of materials or throughput can be evaluated



- Tour Facility
- Identify Data Sources for the Facility
- List Unit Processes, Create Facility Flow Diagram, Write Facility Description
- Create Unit Process Descriptions and Unit Process Maps
- Collect and Analyze Data on Unit Processes / Expand Unit Process Maps
- Establish Preliminary Measurements
- Rank Process Unit Areas for Further Evaluation
- Construct a Preliminary Assessment Report

Preliminary Facility Assessment

Tour Facility

- ☑ Tour Facility – P2 Teams acquaint themselves with the facility operations
- — Plant tour will help the P2 program team decide how to describe plant production in terms of unit processes
- — Schedule the initial walk-around when the majority of the production units are in operation
- — Determine where materials are used and waste is generated - don't forget to look in the dumpsters!
- — Ask questions and take notes

Note: Subsequent tours will be necessary to fully examine process activities

Preliminary Facility Assessment

Identify Data Sources for the Facility

- ☑ Identify data sources - there may be several existing sources of data that can be used in the P2 assessments

Determine what potential sources of data are available and how they can be accessed

Data Sources for the Facility

Plant Business Records and Accounting Information:

- Invoices / bills (utility fees - including surcharges, waste management fees, consulting or specialized services)
- Department cost accounting reports (include O & M)
- Internal tracking reports (handling, storage, and losses)
- Purchasing records (raw materials, products, equipment)
- Other inventory records

Raw Material/Production Information:

- Product composition and batch sheets
- Safety data sheets (SDS) / Environmental data sheets (EDS)
- Material application diagrams
- Product and raw material inventory records
- Operator data logs and production schedules
- Lab reports / characterization data

Data Sources for the Facility

Process Engineering and Operating Information:

- Plant design documents and process descriptions (architect's facility plans, piping and equipment layouts, organization charts, process / workflow diagrams)
- Equipment information (lists, operating manuals, manufacturer specifications)
- Plot and elevation plans
- Standard operating procedures (SOPs)

Regulatory Information:

- Permits and/or permit applications
- Waste shipment manifests
- Regulatory reports (Biennial hazardous waste reports, NPDES reports, EPCRA Form R, spill reports, etc.)
- Environmental audit reports / Emission inventories (waste, wastewater, and air emissions analyses - including intermediate streams)

Preliminary Facility Assessment

List Unit Processes, Create Facility Flow Diagram, Write Facility Description

- ☑ Identify and list all the unit processes within the facility

A *unit process* can be defined as an area of the facility, a specific process, or a piece of equipment

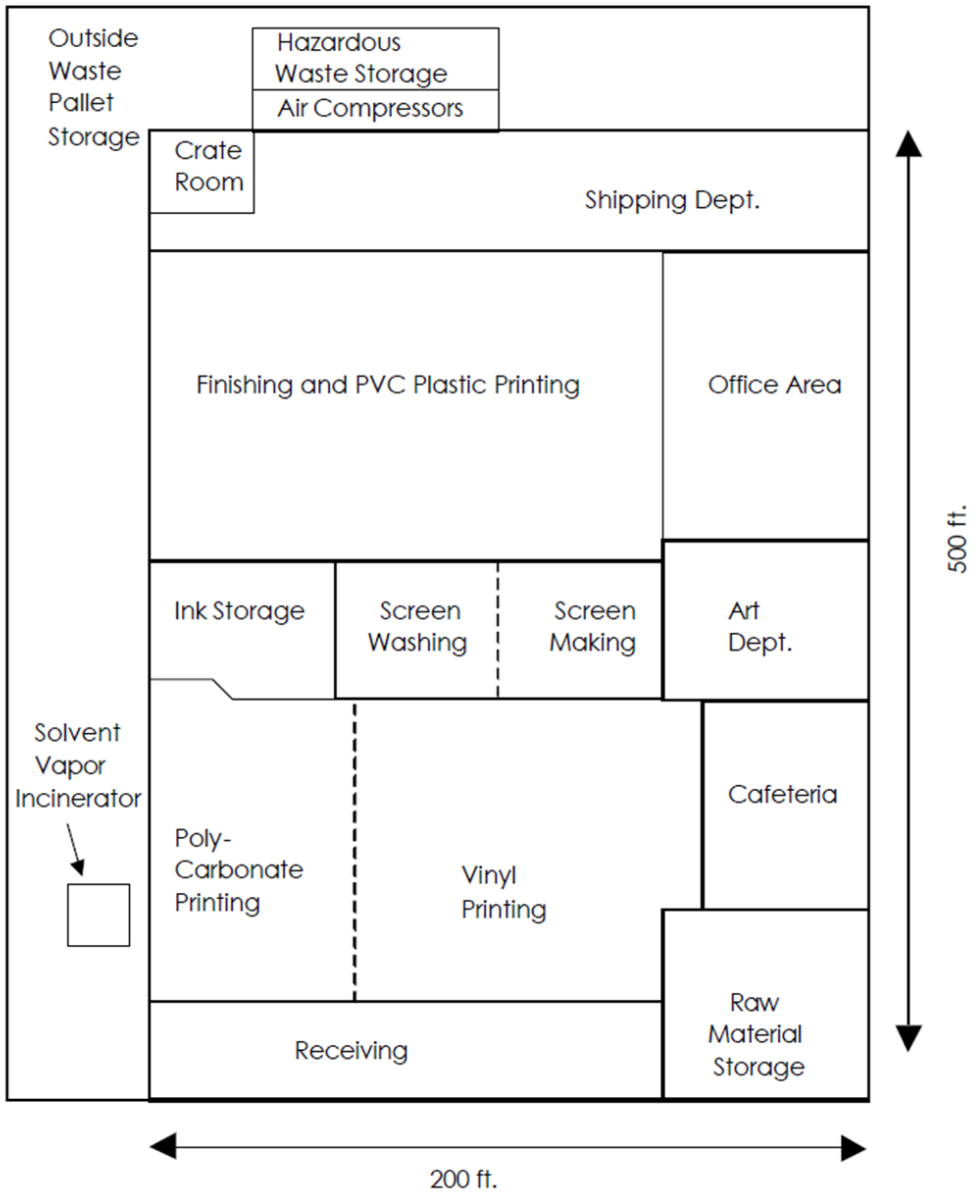
Abrasive Blasting
Two (2) glass bead cabinet blasting units
Five (5) aluminum oxide grit blasting units
Electrolytic Stripping
One (1) electrolytic stripping tank
One (1) nitric acid stripping tank
One (1) immersion tank
One (1) Kolene tank
Acid Stripping
One (1) 55-gallon nitric acid stripping tank
One (1) hydrochloric acid stripping tank
Machining
One (1) maintenance shop:
Four (4) lathes, two (2) mills, one (1) plasma cutter
Metal Surface Coating Operations
Two (2) High Velocity Oxy Fuel coating guns
Three (3) plasma surface coating stations
Eight (8) detonation surface coating stations
Plasma Coating Operations
Nine (9) surface coating stations
Cleaners / Degreasing operations
One (1) tank
One Laboratory

Preliminary Facility Assessment

List Unit Processes, **Create Facility Flow Diagram**, Write Facility Description

- A **facility flow diagram** outlines the flow of production activities for the entire facility
  - Includes all unit processes that were listed (don't forget materials storage and handling, equipment maintenance /repair, and waste management areas)
  - Serves as a visual representation of the sequence of operations and relationships between individual unit processes (not a floor plan)
  - Helps determine measurement points and the logistics of potential P2 opportunities

Example – Basic Facility Layout



Screen Printing Facility

A simplified layout of the facility provides orientation and scale of operations

This can be useful for creating a facility flow diagram and reviewing logistical aspects of potential P2 opportunities

Source - Guide to Industrial Assessments for Pollution Prevention and Energy Efficiency, U.S. EPA, EPA/625/R-99/003

Example – Facility Flow Diagram

Paints Manufacturing

Preliminary Facility Assessment

List Unit Processes, Create Facility Flow Diagram, **Write Facility Description**

- A **facility description** provides a scale of operation and comparison for material use, energy consumption, and waste generation versus production

Basic items to include:

- Number of employees
- Annual business sales
- Annual business volume
- Annual operating costs
- Operational schedules
- Previous energy conservation and P2 efforts
- General characteristics of the plant facilities

Example – Facility Description

Company Name: Mars Printing Facility Description Information	
Address: 1678 Mars St. Anywhere, US 45609	**Contact Person:** John Smith **Contact Phone:** 619-123-4567
Annual Business Volume: 20 Million feet of printed material Production is not seasonal.	**Annual Business Sales:** Approximately $10 Million
Number of Employees: 250 **Employees per shift:** 1st - 150 7am-3pm 2nd - 100 3pm-11pm	**Operational Schedule:** 5 days per week, 50 weeks per year Facility closed one week in December and one week in July for facility maintenance.
Energy Conservation Measures Implemented: Installed ceiling fans in offices and break areas Installed occupancy sensors for lighting	**Pollution Prevention Measures Implemented:** None
General Facility Information:	
Age of Facility: 15 yr. Basic Construction: Concrete Block	No. of Buildings: 1 Plant Size (ft^2 per building): 100,000 ft^2

Source - Guide to Industrial Assessments for Pollution Prevention and Energy Efficiency, U.S. EPA, EPA/625/R-99/003

Preliminary Facility Assessment

Create Unit Process Descriptions and Process Maps

- ☑ Develop **unit process descriptions** and **process maps** - use the unit process list and the facility flow diagram as guides

A **unit process description** should include:

- The main products produced
- A list of raw materials
- A step-by-step description of unit operations (beginning of the product manufacture to the finished product)

A **process map** outlines all steps in each process, including:

- Intermittent operations (i.e., tank cleaning, make-up)
- Any known direct releases (i.e., fugitives, spills, leaks)

Example – Unit Process Description

Mars Screen Printing Process Description

This plant uses screen printing to produce, in several varieties and color schemes, fleet (transportation truck) decals, beverage dispensing machine colored panels and tooth brush backings. Raw materials include plastic sheets, rolls and spools of plastic stock, inks, adhesives, urethane and various other chemicals and solvents related to image production and printing operations.

The printing process begins with the plant receiving a mylar sheet with a positive image, paper copy or computer file from clients. Some artwork is done in-house. Images received on a computer disk, and other images developed on-site, are processed in a computerized system to yield a mylar positive. The image sheets are then transported to the screen-making department.

Screen images are produced in several steps. First, large screens are coated with a photo sensitive emulsion in an automated system. Emulsion is applied to smaller screens manually. Coated screens are then covered with mylar sheets containing positive images and are placed on a "burn table" which exposes the screen to ultraviolet light for a specified period of time which hardens the emulsion through transparent areas exposed to light. After exposure, screens are removed from the "burn table" and the uncured emulsion is washed away with a warm water high-pressure spray.

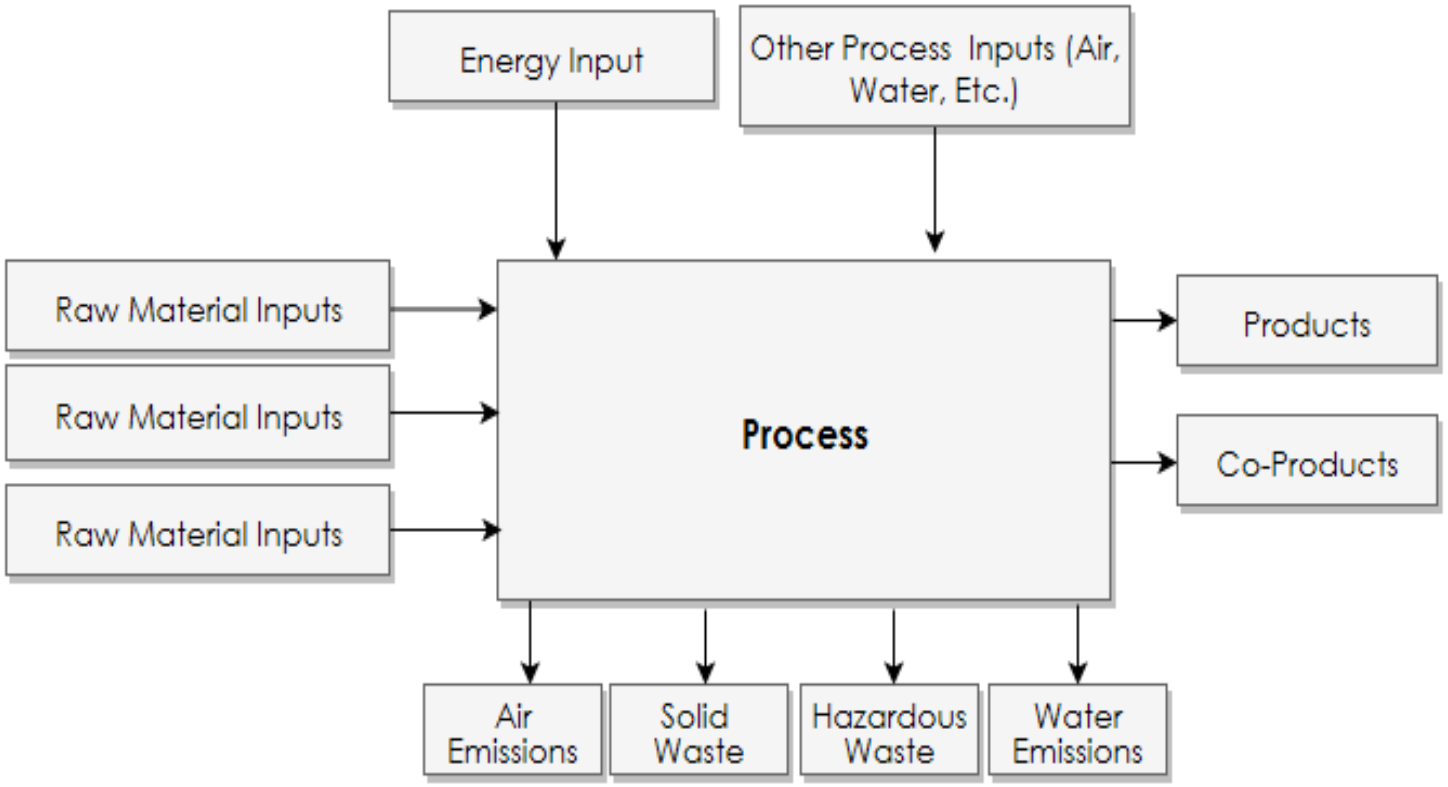
A prepared screen is mounted horizontally on a press, and ink is troweled into an above-screen reservoir. Ink is received in 3 to 5 gallon containers from which it is used directly or blended to customer specified colors in an ink-mixing area. During printing, a mechanical "wipe" moves across the screen and forces ink through porous areas onto the substrate sheets. Subsequent use of other screen images in a set produces a multi-colored image on the sheets. After printing, the substrate is placed on a conveyor for transport through an ink-curing oven. After curing, some of the printed substrates are coated with an adhesive or a thin urethane film-followed by heat curing. Finished materials are inspected, packaged and shipped to customers.

At the end of a printing run, screens are cleaned for reuse. Initially, excess ink is removed from screens with a putty knife. Next, they are hand-wiped with solvent-wetted paper towels while still positioned on the press. Then the screens are removed from the presses and are transported to a screen washing room. In this room, screens are positioned upright over a trough and dipped in ink-remover, and occasionally a "ghost" image remover is brushed into screen material, followed by a high pressure heated water rinse. In cases where it is not required to save a screen image, an emulsion remover is used to remove hardened emulsion. Clean screens are allowed to air dry and are returned to storage for future use.

Source - Guide to Industrial Assessments for Pollution Prevention and Energy Efficiency, U.S. EPA, EPA/625/R-99/003

Example – Unit Process Map (Block)

Shows the system boundaries, all streams entering and leaving the process, points at which products or wastes are generated, and where losses occur



Source - Guide to Industrial Assessments for Pollution Prevention and Energy Efficiency, U.S. EPA, EPA/625/R-99/003

Preliminary Facility Assessment

Collect and Analyze Data on Unit Processes / Expand Unit Process Maps

- **Collect and Analyze Data on Unit Processes** - assemble as much readily available information about each unit process operation as possible

  - Use the data sources identified for the facility to gather specific unit process information
  - Record information in quantifiable terms, including: weights, volumes, costs, labor or time allocated, amounts of products created, services rendered, etc.
  - All data should be based on the same time unit (e.g., annual, quarterly, or monthly)

Preliminary Facility Assessment

Collect and Analyze Data on Unit Processes / **Expand Unit Process Maps**

- ☑ **Expand unit process maps** with collected data

Products and Services

- Products and services quantities, associated profits
- Byproduct(s) amounts (note if any are recycled back into the process)

Equipment and Operations

- Equipment list, all units
- Equipment specifics (including pollution control devices) such as equipment ratings, average loads, energy/fuel source, hours of operation, temperature, pressure, etc.
- Equipment maintenance and operating costs (e.g., emergency generators)

Preliminary Facility Assessment

Collect and Analyze Data on Unit Processes / **Expand Unit Process Maps**

Raw Materials

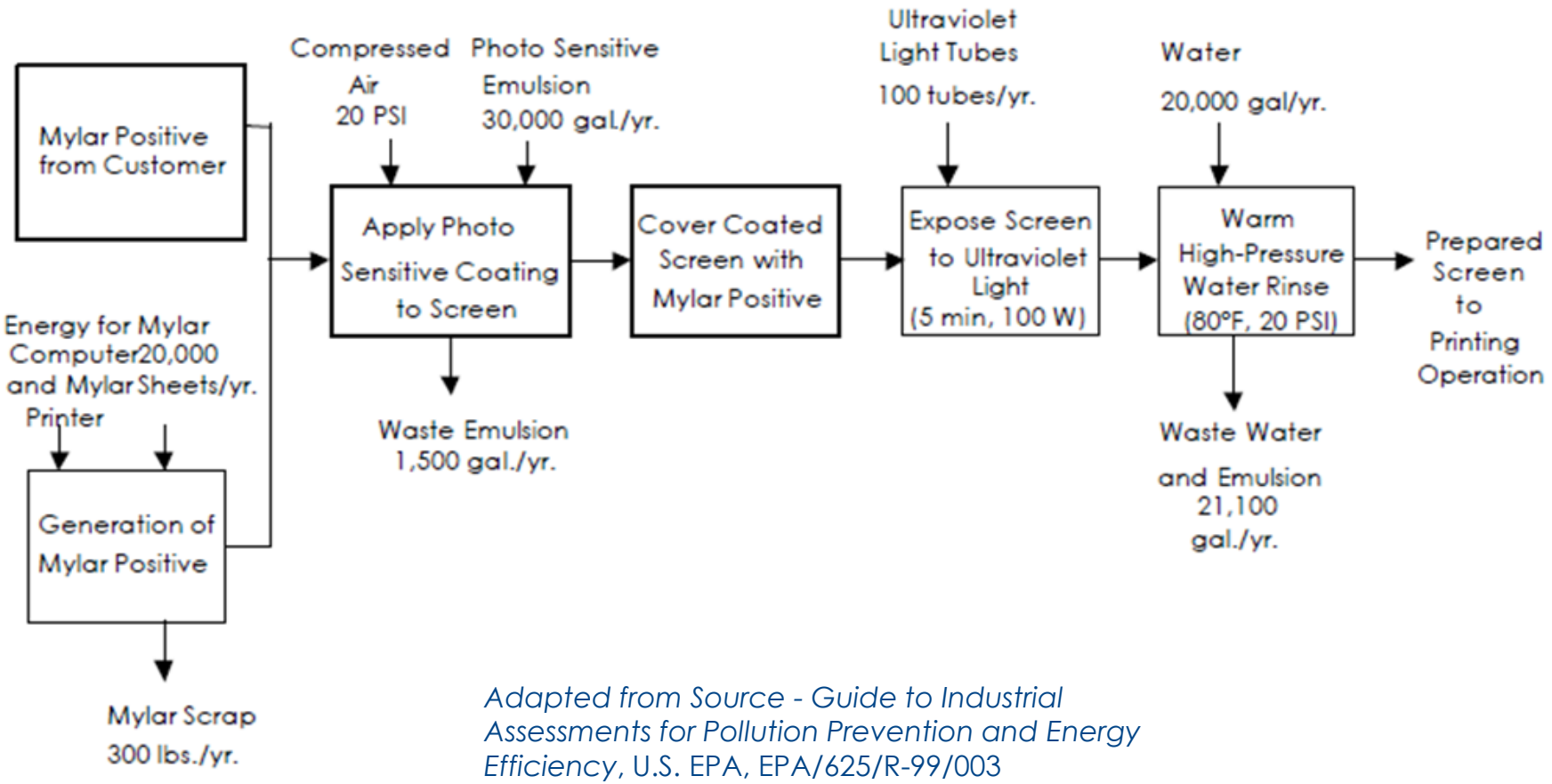
- Weight and/or volume of procured raw materials (routine and non-routine) along with purchase costs and inventory practices
- Utility (water and energy) consumption and costs

Waste Streams (routine & non-routine) and Environmental Releases

- Volume and characteristics of hazardous wastes generated
- Volume and characteristics of air emissions
- Volume and characteristics of wastewater discharges
- Other releases and environmental impacts
- Waste management costs for each of the above waste streams

Example – Process Flow Map

Screen Making Operation



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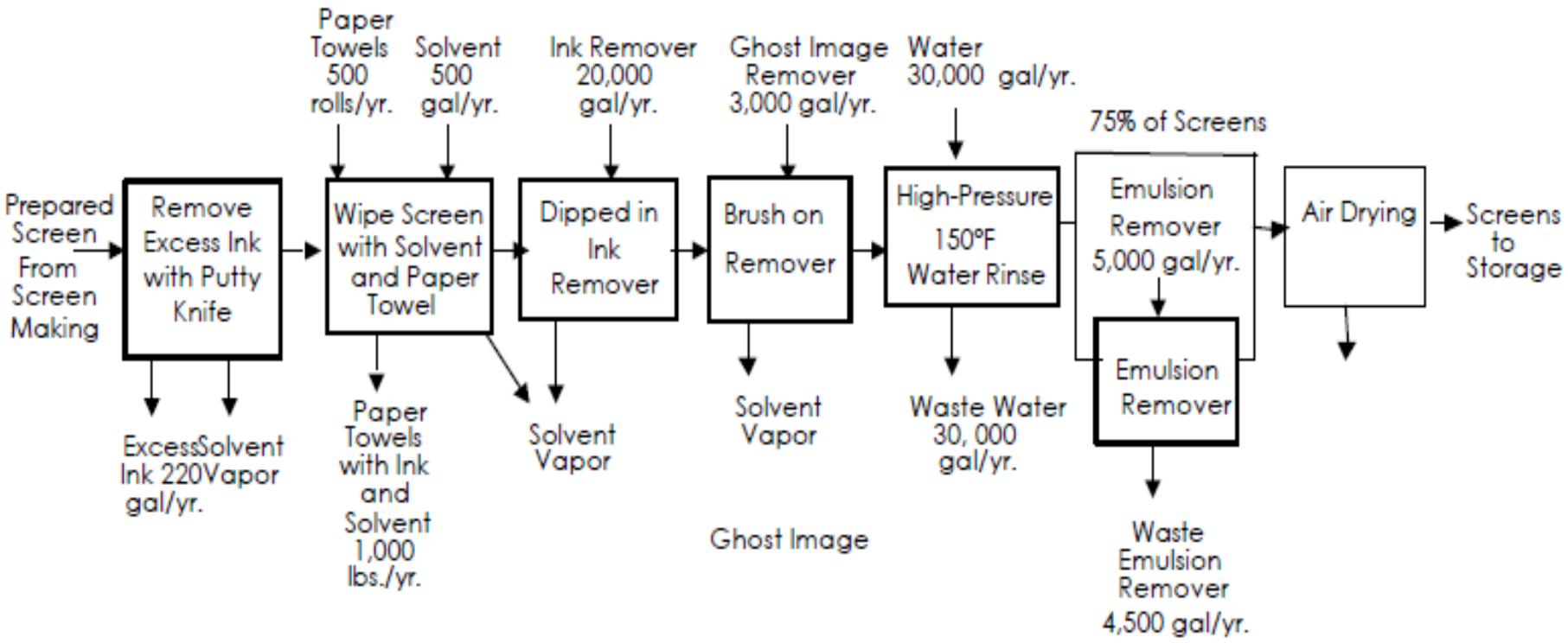
Example – Process Flow Map

Cleaning Operations



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Preliminary Facility Assessment

Establish Preliminary Measurements

- **Prepare preliminary measurements** to be used for ranking unit processes for further evaluation, identifying data gaps, and determining sampling requirements that may be needed during detailed assessments

Use simple methods of measurement:

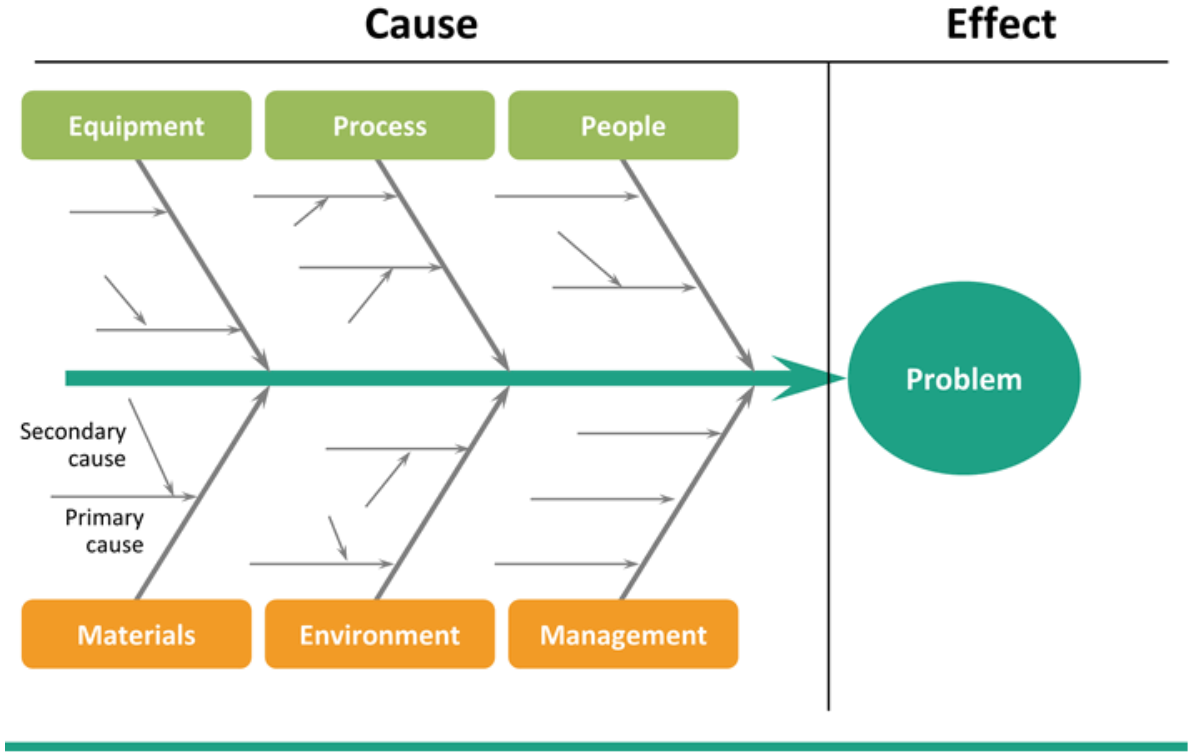
- Cause and effect (fishbone) diagrams
- Material balance accounting
- Basic cost analysis

Evaluation techniques will depend on the nature of the processes being assessed and the company P2 goals

Preliminary Facility Assessment

Establish Preliminary Measurements

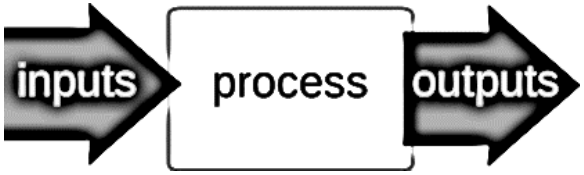
Fishbone diagrams can be useful to identify causes for problems identified and for sorting information or ideas into useful categories.



Preliminary Facility Assessment

Establish Preliminary Measurements

A **material balance** is an organized system of accounting for the flow, generation, consumption, and accumulation of resources in a process (all materials that enter and leave a process)



Mass in = (Mass out – Generation + Consumption + Accumulation)

If no chemical reactions occur and the process progresses in a steady state, the material balance for any specific compound or constituent is:

Mass in = Mass out

Preliminary Facility Assessment

Establish Preliminary Measurements

A **Basic Cost Analysis** is an estimation of the costs associated with a process

- Basic material costs can be gathered from purchase and utility records
- Basic waste management costs can be estimated by identifying treatment expenses (including operating costs for control devices), disposal fees, and waste transportation fees

High costs can indicate a need to further evaluate the process on the basis that potential financial savings opportunities exist

Preliminary Facility Assessment

Rank Process Unit Areas for Further Evaluation

- **Rank process unit areas for further evaluation** and select those that should be prioritized for detailed assessments to identify P2 opportunities
  - Follow the P2 Management Plan guidelines for priority ranking methods and criteria (if established)
  - Consider using a decision matrix such as the *Option Rating Weighted Sum Method* which quantifies important criteria by assigning values (set using professional judgement or team consensus) for screening and ranking purposes

Preliminary Facility Assessment

Rank Process Unit Areas for Further Evaluation

Example Option Rating Weighted Sum Method

	Ratings for each option (R)			
Rating Criteria	Weight (W)	X	Y	Z
Reduce treatment costs	10	8	6	3
Reduce safety hazards	8	6	3	8
Reduce liability	7	4	4	5
Ease of implementation	5	2	2	8
Sum of weight times ratings ∑ (W x R)		166	122	169

Preliminary Facility Assessment

Rank Process Unit Areas for Further Evaluation

Typical considerations for prioritizing processes for further study

- Potential to meet company goals
- Compliance with current and anticipated environmental regulations
- Occupational safety and health considerations (regulation compliance, employee hazards, liability concerns)
- The type, quantity or volume of wastes produced (i.e., hazardous, difficult to manage, etc.)
- Specific hazardous properties of materials used or wastes produced (toxicity, flammability, corrosivity, and reactivity)

Preliminary Facility Assessment

Rank Process Unit Areas for Further Evaluation

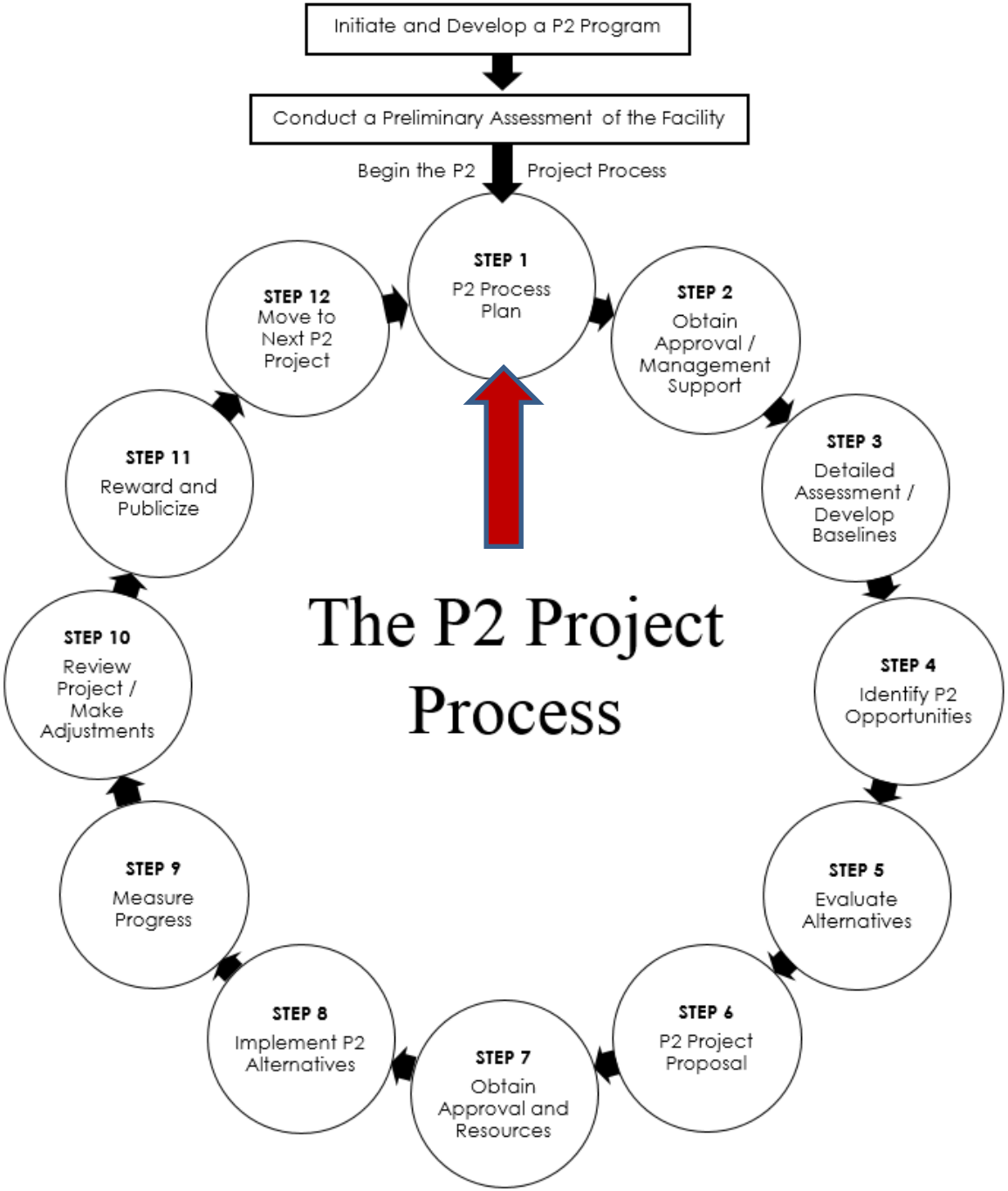
Typical considerations for prioritizing processes for further study

- Estimated costs of materials and resources and/or waste management
- Potential for P2 options (i.e., ease of implementation, payback time)
- Available budget for the P2 assessments and/or P2 project implementation
- Opportunity to perform process improvement/optimization
- Opportunity for product or service quality improvements
- Potential recovery of valuable byproducts
- Obvious opportunities for economic savings

Preliminary Facility Assessment

Construct a Preliminary Assessment Report

- **Construct a Preliminary Assessment Report** to summarize the assessment results
  - All process units should be listed in the order of priority ranking accompanied by the input/output analysis
  - Identify the top 3 to 5 unit processes to be considered for further evaluation / P2 projects
  - Include detailed justifications for selections – attach supporting information (i.e., data sources, flow diagrams / maps)
  - Obtain approval to begin the P2 process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The P2 Project Process

12 Steps to P2 Success – The P2 Project Process

It is time to begin the P2 Project Process for one or more areas being recommended for further evaluation

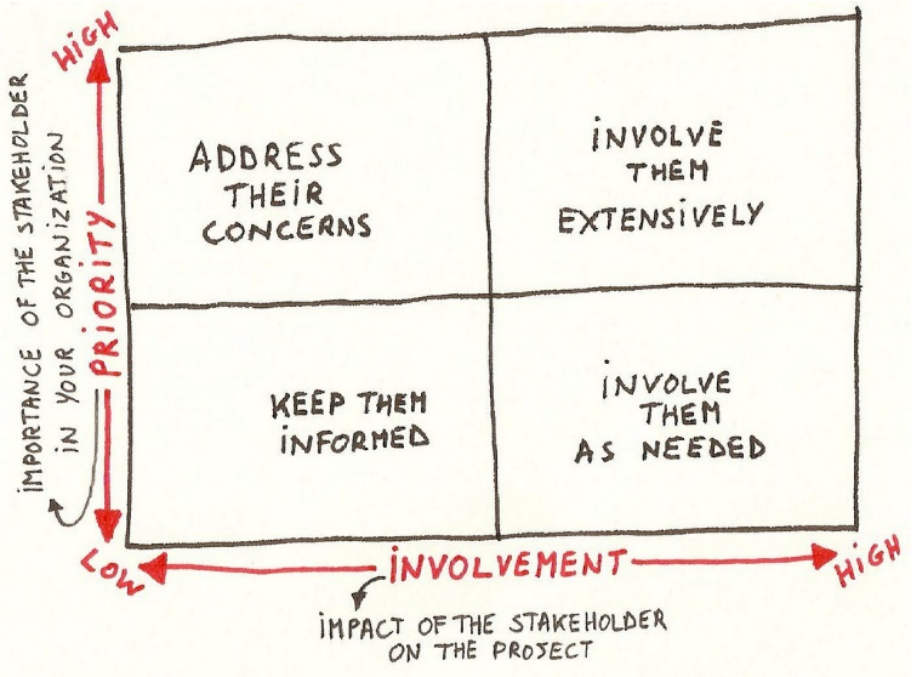
Each step of the P2 Project Process expands upon the framework established by the company's mission statement(s), P2 policy, the P2 program management plan, and facility assessment results

The P2 Project Process outline serves as a guide for P2 project implementation and can be adjusted according to specific company and project needs

Stakeholder Involvement

Before creating the P2 Process Plan (Step 1), determine if external stakeholder involvement is recommended

If considering the full life cycle of a process or product, potential stakeholders are drawn from the entire supply chain

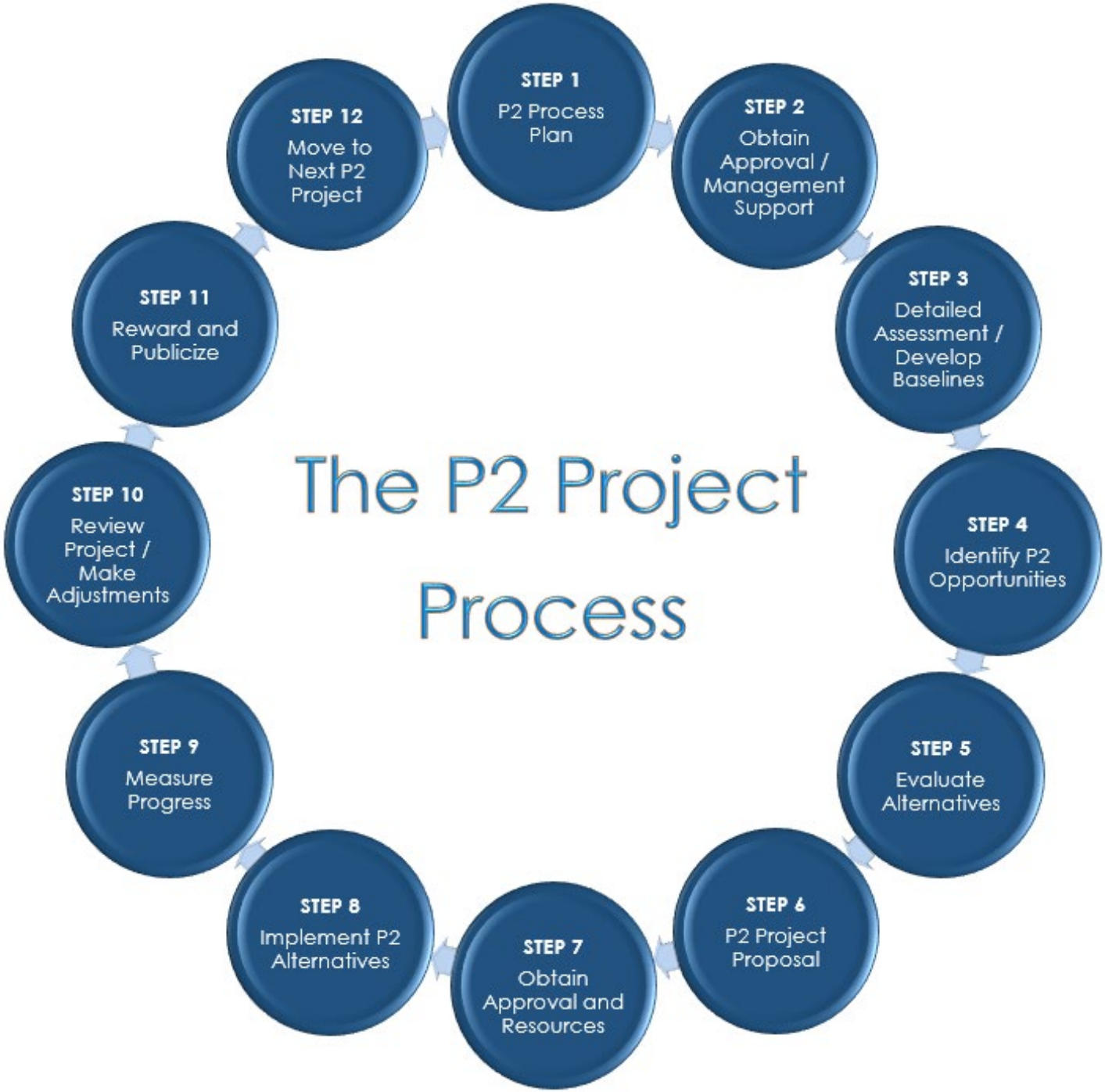


Involvement throughout the project helps to ensure that stakeholders understand and support the outcomes, and promote adoption of the P2 projects

Stakeholder Involvement

Typical stakeholders include:

- Chemical manufacturers / suppliers
- Product manufacturers / suppliers
- Nonprofit organizations
- Neighborhood and community leaders
- Waste and recycling companies
- Material and waste transporters
- Government agencies
- Retailers
- Consumers
- Innovators
- Academics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Move to Next P2 Project

The P2 Project Process

Step 1- Prepare the P2 Process Plan

The P2 process plan outlines the following for each process that has been selected for further evaluation:

- The **scope and assessment objectives** – describe each stage of the P2 Project Process that is required for each process being evaluated – state quantitative and qualitative objectives – includes stakeholder input (if applicable)
- **Schedules** - list milestones within each stage - from detailed assessment through implementation – set realistic target dates

The P2 Project Process

- **Data collection needs and format** for the assessment(s) - worksheets, questionnaires, or checklists
- **Potential obstacles and solutions** - a number of factors will complicate the process - recognize them and propose mechanisms to address - less likely to impede progress later
  - **Potential obstacles and solutions**
    - *Limited financial resources* for capital and other improvements may become a problem even for P2 options that will be profitable - investigate the availability for funding assistance or low-interest loans

The P2 Project Process

- **Potential obstacles and solutions**
  - *Regulatory obstacles* may be a barrier to some P2 options that require material substitutions, significant process changes, or new equipment - even when the changes result in decreased emissions. Recognizing and researching these possibilities in advance can allow the company to work with the appropriate regulatory entities early in the planning process to avoid delays, noncompliance, or negative regulatory surprises.

  - *Limited flexibility* in the manufacturing process may pose technical barriers (new P2 operation does not work as expected, creates bottleneck, facility lacks space for new equipment) – have appropriate design and production personnel in the planning process, use tested technology, pilot operations in advance

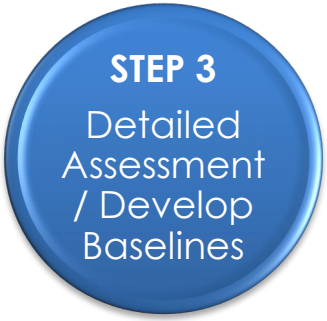
The P2 Project Process

- **Potential obstacles and solutions**
  - *Product quality or customer acceptance concerns* might cause resistance to change, reduced sales, or loss of customer support. Plan to avoid potential product quality degradation by verifying customer needs, preliminarily testing the new process or product, and increasing quality control during manufacture.
  - *Technical obstacles* may arise related to the possible disruption of production, product quality changes, and availability of quality information - identify potential side effects, measures to avoid them, and ways for adaption.

The P2 Project Process

Step 2 - P2 Process Plan Approval / Obtain Management Support

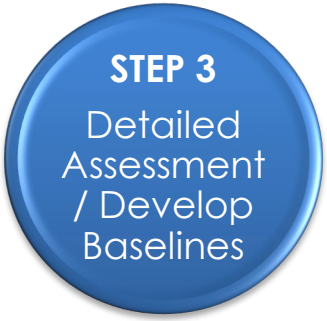
- Receive formal P2 process plan review, approval, and support - guidelines outlined in the P2 management plan
- Approval process may include revisions to the plan
- Resources get allocated for implementation
- Management / supervisors at process location must understand and support the P2 Process Plan - will increase the probability of success, staff cooperation, and efficiency of evaluations and project implementations
- Forward finalized plan and attachments to the appropriate personnel



The P2 Project Process

Step 3 - Detailed Assessment Phase - Analyze Process / Develop Baselines

- **Establish P2 Assessment Teams**
- **Review Data and Process Operations (Sites)**
- **Organize, Document, and Analyze Process Information**
- **Describe the Current Practices**
- **Consider Current Process Life Cycle and Total Costs**
- **Record Baseline Values**



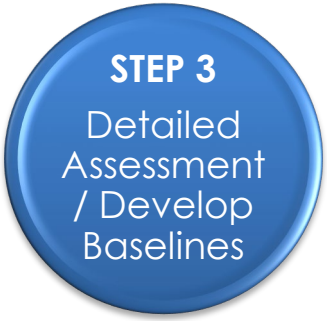
The P2 Project Process

Establish P2 Assessment Teams

- A cross-functional, multidisciplinary team - composed of individuals with a variety of skill sets - likely to achieve a comprehensive assessment and provide better input

- Will examine each production process in greater detail - gather additional data, interview workers

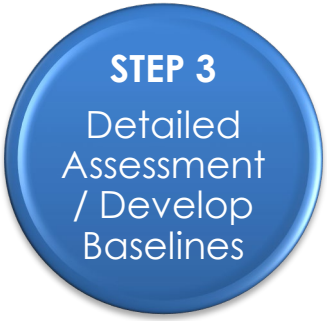
- Core team members will include P2 program staff, line workers and supervisors with day-to-day operational responsibility and experience, waste management and environmental staff



The P2 Project Process

Review Data and Process Operations (Site Review)

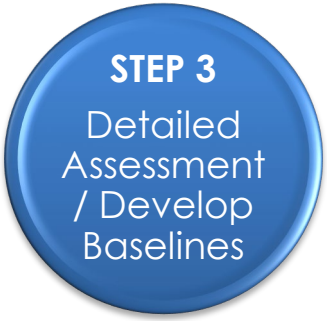
- Use existing data sources and search for additional sources of useful data - limit information collection to information necessary for assessment
- Teams perform thorough site review(s), worker interviews, review /update process flow map(s)
- Site reviews should be well planned and efficiently executed - multiple visits to check or supplement data usually required - good planning can minimize repetitions



The P2 Project Process

Review Data and Process Operations (Site Review)

- Preparation and execution of site reviews
  - **Prepare an agenda** in advance
  - **Schedule** to coincide with operation of interest
  - **Follow the process from beginning to end** - point where input materials enter to point where products and wastes exit
  - **Monitor the operation at different times** during all shifts - different days of the week or month
  - **Interview** the operators, shift supervisors, and work leaders in the assessed area



The P2 Project Process

Review Data and Process Operations (Site Review)

- Preparation and execution of site reviews
  - **Photograph or digitally record** the area of interest - excellent methods of capturing details quickly and accurately
  - **Observe the "housekeeping"** of the operation - cleanliness, signs of spills or leaks, or maintenance problems
  - **Assess administrative controls** such as cost accounting procedures, material purchasing procedures, and waste collection procedures
  - **Verify / update the accuracy of the process flow map** - check against actual layout and functioning of equipment
  - **Take notes** of employee suggestions or ideas that arise

STEP 3
Detailed Assessment / Develop Baselines

The P2 Project Process

Employee Interviews

Sample Questionnaire

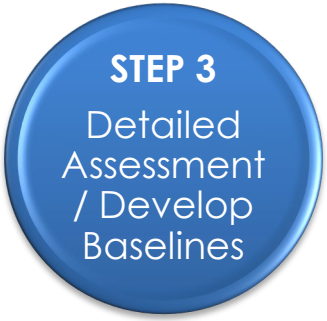
- What are specific wastes that are generated by this department?
- What comments do employees in the department have about their waste (i.e., quantity, toxicity, or necessity)?
- Is the area free of easily avoidable waste such as spills, drips, or inefficient use of materials?
- Are there strong odors, perhaps indicating leaks, overuse, or spills?
- What are the waste materials found in the department's trash cans / dumpsters?

STEP 3
Detailed Assessment / Develop Baselines

The P2 Project Process

Review Data and Process Operations (Site Review)

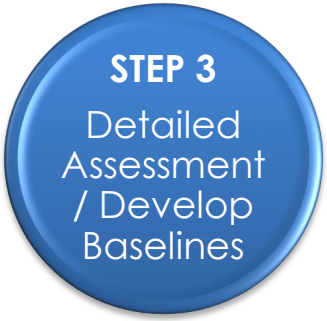
- Preparation and execution of site reviews - Tips
  - Solicit assistance and input from staff who operate the processes - they are the "experts"
  - Explain what you are doing - the staff will have to implement the opportunities identified
  - Explain why the assessment is important to all staff involved
  - Share results of the audits with staff once completed



The P2 Project Process

Organize, Document, and Analyze Process Information

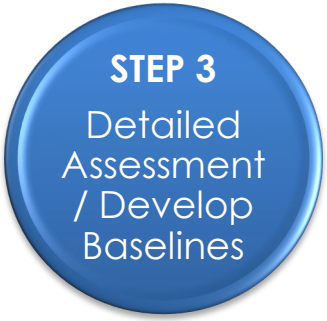
- **Work Practices** - moment-by-moment actions, routes, interrelated activities, dependencies between applications
- **Materials and resource inputs** - raw materials used (natural and process), source(s) and procurement practices
- **Process outputs** - products/services; coproducts; all waste streams; spills and releases; output material characteristics; and output handling, storage, and transport practices
- **Waste Management** - mixing, handling, storage, transport, treatment, recycling, final disposal methods, and waste reuse



The P2 Project Process

Organize, Document, and Analyze Process Information

- **Quantify** all available input and output data for the unit process
- **New material balance** should be calculated for each component entering and leaving the process
- **Use material balance results** to determine if there is a need to investigate raw material storage and handling losses, perform sampling or testing, or conduct a waste composition audit
- **Plan / perform needed analyses** if possible to acquire accurate and detailed information



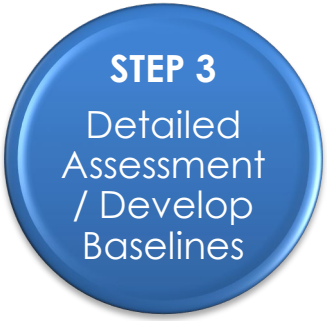
The P2 Project Process

Describe the Current Practices

- Assemble all current information - material balance results for total amount of raw material inputs and waste outputs for each unit process

- If necessary, repeat the material balance evaluation for individual contaminants - those that pose a specific problem (high costs, environmental impact, or health and safety issues) - resulting values can be used as baselines for that process

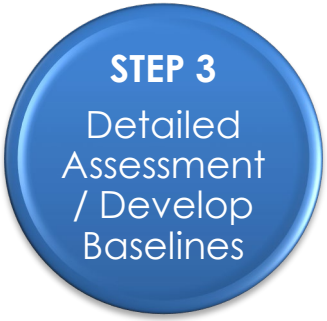
- Update process unit descriptions, process maps, process plan (stages, timelines, etc.)



The P2 Project Process

Consider Current Process Life Cycle and Total Costs

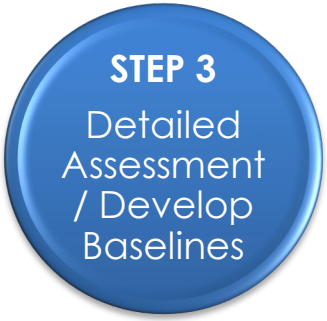
- **Life cycle assessment (LCA)** is a snapshot of inputs and outputs - used to identify and evaluate opportunities to reduce the full range of environmental impacts assignable to a product, process, or activity
- **Total cost accounting (TCA)** employs both economic and environmental criteria as factors affecting the bottom-line costs for a particular process
- Consider conducting for the current operations - these analyses can be utilized again and expanded to their full potential during the P2 opportunity assessment phase



The P2 Project Process

Current Process Life Cycle

- The term "*life cycle*" refers to the notion that a fair, ***holistic assessment*** requires the consideration of a process or product's:
  - Raw material extraction and production
  - Manufacture
  - Distribution
  - Use
  - Disposal
  - Intervening transportation steps necessary or caused by its existence



The P2 Project Process

Current Process Life Cycle

Three Phases of a Life Cycle Assessment

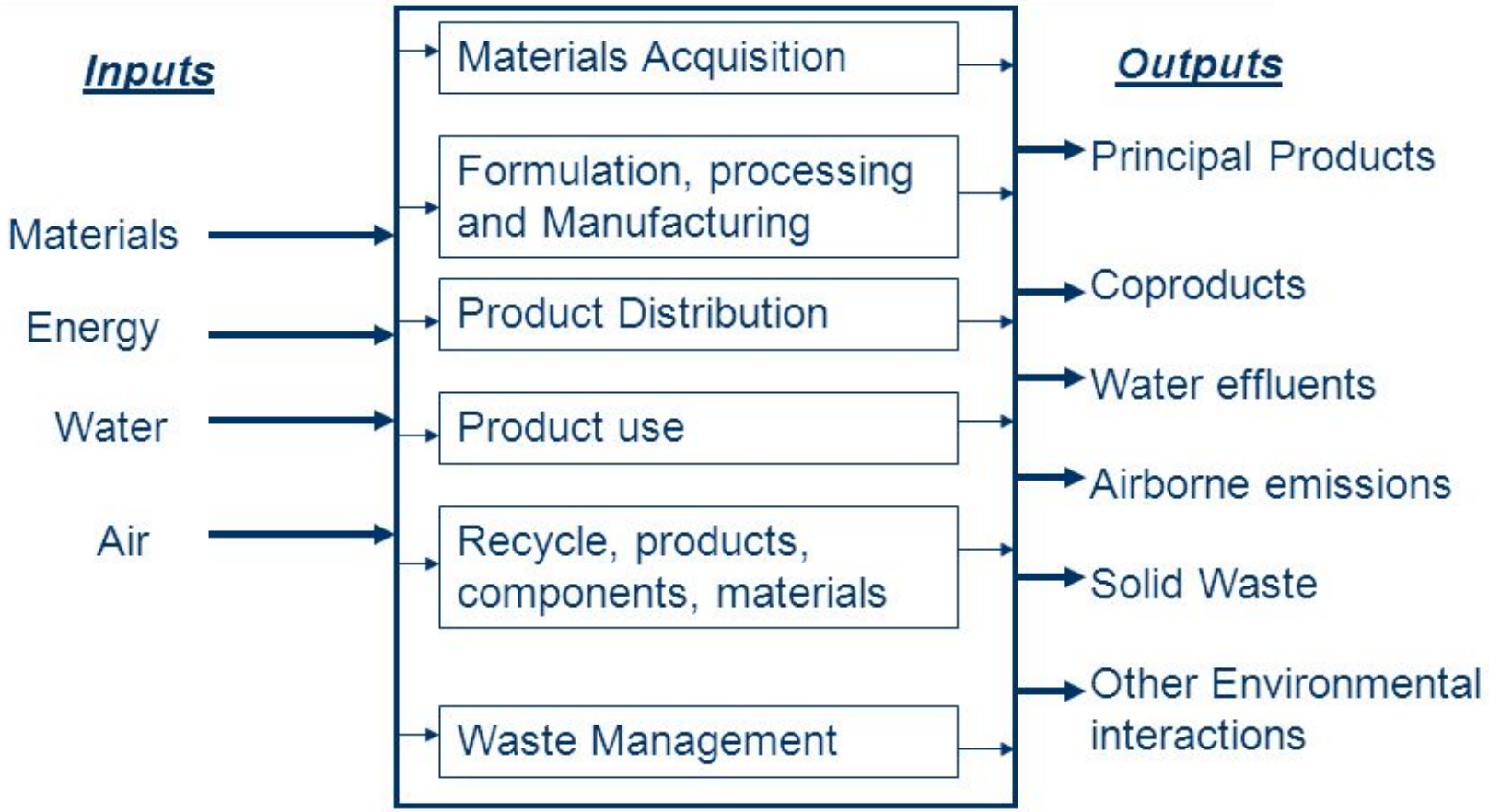
Inventory Analysis
Impact Analysis
Improvement Analysis

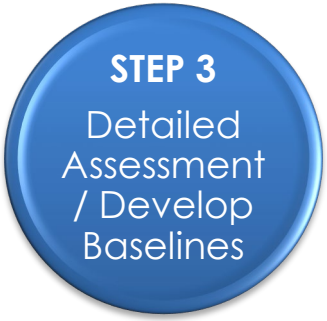
- **Inventory analysis** - the identification and quantification of energy and resource use and waste emissions
- **Impact analysis** - the assessment of the consequences those wastes have on the environment
- **Improvement analysis** - the evaluation and implementation of opportunities to effect environmental improvements

STEP 3
Detailed Assessment / Develop Baselines

The P2 Project Process

Life Cycle Inventory Analysis

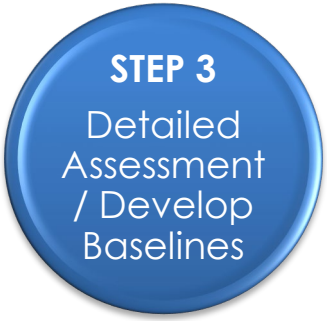




The P2 Project Process

Current Process Life Cycle

- Conducting the **life cycle inventory** and **impact analyses** of the current process can help establish better baseline values and evaluate the impacts and costs of additional criteria
  - Use the quantifications established for all inputs and outputs of material flows for the process or product
  - Account for the environmental loads during the product's life cycle - intended to be a "cradle-to-grave" approach (material flows from raw material extraction through final disposal)
  - Associate a "full or total cost accounting" from the product manufacturing



The P2 Project Process

Consider Total Costs

- Current cost estimations of a process (determined earlier) can be expanded to associate the "true" **costs of materials** (including cleanup, ancillary operations, and labor for material management) **and wastes** (including labor, equipment expenditures, permitting fees, etc.)
- Total cost accounting (TCA) tracks direct costs, indirect costs, and less tangible costs and benefits
- By factoring in these indirect environmental costs and benefits, TCA helps to assess the economics associated with environmental impacts

STEP 3
Detailed Assessment / Develop Baselines

The P2 Project Process

Consider Total Costs

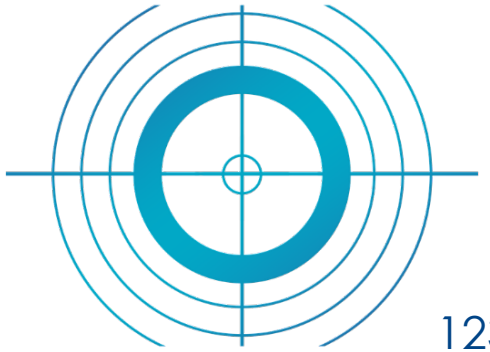
Total Cost Accounting – Cost Categories for Current Operations		
Direct Costs	**Indirect or Hidden Costs**	**Liability Costs**
Capital Expenditures · *Buildings* · *Equipment* · *Utility connections* · *Equipment installation* · *Engineering* Operations and Maintenance Expenses/Revenues · *Raw materials* · *Labor* · *Waste disposal* · *Utilities* · *Value of recovered materials*	Administrative Costs Compliance Costs · *Permitting* · *Recordkeeping and Reporting* · *Monitoring* · *Manifesting* Insurance Workers' Compensation On-Site Waste Management On-Site Pollution Control Equipment Operations	Penalties and Fines Personal Injury Property Damage Natural Resources Damage / Cleanup Costs (Corrective Action)

STEP 3
Detailed Assessment / Develop Baselines

The P2 Project Process

Record Baseline Values

- **A baseline value (or measurement)** is needed to determine the exact starting point for each project - "before" value
  - Document all baseline values for the unit process (or areas of concern) - values are directly linked to project design and measuring project impacts
  - Baseline data is prerequisite for setting P2 project targets
  - Establishing baseline and target values are an integral part of project design



STEP 3
Detailed Assessment / Develop Baselines

The P2 Project Process

Record Baseline Values

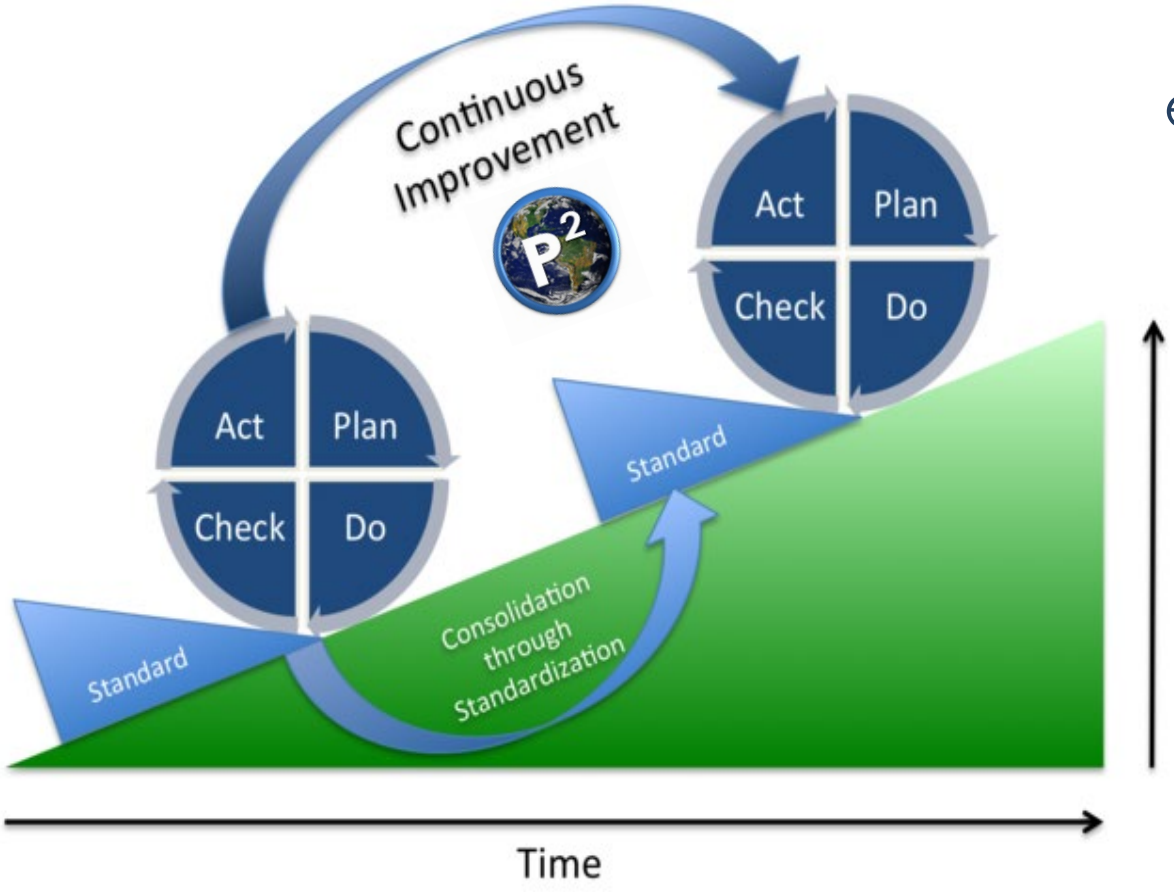
Baseline Value + Desired Level of Improvement = Target Performance

Use this information to help select a focus for first P2 project

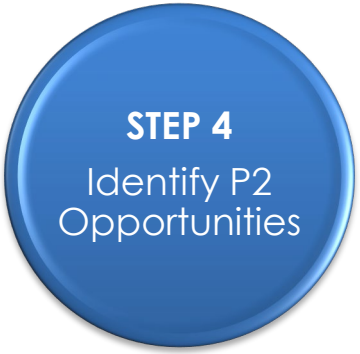
STEP 3
Detailed Assessment / Develop Baselines

The P2 Project Process

Record Baseline Values - Step 3 Repeats



The baselines established now will be the foundations for continuous improvement

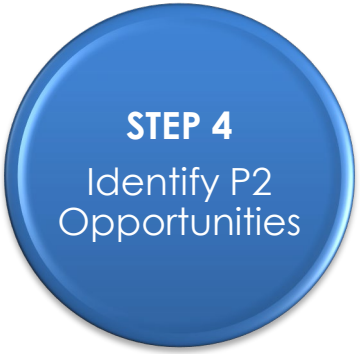


The P2 Project Process

Step 4 - Identify P2 Opportunities

- Objective is to generate a comprehensive set of P2 options through:
  - Brainstorming
  - Other Employees' Suggestions
  - Research and Technical Resources

- Each process should be considered separately
- Develop a list of options for the most problematic areas of the process first - then look for holistic opportunities for the entire process



The P2 Project Process

Potential problematic areas of the process (identified in site review / assessments):

- Leaks or losses
- Resource inefficiencies (materials, energy, water)
- Large volumes of waste
- Highly toxic waste streams
- Operational inconsistencies
- Straying from best management practices or other written procedures
- Poor housekeeping efforts
- Lack of environmental ethics within the process

STEP 4
Identify P2 Opportunities

The P2 Project Process

Hold Brainstorming Sessions

Include representation from all levels of the organization

Effective Brainstorming

- Consider all ideas
- Address problematic areas of the process
- Identify obvious and easy-to-implement opportunities – "low hanging fruit"
- Follow the P2 hierarchy when drafting ideas for process improvements
- Develop long-term waste reduction alternatives
- Use established information sources to generate ideas

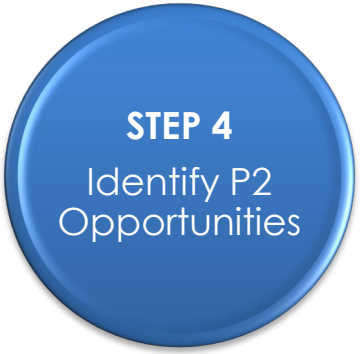
STEP 4
Identify P2 Opportunities

The P2 Project Process

Other Employees' Suggestions

- Employees' ideas for P2 projects should be actively sought
- Encourage employee participation
- Forums such as breakfasts or informal P2 review meetings promote the exchange of information that will help generate new ideas

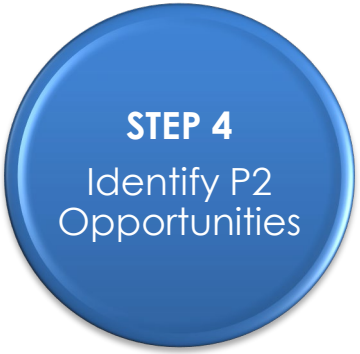
- Suggestion boxes, surveys, contests, rewards, and recognition mechanisms are all ways to gather employee input



The P2 Project Process

Research and Technical Resources

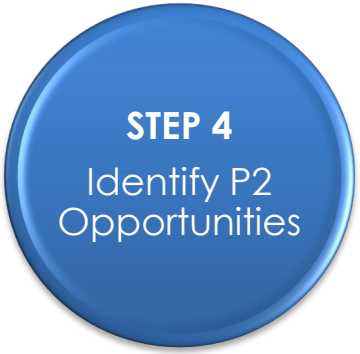
- Contact and research other information sources
  - **Trade associations** - information tailored to the specific industry
  - **Published literature** - articles in technical journals, trade magazines, government reports, and research briefs
  - **Case studies and success stories** - found through P2 clearinghouses, the TRI database, internet resources, and technical support groups
  - **Federal (U.S. EPA), state, and local environmental agencies** - provide P2 publications and technical assistance programs



The P2 Project Process

Research and Technical Resources

- Contact and research other information sources
  - **University engineering departments** - often provide free waste and energy assessments, workshops, on-site training, and consulting services
  - **Equipment vendors and suppliers** - helpful in identifying and analyzing potential equipment-oriented options
  - **Consultants** with experience in P2
  - **Other Companies -** can be a source of information on technical issues and suppliers
  - **P2 Resources** from *Chapter 8* of the manual



The P2 Project Process

At a minimum, consider the following P2 opportunities for each targeted area:

- Input changes or material substitutions
- Operational improvements or improved housekeeping
- Production process changes / process optimization
- Product redesign or reformulation
- Waste stream segregation
- Inventory control
- Closed-loop recycling, direct reuse, or reclamation systems
- Best management practices and training

More P2 Strategies in Chapter 7 of P2 for Businesses Manual

The P2 Project Process

Step 5 - Evaluate Alternatives

Proposed P2 opportunities have been identified - now the range of alternatives must be narrowed for comprehensive evaluation

- **Screen and Prioritize Identified P2 Opportunities**
- **Conduct Feasibility Analysis**
- **Prioritize Options**
- **Generate an Assessment Report**

The P2 Project Process

Screen and Prioritize Identified P2 Opportunities

Option screening should consider these questions:

- Which options will best achieve the goal of waste reduction?
- What are the main benefits to be gained by implementing this option (e.g., financial, compliance, liability, workplace safety, etc.)?
- Does the necessary technology exist to develop the option?
- How much does it cost? Does it appear to be cost-effective, meriting in-depth economic feasibility assessment?
- Can the option be implemented within a reasonable amount of time without disrupting production?
- Does the option have a good "track record"? If not, is there convincing evidence that the option will work as required?
- What other areas will be affected?

Facility Pollution Prevention Guide, U.S. EPA

The P2 Project Process

Screen and Prioritize Identified P2 Opportunities

Screen options and separate ideas into three categories:

1) Options that qualify as "low hanging fruit" (those that can be easily executed and have low costs and risks)

2) Options that are found to have marginal value or are impractical due to obvious company technical and resource limitations

3) The remaining options that will require feasibility assessment

The P2 Project Process

Screen and Prioritize Identified P2 Opportunities

- Remaining ideas should be ranked to determine their priority for detailed evaluation efforts
- If prioritization methods have been determined in the P2 management plan - follow them
- The ranking process can range from an informal review (such as a P2 program team vote) to use of quantitative decision-making tools (weighted sum method or similar technique)

STEP 5
Evaluate Alternatives

The P2 Project Process

Feasibility Analysis

Evaluate the implementation feasibility and effectiveness for target area alternatives by conducting:

- ☑ A **technical** feasibility analysis
- ☑ An **economic** feasibility analysis
- ☑ An **environmental** feasibility analysis

STEP 5
Evaluate Alternatives

The P2 Project Process

Technical Feasibility Analysis

A **technical** feasibility analysis - determines if P2 projects will work in application and screens out options that are not technically feasible

Consider potential technical factors:

- Results from applications in similar operations
- Availability of new equipment or materials
- Impacts on current process operations (operating procedures, workflow, and production rates)
- Impacts on other facility operations (production steps eliminated, bottlenecks removed, requires changes up or downstream of the process)

The P2 Project Process

Technical Feasibility Analysis

Consider potential technical factors:

- Impacts on the safety and quality of the product; maintained or improved?
- Impacts on customer needs (compatibility, schedules, price, etc.)
- Downtime requirements and effects
- Functionality for current facility design (space availability, transport and installation factors, utility requirements, etc.)
- Impact on annual operating and maintenance costs

The P2 Project Process

Technical Feasibility Analysis

Consider potential technical factors:

- Impacts on employees (labor required, safety concerns, special skills or worker expertise required to operate or maintain the new system)
- Potential of new hazards or negative environmental impacts

Some technical evaluations will be straightforward, others will require special expertise - significant coordination with the process operators, related product vendors, and external engineering consultants may be necessary before deciding whether a proposed P2 solution is technically feasible

The P2 Project Process

Economic Feasibility Analysis

An **economic** feasibility analysis - costs, revenues, and savings are evaluated for each project to determine advantages of competing projects and allocation of resources

Consider potential financial factors:

- Capital cost / process modification cost changes
- Raw material and waste cost changes
- Utility, operation, and maintenance cost changes
- Changes in overhead costs – include labor costs
- Insurance, liability, and regulatory compliance rates
- Cost changes associated with product quality

STEP 5
Evaluate Alternatives

The P2 Project Process

Economic Feasibility Analysis

The types of tools and techniques used for economic evaluations may vary from one process to the next in order for the results to be valuable

Some techniques include:

Payback Period

Net Present Value (NPV)

Internal Rate of Return

Profitability Index (PI)

Life Cycle Cost Analysis (LCCA)

Total Cost Accounting (TCA)

The P2 Project Process

Economic Feasibility Analysis

Payback Period – The purpose of the payback analysis is to determine the length of time it will take before the costs of a new project are recovered.

Net Present Value (NPV) – NPV (also called a cost-benefit analysis) is a value method that is based upon the concept that a dollar today is worth more than a dollar in the future (a concept known as the time value of money). The NPV concept captures the cost of a given project, taking into consideration discounted future monetary values.

Internal Rate of Return – The internal rate of return (IRR) is another technique used in decision-making. The purpose of determining the IRR is to accurately describe the relationship between future cash flows and current investment costs.

The P2 Project Process

Economic Feasibility Analysis

Profitability Index (PI) – The profitability index (also called the benefit-cost ratio) is an appraisal technique used to determine the potential profitability of a project, and to compare different projects to one another.

Life Cycle Cost Analysis (LCCA) – The LCCA associates economic criteria and societal (external) costs with individual P2 opportunities. The purpose of LCC is to quantify a series of time-varying costs for a given opportunity over an extended time horizon, and to represent these costs as a single value.

Total Cost Assessment (TCA) – There are four elements of Total Cost Assessment: expanded cost inventory, extended time horizon, use of long-term financial indicators, and direct allocation of costs to processes and products.

STEP 5
Evaluate Alternatives

The P2 Project Process

Environmental Feasibility Analysis

An **environmental** feasibility analysis - considers both human and environmental health factors and options that permanently reduce / eliminate a facility's negative environmental impacts

Evaluate effects within the facility and within the surrounding community

Some options are not obvious and require a thorough environmental evaluation, especially if they involve product or process changes or the substitution of raw materials

The P2 Project Process

Environmental Feasibility Analysis

Consider potential environmental factors:

- Effect on the number, volume, and toxicity of waste streams
- Risk and acceptability of transfer of pollutants to other media
- Impact of the P2 option on other processes or procedures (including disposal methods)
- Raw materials requirements and sourcing (renewable?)
- Overall associated resource (water and energy) consumption
- Hazard impact on safety and health

STEP 5
Evaluate Alternatives

The P2 Project Process

Prioritize Options

- Determine the most feasible and effective P2 options
- Use established criterion for ranking - assign a value that reflects how the activity matches each criterion
- Select projects for management review and potential implementation (immediate and future)
- Resolve any conflicts that might exist among the teams about the approach and resources required for the project(s) they intend to propose

The P2 Project Process

Generate an Assessment Report

- Prepare a summary report - present the results of investigations and list the P2 options determined to be feasible in order of priority

- All appropriate information should be carried over into a complete assessment report - including methodology used

- The best P2 projects are selected for potential implementation (immediate and future) and incorporation into a P2 project proposal

The P2 Project Process

Step 6 – P2 Project Proposal

- After the prioritization and evaluation of the identified P2 opportunities is complete, generate a P2 Project Proposal
- Describe in detail the option(s) recommended for implementation (based on feasibility analyses results or initial determination of "low hanging fruit")
- The proposal should contain all information needed to present the recommended opportunities to facility managers for possible implementation

The P2 Project Process

Required Information

- General process information
- Executive summary with a listing of the P2 measure(s) recommended and estimated effectiveness (P2 potential)
- Target values for reductions
- Advantages and disadvantages of the P2 project
- Potential implementation obstacles
- The maturity of the technology and a discussion of successful applications
- The overall project economics (including profitability under both optimistic and pessimistic assumptions)

The P2 Project Process

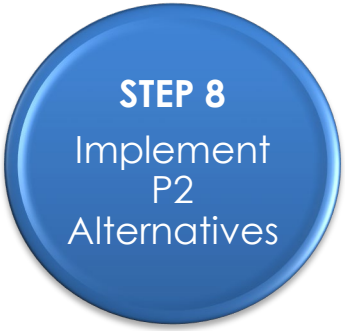
Required Information

- A qualitative evaluation of the indirect and intangible costs and benefits
- The required resources and how they will be obtained
- The proposed schedule for implementation (estimated time for installation and startup)
- A plan for adjusting and fine-tuning the initial project(s) as knowledge and experience increases, or to overcome unforeseen challenges
- Possible performance measures to allow the project to be evaluated after it is implemented

The P2 Project Process

Step 7 - Obtain Approval and Resources

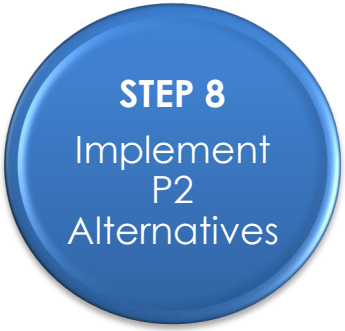
- Submit the P2 Project Proposal for management review and approval
- Once approved, work to secure resources (staff time and financial support)
- If difficult to raise funds internally - evaluate financing options (private sector lending) and public financial assistance (pollution prevention and toxics reduction grants from state and local governments)



The P2 Project Process

Step 8 - Implement P2 Alternatives

- Implementation measures vary greatly from project to project - some will be immediate with few resources - others involve significant preparatory work
- In-house expertise may be used or work may be contracted to an outside organization



The P2 Project Process

- It may be necessary to conduct a pilot project - analyze/critique elements of the project - reevaluate feasibility and cost benefit analysis
- Once refined, scaled up to full potential – install equipment/implement procedures
- Document the implementation process by taking "before and after" photographs for project review and promotional activities later
- Keep data logs current and have point people assigned for oversight during early stages of implementation

STEP 8
Implement P2 Alternatives

The P2 Project Process

- Continually monitor the progress of the project and document performance - make adjustments as needed
- Allow everyone sufficient time to adapt to changes resulting from P2 implementation - may require training and incentive programs to get employees used to the new P2 procedures and equipment

The P2 Project Process

Step 9 - Measure Progress

- Track and measure the progress of P2 projects to evaluate performance
- Progress should be measured against the expected technical, environmental, and financial returns and established company goals
- Measurable results are normally available within six months of startup
- Calculate the financial savings and acknowledge the indirect benefits - try to gauge the value

The P2 Project Process

Selecting and Acquiring Data

1) **Select a quantity** (e.g., waste volume or toxicity) that accurately reflects the waste(s) of interest (it is helpful if the units easily correlate to previously established baseline values)
2) **Measure that quantity** – even when the criteria being used for comparisons is qualitative, it must be measurable in some way using the company resources currently available
3) **Normalize the data as necessary** – quantity comparisons can be useful for P2 review; however, the data may have to be normalized to account for influential factors not related to the P2 method being reviewed

The P2 Project Process

Normalizing data

Normalizing data is a process of structuring data so as to reduce or eliminate data redundancy and properly attribute impact values to derivations

Some of the common factors that may affect the process quantities (including costs and savings) are:

- Total hours the process operated
- Number of batches processed
- Input material changes
- Total employee hours
- Area, weight, or volume of product produced
- Area, weight, or volume of raw material purchased
- Profit from product

The P2 Project Process

Using Established Baselines

- Baseline values can be used effectively for comparison and P2 performance evaluation
- Historical performance for an existing process can be used for comparison
- If the P2 efforts involve incremental changes to the process, new baselines can be established as changes are implemented, and used to evaluate continual progress
- New processes or units may use estimates from similar processes utilized in other facilities or companies as baseline values
- Baselines may be projected amounts of pollution that will never be generated

STEP 9
Measure Progress

The P2 Project Process

Using Established Baselines

Monitor process and waste production changes

- Material Input
- Waste Shipped Off-site or Treated On-site
- Quantity of Waste Generated or Used
- Change in Amount of Toxic Constituents
- Change in Material Toxicity

It is important to assess if any wastes have been shifted - transferring a given pollutant to another media or replacing it with a different pollutant is, in P2 principle, to be avoided

The P2 Project Process

Step 10 - Review Projects / Make Adjustments

- Performance should continue to be periodically assessed against the expected returns
- Quantitative evaluation enables comparison of the process unit with similar units in the company and with data from other companies
- Continue to evaluate and fine-tune P2 projects – make sure data reports are generated at meaningful intervals
- Options that do not meet the original performance expectations may require rework or modifications to be effective

STEP 10
Review Project / Make Adjustments

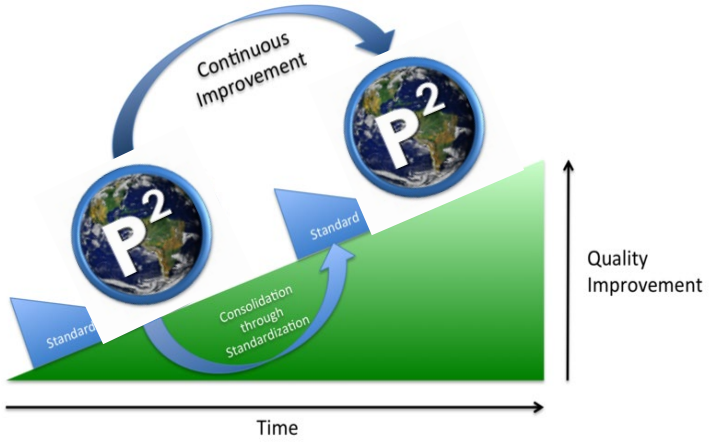
The P2 Project Process

Consider these questions during project review:

- Were goals met? Have target goals changed?
- What obstacles were realized?
- Were estimations accurate?
- What lessons were learned?
- What can be improved?
- How can changes or corrective actions be implemented?
- What future opportunities have been realized?

STEP 10
Review Project / Make Adjustments

The P2 Project Process



Continual improvement can be built into the P2 planning process and sustained by:

- Building and maintaining a strong P2 Program Team
- Scheduling periodic reviews of unit processes, the P2 Program, and the facility
- Building in methods to evaluate and reevaluate performance

STEP 11
Reward and Publicize

The P2 Project Process

Step 11 - **Reward** and Publicize

Keep enthusiasm high and innovative thinking persistent

Acknowledge and reward employee P2 contributions

- Grant material rewards (cash or merchandise) – cash can be a set percentage of the estimated annual savings realized by the company - merchandise may be desirable to employees and cost-effective for the company

- Formal awards – give plaques, trophies, or certificates at staff meetings or ceremonies

STEP 11
Reward and Publicize

The P2 Project Process

- Recognition among peers – give recognition in company publications (e.g., newsletters), on bulletin boards, and in media blasts - post employee pictures and their P2 profiles on websites, banners, or in common areas like cafeterias, breakrooms, or
- Cite accomplishments in performance reviews

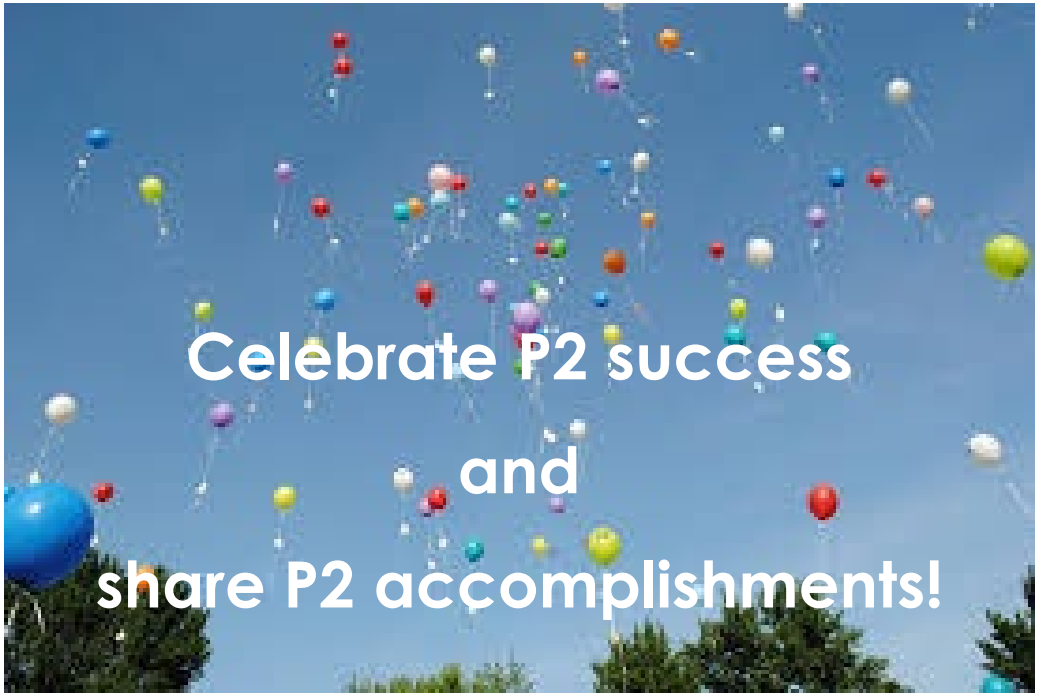
The P2 Project Process

Step 11 - Reward and **Publicize**

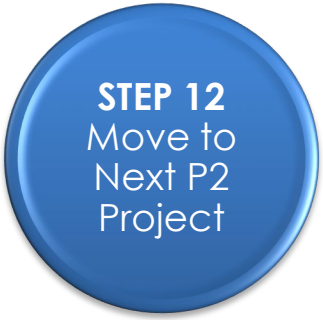
- Create and publicize success stories that exemplify the effectiveness of the P2 program and demonstrate the benefits that have been realized
- Submit press releases on innovations to local media and to industry journals read by prospective clients
- Arrange for employees to speak publicly about P2 measures in schools and civic organizations

STEP 11
Reward and Publicize

The P2 Project Process



- Generate publicly accessible reports (post on company website)
- Include P2 projects in public relations/marketing efforts such as commercials, social media, or flyers



The P2 Project Process

Step 12 - Move to the Next P2 Project

- Armed with increased P2 awareness, knowledge, and experience, repeat the P2 Project Process
- Start again at Step 1, developing a P2 Process Plan for the next P2 project and follow the appropriate steps to additional P2 success
- It is recommended to conduct regular assessments of the business to identify additional P2 opportunities, and to view P2 as a continuous cycle of improvement
- As long as materials are used and waste generated, there will be opportunities to reduce or eliminate it!

The P2 Project Process

Move to the Next P2 Project

P2 Strategies

Many P2 efforts are inexpensive and simple to implement

Some involve only a change in attitude or work procedures

P2 Strategies

Eight (8) Commonly Used P2 Approaches:

1) **Integrating Environmental Considerations into the Business Planning Process**

2) **Process and Equipment Optimization, Redesign, Modification, or Modernization**

3) **Product Design, Product Reformulation or Redesign, Product Stewardship and Sustainable Development**

4) **Purchasing and Inventory Management**

P2 Strategies

Eight (8) Commonly Used P2 Approaches:

5) **Improved Maintenance, Preventative Maintenance, and Housekeeping**

6) **Improved Receiving and Distribution Practices**

7) **Green Building, Infrastructure, and Sustainable Grounds Management**

8) **Energy Usage, Conservation and Efficiency**

P2 Strategies

1) **Integrate Environmental Considerations into the Business Planning Process**

- *Implement Cost Accounting* - most successful P2 programs account for the true cost of wastes through cost accounting.
- *Implement an Environmental Management System (EMS)* - a set of processes and practices that enable a business to reduce environmental impacts and increase operating efficiency.
- *Provide Support for the P2 Program* - P2 goals need to be considered as part of the company bottom line through cost accounting and allocation of company resources.
- *Best Management Practices* - update standard operating procedures (SOPs) to incorporate P2 and assist with total cost accounting practices.

P2 Strategies

2) <u>Process and Equipment Optimization</u>, Redesign, Modification, or Modernization

- Make system adjustments to existing processes such as flow rates, temperature, pressure, or residence times to optimize functions.
- Position parts being cleaned in a degreaser/defluxer in a manner that permits maximum drainage and minimizes dragout (whether in baskets, suspended from hooks or racks, or conveyed on a belt).
- Implement water conservation practices - reduce water use and chemical inputs to water.
- Install or make better use of automation equipment and process controls (e.g., thermostats, shut-off valves, or flow meters).

P2 Strategies

2) Process and Equipment Optimization, Redesign, <u>Modification, or Modernization</u>

- Buy and maintain durable equipment / upgrade tool and equipment quality.
- Install holding tanks or other equipment to segregate waste streams.
- Install mechanical alarms to notify of leakages and process bypasses.
- Replace high-volume hoses with high-pressure, low-volume systems.
- Install splash guards and drip boards to minimize solvent and chemical losses.
- Install systems to allow for "grey" water reuse (i.e., filtration type units, piping).

P2 Strategies

2) Process and Equipment Optimization, Redesign, Modification, or Modernization

- Design continuous closed systems to replace batch processes.
- Design or retrofit units to use energy / fuel sources that are renewable or cause fewer emissions.
- Redesign refrigeration units to use non-ozone depleting refrigerants.
- Use distillation, filtration, or vapor recovery equipment to capture and reclaim cleaning or process chemicals such as solvents, oils, and toxics.
- Install efficient condensers, regenerative heat exchangers, heat pumps, or similar equipment to recover and reuse heat.

P2 Strategies

3) Product Design, Product Reformulation or Redesign, Product Stewardship and Sustainable Development

- Integrate P2 into pre-manufacturing decisions by beginning P2 at research, development, and design phases of the product.
- Include P2 into equipment and materials procurement for the production of the product.
- Design and create products or services that are ecologically safe throughout their life cycle.
- Design durable products that allow for resale, reuse, or are conducive to recycling (i.e., plastic parts are marked to aid recycling) instead of immediate disposal.

P2 Strategies

3) Product Design, Product Reformulation or Redesign, Product Stewardship and Sustainable Development

- Use modular and upgradeable designs allowing for easy repair, replacement of component parts, and upgrades (thus lengthening the useful life of the product).
- Produce combined, condensed, or concentrated products that require less packaging.
- Use natural, renewable, or recycled materials in manufacturing processes.

P2 Strategies

3) Product Design, Product Reformulation or Redesign, Product Stewardship and Sustainable Development

- Introduce new product lines specifically designed to eliminate or reduce the use of toxic chemicals.
- Eliminate raw materials that are not incorporated into final products or services.
- Substitute raw materials by:
  - Using organic or aqueous-based materials instead of petroleum, solvent, or toxic chemical-based inputs / ingredients.
  - When toxics are required, use the least toxic alternative available.

P2 Strategies

4) Purchasing and Inventory Management

- Implement a computerized inventory control program.
- Implement "just in time" purchasing (in quantities matching process demand), as the cost associated with the disposal of surplus hazardous materials often exceeds the purchase price of the items.
- Purchase frequently or commonly used products in bulk or in concentrated form.
- Prioritize purchasing locally to reduce transportation and storage needs.
- Purchase durable, long-lasting materials.
- Avoid unnecessary purchasing / disposal by participating in a material exchange program.

P2 Strategies

5) Improved Maintenance, Preventative Maintenance, and Housekeeping

- Regularly conduct key maintenance activities and system adjustments (i.e., calibration, air to fuel ratios) - improve housekeeping or process / product inspections.
- Identify equipment or systems that frequently malfunction and implement preventative measures.
- Repair equipment whenever possible / maintain a supply of spare parts for equipment that needs frequent repair. When repair is not possible replace defective equipment promptly.
- Update system maintenance and monitoring software regularly.
- Implement spill prevention training and procedures.

P2 Strategies

6) Improved Receiving and Distribution Practices

- Work with suppliers and transporters to implement the use of lightweight, returnable, and reusable containers for shipping and receiving.
- Reduce or eliminate excess product packaging.
- Increase the use of recycled or recyclable packaging.
- Ship products in bulk or in concentrated form.

P2 Strategies

7) <u>Green Building</u>, Infrastructure, and Sustainable Grounds Management

- Use life cycle thinking in all engineering activities and ensure that all material and energy inputs and outputs are as inherently safe and benign as possible.
- Use zero or low VOC-emitting construction materials and interior finish products.
- During the construction phase, reduce the amount of material going to landfills.
- Install a skylight system and design window placement to provide more natural light and lessen the need for electric lighting during the day - Reduce heat gain by tinting windows.

P2 Strategies

7) <u>Green Building</u>, Infrastructure, and Sustainable Grounds Management

- Orient windows, walls, and awnings with trees to shade windows and roofs during the summer while maximizing solar gain in the winter.
- Reduce infiltration / exfiltration (air leakage) by insulating the building envelope, installing high-performance windows, and adding extra insulation in walls, ceilings, and floors.
- Generate renewable energy for building use through solar power, wind power, geothermal power, or hydropower.
- Install solar powered equipment within the facility (i.e., water heating units).

P2 Strategies

7) Green Building, Infrastructure, and Sustainable Grounds Management

- Install personal temperature and airflow controls over the HVAC system.
- Design systems to collect, purify, and reuse water on-site (e.g., "point of use" water treatment, dual plumbing that recycles water into toilets (flushing), or cisterns for non-sewage and grey water collection for reuse).

- Utilize water conserving fixtures such as ultra-low flush toilets and low-flow faucets.
- Install a hybrid central chilled water system (cools floor-by-floor with steam instead of water).

P2 Strategies

7) **Green Building, Infrastructure, and Sustainable Grounds Management**

- Reroute rooftop drainage pipes from draining into the storm sewer to draining into rainwater harvesting systems, cisterns, or permeable areas.
- Plant trees on-site to reduce and slow stormwater by intercepting precipitation in their leaves and branches.
- Install bioretention or bioinfiltration cells.
- Use permeable pavements made of pervious concrete, porous asphalt, or permeable interlocking pavers to infiltrate, treat, and/or store rainwater where it falls.
- Install green roofs that are covered with growing media and vegetation.

P2 Strategies

7) Green Building, Infrastructure, and <u>Sustainable Grounds Management</u>

- Reduce watering cycles when weather appropriate.
- Irrigate higher grounds first to provide run-off to lower areas, use timers, and direct nozzles away from concrete areas.
- Use rakes or blowers to remove leaves and debris from walkways instead of water hoses.
- Use organic pesticides and mulches.
- Use native plants in garden areas - naturally resist insects, infections and fungus - can withstand local weather conditions (e.g., extreme heat, cold, or drought).

P2 Strategies

7) Green Building, Infrastructure, and Sustainable Grounds Management

- Install vegetated swales to slow, infiltrate, and filter stormwater flows along streets and parking lots.
- Convert lawns to natural areas (e.g., prairies) with a diversity of native plants (e.g., wildflowers, groundcovers, and grasses).

- Monitor the growth of remaining lawns and only mow when necessary. Leave clippings where they fall to facilitate recycling nutrients back into the soil. If clippings are collected, compost them with garden waste, raked leaves, and organic cafeteria waste (if appropriate).

P2 Strategies

8) Energy Usage, Conservation, and Efficiency

- Conducting a facility-wide energy assessment.
- Submetering energy usage for detailed information on how and where energy is used within a facility and within processes.
- Maintaining equipment and the facility through an ongoing maintenance program (see tables in Chapter 7 of the manual).

ENERGY EFFICIENCY
in Industrial Processes

IDEM, Office of Program Support
P2 Programs

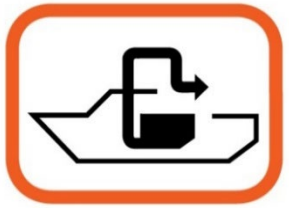
- Environmental Stewardship Program – A voluntary program that recognizes and rewards regulated entities for going above and beyond current environmental regulations.

- Indiana Partners for Pollution Prevention – An organization comprised of Indiana industries, businesses, nonprofit organizations, and governmental entities that are interested in pollution prevention and its financial and environmental benefits.

- Comprehensive Local Environmental Action Network (CLEAN) Community Challenge – A voluntary program that recognizes and rewards communities that proactively manage environmental and health impacts associated with governmental operations.

IDEM, Office of Program Support
P2 Programs

- Clean Vessel Act Grant Program – Provides grants to marinas for projects that prevent nonpoint source pollution and add infrastructure.



- Indiana Clean Marina Program – Provides technical assistance to marinas and boaters and recognizes marinas for environmental stewardship.

- Governor's Awards for Environmental Excellence – Indiana's most prestigious environmental recognition awards for the most innovative, sustainable, and exemplary programs or projects that positively impact Indiana's environment.

IDEM, Office of Program Support P2 Programs

- The Compliance and Technical Assistance Program (CTAP) is Indiana's environmental business assistance program. CTAP also offers P2 assistance to businesses by helping them identify P2 opportunities during site assessment visits, and by helping them conduct and review a P2 self-assessment using the Pollution Prevention Opportunity Self-Assessment Checklist.

- CTAP also provides in-person classroom training and pollution prevention resource materials online, including guidance documents, success stories, and sector-specific P2 guides for various industries.

Indiana P2 Resources - IDEM

Partner for P2 Events - **2018**

September 19, 2018: 21st Annual Pollution Prevention Conference and Tradeshow "Sustainability: Pollution Prevention is a Piece of the Puzzle"

- Conference Information Slides [PDF]
- Keynote: From Preparedness to Action [PDF]
  - Janet McCabe, IU Environmental Resilience Institute
- Keynote: Integrating Sustainability and Enterprise Risk [PDF]
  - Karen Lutz, TRC Solutions
- 2018 Governor's Awards for Environmental Excellence [PDF]
  - Bruno Pigott, IDEM Commissioner

Indiana P2 Resources - IDEM

June 20, 2018: Partners For Pollution Prevention Quarterly Meeting

- Honda Overview [PDF]
  - T. Reisinger, Honda Manufacturing of Indiana
- Honda Global and Regional Perspective [PDF]
  - Joanna Bambeck, Honda Manufacturing of Indiana
- Honda Environmental Management Overview [PDF]
  - Jeff Loeffler, Honda Manufacturing of Indiana
- NH Circle Project - Door Line Divine [PDF]
  - Tammy Gabbard, Honda Manufacturing of Indiana
- Establishing an Energy Management Culture in Paint [PDF]
  - Alexis Kaminski, Honda Manufacturing of Indiana
- Greening Logistics - Load Maximization [PDF]
  - Karl Gimbel, Honda Manufacturing of Indiana

Indiana P2 Resources - IDEM

March 28, 2018: Partners For Pollution Prevention Quarterly Meeting

- Indiana's Energy Future [PDF]
  - Vince Griffin, Advanced Energy Economy

Historical Meeting Presentations

- Zipped files each contain a year's worth of presentations

In 2017, IDEM worked with Elanco Clinton Laboratories (ESP member) to feature several environmental improvement initiatives that were completed resulting in both energy and water reductions. A presentation was made at Indiana's Annual Pollution Prevention Conference and Tradeshow (2017), Energy Savings through Capital Improvements and Procedural Changes [ZIP], and a success story was written in December, Site Energy Efficiency Improvements [PDF].

Indiana P2 Resources - IDEM

Reports and Information

As of 2018, 58 businesses are members of IDEM's Environmental Stewardship Program (ESP). Members must submit an annual performance report (APR) to demonstrate progress towards their environmental stewardship objectives and targets, and certify that the ESP requirements continue to be achieved

- Historical APRs
- Success Stories

Indiana P2 Success Stories
ARaymond Tinnerman Manufacturing

457,954.55 lbs. of pollution prevented

- Installed a natural gas-fired endothermic generator, allowing for the elimination of a methanol storage tank and feed system.
- As a result, methanol is no longer stored onsite and will not have to be reported to the EPA Toxic Release Inventory for CY2018.
- Results have been better than expected, as heat treated parts have less carbon deposits and do not have to be cleaned as aggressively as in the past.
- Also, installed a recirculating cooling water loop with water-to-chilled-water heat exchanger for cooling of heat treat furnace bearings and equipment.

Indiana P2 Success Stories
Raytheon Indianapolis

9,200,000 lbs. of waste diverted

- Expanded composting effort to include composting of prepared, excess food that was previously either sent to the incinerator or through the garbage disposal.
- It is estimated this effort contributes an additional 25 pounds of food waste to the compost pile daily. This results in an increase of 4,600 pounds of waste diverted from incineration for the last three (3) quarters of 2018.
- Currently working to achieve the *TRUE Zero Waste Certification*. Part of the certification criteria requires a ninety percent (90%) diversion rate, in addition to many best management practices for waste and resources management.

Indiana P2 Success Stories - Electro-Spec

341.35 lbs. of waste diverted

- Reduced the amount of cyanide filters being shipped out by 25% by using reusable filters.

- **NEWEST PROJECT** - Will soon be using a solvent blend from *Brulin,* an Indianapolis company, called SolVantage
  - Can be used as a direct replacement in the airless/airtight degreasing unit for solvent containing TCE
  - The mixture has zero ozone depleting potential and low global warming potential
  - Is not regulated as a hazardous waste (RCRA, EPCRA)
  - Is not listed as a hazardous air pollutant, is EPA SNAP approved, is considered a suggested replacement for TCE, MeCl, Perc and NPB, and the use will reduce VOC emissions by over 50% permanently

Indiana P2 Success Stories
Astra Zeneca

Water use reduction of 12,756,774 gallons

- The facility has instituted several water reduction projects including:
  - no flush urinals
  - eliminated irrigation
  - evaluating water usage for several equipment cleaning areas

Indiana P2 Success Stories
Eli Lilly Corp

17,728,571.43 Kwh energy reduction

- Lilly engineers created a model incorporating the historical wet bulb correlation with a coefficient of performance for each chiller that is part of the system for generating chilled water for building conditioning.
- After it was validated, the model was upgraded to upload forecasted weather data from the internet to predict the required chiller load and to facilitate the operational plan to optimize chiller usage.

Indiana P2 Resources - Universities

- Indiana University Environmental Resilience Institute
- IUPUI Industrial Assessment Center
- Purdue University's Technical Assistance Program (TAP)
- Purdue Manufacturing Extension Partnership (MEP)

Federal and Regional P2 Resources

- Toxics Use Reduction Institute (TURI)
- Interstate Chemicals Clearinghouse (IC2)
- University Library - University of Illinois at Urbana-Champaign, Pollution Prevention 101
- National Pollution Prevention Roundtable (NPPR)
- Global Development Research Center

U.S. Environmental Protection Agency P2 Related Programs and Resources

- U.S. EPA Pollution Prevention

- U.S. EPA's Energy and the Environment
- E3: Economy, Energy and Environment
- ENERGY STAR®
  - ENERGY STAR Portfolio Manager®
  - Target Finder
  - Energy Performance Indicators (EPIs)
  - Industrial Energy Tracking Tool
- Environmental Management Systems (EMS)
- RE-Powering America's Land
- Safer Choice
- Safer Chemical Ingredients List
- Sustainable Marketplace: Greener Products and Services
- Toxics Release Inventory (TRI) Program Pollution Prevention (P2) Resources
  - TRI's P2 Search Tool
- U.S. EPA's WasteWise
- U.S. EPA's WaterSense
  - Water assessment checklist
  - Water assessment worksheets
- U.S. EPA Pollution Prevention Resources
  - Pollution Prevention Information Clearinghouse (PPIC)
  - The Pollution Prevention Resource Exchange (P2RX)
  - Newsletters
  - U.S. EPA P2 publications
  - A-Z Pollution Prevention Subject Index
  - Case Studies
  - U.S. EPA, Pollution Prevention (P2) Small Business Guide
- Green Engineering
- Green Chemistry
- Greener Cleanups

Questions About This Presentation?

- Thank You for your Participation!
- Please fill out the after class survey.
- Look for new featured topics and P2 news on our website.

EXERCISES

P2 Exercise – The Fun Factory

The goal of this training exercise, which uses a mock industrial process to illustrate waste reduction principles, is to give participants experience in recognizing waste reduction opportunities.

Please review Instructions Sheet for:

- Required Materials
- Positions and Job Descriptions
- Company Policies
- Rules
- Instructions

Disclaimer: *Although some colors are described as being hazardous materials and wastes, the props are in no way or form hazardous. This is a mock industrial process for training purposes.*

P2 Exercise – The Fun Factory

Review and Open Forum Discussion

- What problems did you encounter?
- What solutions did you find?
- What did you learn?

The P2 Cost Savings Calculator