Greening on the Go

A Pocket Guide to Green Productivity

Greening on the Go: A Pocket Guide to Green Productivity© is based on the original Train the Trainer Manual for Green Productivity.

Lynn Johannson of Canada was commissioned by the APO to produce the pocket guide as a user friendly tool.

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Special thanks to the many people that provided comments and insight in the development of this guide.

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Asian Productivity Organization
Tokyo

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Explanation of Product

Greening on the Go is literally a pocket-sized guide that contains information to help you with your Green Productivity (GP) efforts as you work. Put it in your shirt or jacket pocket. Hang it on a string by a door. Post it in the production area so that you can use it as an aid to explain to employees how to apply GP tools and techniques to challenges they face daily. Put it in your briefcase or backpack to use when you are in a meeting off-site. Take it as a reference tool to a peer or expert when you want to explain a challenge you are facing. The pocket guide can be a communication aid during this exchange. You can reference different tools and techniques to better understand their suggestions for continual improvement.

Greening on the Go is a reference tool, which:

- presents six steps for your success in Success in Six (76·1).
- explains the thirteen tasks in the Green Productivity Methodology (40·1).
- outlines over 83 concepts, tools and techniques to help you to:
  - generate or group ideas,
  - decide on your priorities, and
  - implement your GP program.

Greening on the Go also provides you with:

- Cross-referencing to the companion handbook: ***Handbook on Green Productivity***
- Key contact information for:
  - The Asian Productivity Organization (APO)
  - National Productivity Organizations (NPOs)
  - GP resources that are found on-line

Green Productivity

Success in Six

Step 1 Getting Started

- Form a Green Productivity Team
- Conduct a Walk Through Survey and Gather Information

Step 2 Planning

- Identification of Problems & Causes
- Setting Objectives and Targets

Step 3 Generation And Evaluation-GP Options

- Generation of Green Productivity Options
- Screening and Evaluation of Green Productivity Options
- Preparation of Implementation Plan

Step 4 Options for Implementation of GP

- Implementation of Selected Options
- Awareness Building, Training and Developing Competence

Step 5 Monitoring and Review

- Monitoring and Evaluation of Results
- Management Review

Step 6 Sustaining Green Productivity

- Incorporate Changes
- Identify New or Additional Problem Areas for Continuous Improvement

Tools and Techniques

Step 1

- *Brainstorming*
- *Attribute Analysis*
- *Needs Analysis*
- *Responsibility Matrix*
- *Checklists*
- *Flowcharts*
- *Flow Diagram*
- *Material Balance*
- *Benchmarking*

Step 2

- *Brainstorming*
- *Cost Benefit Analysis*
- *Eco-mapping*
- *Fishbone Diagram*
- *Benchmarking*

Step 3

- *Brainstorming*
- *Cost Benefit Analysis*
- *Eco-mapping*
- *Failure Mode And Effect Analysis*
- *Pareto Charts*
- *Program Evaluation Review (PERT)*

Step 4

- *Training Needs Analysis*
- *Team Building*
- *Responsibility Matrix*
- *Critical Path Method*
- *Gantt Chart*
- *Spider Web Diagrams*

Step 5

- *Eco-mapping*
- *Failure Mode And Effect Analysis*
- *Charts (control/tally, etc.)*
- *Spider Web Diagram*

Step 6

The tools are repeated here since the activities are looped back to the previous steps to provide consistency and encourage continuous improvement. This empowers the people involved to build on their new knowledge with confidence for success.

Greening on the Go

How to Use

Greening on the Go was conceived back in 2000 as a practical way to get the tools, concepts and techniques used in Green Productivity (GP) onto the shop floor and into the hands of small business.

Each concept, tool or technique is explained by answering six questions, which are:


What is it? Defines the concept, tool or technique


Why is it useful? Outlines its attributes


How will it help you? Aids in understanding the value of your GP effort


Where do you apply it? Shows its placement either within a location or site, or within your business system


When is it useful? Delineates either a time reference or a stage where it has particular benefit in your process to adopt GP


Who benefits? Characterizes the primary beneficiary of your GP efforts, as well as indicates to whom additional benefit may flow

To demonstrate the synergy between the various concepts, tools and techniques, references are included with the page number identified in parentheses. For example, in the section on Activity Network Diagram, there is a reference to Arrow Diagram (9.1). Our hope is to minimize your time to source answers as you proceed with *Greening on the Go.*

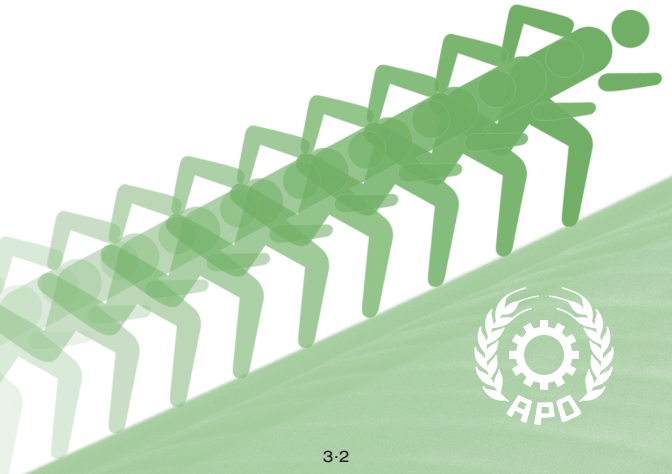
Most sections also provide a **TIP**. These are words of wisdom to focus on some feature, or what experience has shown to be an action or situation to avoid. Learning from the mistakes of others is so much more efficient, and less frustrating.

Each section ends with a Ponder Point - User Notes where an idea, an example or a challenge is outlined to prompt you to try something new.

The explanations provided are not intended to be exhaustive descriptions, with great detail and examples. Rather the style of the explanations is an aid to help you, literally when you are on the go, to solve a problem. Greater explanation of these tools is available on- line or in other reference books that provide more rigorous descriptions.

We hope that you find *Greening on the Go* a practical aid to achieve Green Productivity.

Are you ready?



Activity Network Diagram

What is the Activity Network Diagram?

The Activity Network Diagram (AND) is a graphic representation of the tasks needed to be achieved in order to obtain a goal following the most efficient pathway. Such goals may include the termination of a project, implementation of a training program or developing GP options.

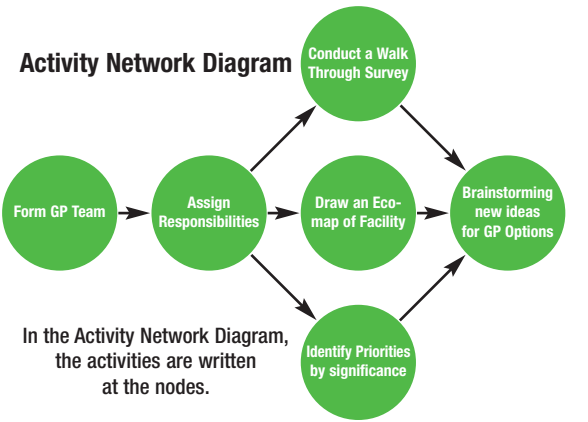
Developing an Activity Network Diagram is basically done by:

a) listing the required activities chronologically,

b) determining which activities you need to complete before others can start or finish, and those which can be done in parallel,

c) graphically displaying your activities (normally using ovals) that are called nodes, and

d) connecting activities that follow a sequence with activity networks.



Why is the Activity Network Diagram useful?

The Activity Network Diagram is useful in two main ways. First, it allows you to understand and visualize what activities need to be carried out and when. Second, it provides an excellent communication tool for other members of the project or program. Each GP Team member can see and understand the importance of their role in the overall project.

How will the Activity Network Diagram help you?

The Activity Network Diagram will help you work out the most efficient sequence of events needed to complete any project. It will provide you with a good overview through a graphic representation of the activities needed to accomplish your GP program. This is a very good way of developing realistic timeframes to meet your deadlines. It can help identify resources that can be reassigned if necessary.

TIP After the Activity Network Diagram has been completed, you can use the Critical Path Method (CPM) by tracing all those activities which, if delayed, would directly delay the whole project or program. This way you can identify and easily share those activities that are critical to meeting the project's deadlines, and activities in which there is more flexibility.

Where do you apply the Activity Network Diagram?

It can be used as part of Brainstorming (11·1) to start a GP program or to check progress. A variation of an AND is a Gantt Chart (36·1) that helps you to schedule tasks and task duration.

When is the Activity Network Diagram useful?

The Activity Network Diagram is useful when you want to have more control of the activities that are involved in your task. The AND will come in handy any time you undertake a new project. It is particularly useful when you have multiple activities involved in your GP program.

Who benefits from the Activity Network Diagram?

The project manager, and all those involved in the project, directly or indirectly will benefit. It empowers each member of your GP Team by showing them their role and the implications of their activities for the project, and the schedule.

Ponder Point – User Notes

An Arrow Diagram (9·1) is a lesser evolved version of AND. Similar, more complicated versions of this diagram include Critical Path Method (CPM) and Program Evaluation Review Technique (PERT).

PERT is more than just a diagram, and is more suited to engineering applications. It is a special network diagram showing task dependency[1]. PERT charts and network diagrams are not interchangeable.

1. Glossary, User's Guide for Microsoft Project 98, Microsoft Corporation, 1997, p307

[For more detailed information refer to Wideman Comparative Glossary of Project Management Terms V 2.1, R Max Wideman, May 2001. http://www.pmforum.org/library/glossary/index.htm]

Activities, Products and Services

What are Activities, Products and Services?

These are the actions your organization undertakes, the goods that it makes for the marketplace or the contractual support it offers to customers.

TIP Defining these elements of your organization can help provide you with a better understanding of the ways and means you can affect improvement to meet your overall GP goals.

Why are Activities, Products or Services useful?

Activities, Products and Services are the means by which you can start to better understand the Scope (71·1) of your organization and self-diagnose your organization's environmental and productivity health.

TIP These three terms are used in ISO 14001.

How will Activities, Products or Services help you?

A clear articulation of the Activities, Products or Services that your organization has or does is key to understanding what it is that you have or do that causes environmental impact and reduces your productivity. It helps you to understand how the environment if left unmanaged can pose a risk to your business.

Where do you apply the Activities, Products or Services concept?

The concept of Activities, Products or Services should be considered where you wish to understand everything that your organization, or a

part of it, does. Changes made to your Activities, Products or Services should be noted because of the effects on your management system and environmental impacts.

TIP A Process Flow Diagram (61·1) can be useful to understand these relationships.

When is the concept of Activities, Products or Services useful?

This concept will come in very handy for motivating Brainstorming (11·1) about what your organization does, determining the Scope (71·1) of application of your other GP programs, as well as forming the basic block for developing Checklists and Check Sheets (13·1 and 14·1).

Who benefits from the Activities, Products or Services concept?

This concept allows your GP Team to identify the relationship between quality, productivity, environmental, health or safety issues in a complete way. It fosters systematic thinking – from cradle to grave, or better cradle to cradle. It can benefit those outside your organization's borders because it helps the organization begin to understand the cause and effect of their operations.

Ponder Point – User Notes

Think outside the box. Think of Design for Environment (DfE) here (20·1). Is there someone from your community who could help you redefine your Activities, Products or Services? Could they help you innovate a GP Activity, Product or Service that would differentiate you in the growing green global marketplace?

Cradle to cradle is a recent evolution in how experts are suggesting businesses look at managing materials with a focus on design.

For more details see www.mcdonough.com

ACTIVITY, PRODUCT or SERVICE	ASPECT	ACTUAL and POTENTIAL IMPACTS
ACTIVITY: Rice Cultivation		
In field operations during growth stage/phase	Consumption of water.	*Land flooding.*
	Use of pesticides.	*Pollution of soil Bioaccumulation of toxic substances in fauna resulting in chronic adverse health effects or species loss.*
	Emission of methane (i.e. greenhouse gas)	*Global warming and climate change.*
PRODUCT: Air Conditioner Service, Maintenance and Repair		
Consumer operation of unit	Use of electricity[c].	*Depletion of non-renewable resources.*
	Generation of solid waste[c].	*Land use.*
	Recovery and reuse of components.	*Conservation of natural resources.*
SERVICE: Transportation and Distribution of Good and Products		
Fleet operation	Consumption of fuel.	*Depletion of non-renewable fossil fuels.*
	Emission of oxides of nitrogen (NO_x).	*Pollution of air – ozone. production – smog.*
	Generation of noise.	*Discomfort or inconvenience to local community.*
Routine fleet maintenance (including oil changes)	Emission of oxides of nitrogen (NO_x).	*Achievement of air quality objectives[d].*
	Generation of waste oil.	*Pollution of soil.*

[a] Abnormal conditions

[b] Emergency conditions

[c] Organization may be able to influence aspect but may not have direct control

[d] Beneficial Impact

Source: ISO 14004: 2004 with minor adaptations

Leverage your knowledge of what you have or do by learning where it occurs - Eco-mapping (24.1) can help you start.

Adult Learning

What is Adult Learning?

Adult Learning encompasses strategies that enable adults to learn. There are differences that should be understood between how adults and children learn. The basic concepts to be considered are:

a) Adults learn more efficiently when they are actively involved in the decision-making about the management, content, style, and delivery of their learning,

b) Adult Learning is fostered through a curriculum and methodology that involves collaboration between the teacher and the learner,

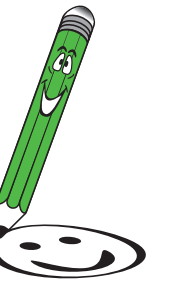
c) The individual learner is the focus of Adult Learning,

d) Adult Learning acknowledges the experience, skills, and knowledge brought by adults to the learning setting, and

e) Adults are capable of learning throughout life.

Accidents

Mistakes



Humour

TIP Even though there is great debate among psychologists and educators about Adult Learning, it is generally accepted that adults learn from their peers as much as kids do. When the focus of Adult Learning is much more individualized, it creates the opportunity where the adult student evolves to a better level of understanding. This is incentive for achieving the desired learning.

Why are Adult Learning strategies useful?

All members of your GP Team are likely adults if the organization is a business or public sector organization. Pretending that adults can be taught like school-aged children is not effective. For an Adult Learning program to be successful it must consider the needs and wants of the adult learner.

There are five steps involved:

1. Conduct a needs analysis.
2. Set objectives.
3. Design the program (content, format, logistics, timing, duration, etc.).
4. Implement the program.
5. Evaluate the training against the objectives.

How will Adult Learning strategies help you?

Training is an expensive and time-consuming undertaking if it is not designed to meet your specific needs. Applying Adult Learning techniques will help you to make the most of your efforts by providing the culturally appropriate approach for the development of training and awareness programs, tailored to adults, that are needed to make your GP program successful.

In the design phase, think of the learning process from 3 perspectives:

- from the needs of the organization for the GP program to be successful
- from the designer's perspective on details of the learning process
- from the needs of the adult learners

Pre-testing the learners' needs can be done by simply asking them to complete statements such as:

1. This learning process will be successful for me if it:
2. I find the most difficult thing about training programs is:

3. The workshop leader can best remedy this by:
4. During the training program, I would like answers to the following questions:
5. The most important thing I would like to learn is:
6. My academic background/work experience is in:

In addition, you can get your GP Team to benchmark what they know about specific topics. This self-assessment can be repeated after the Adult Learning process so that each member can understand how much more they know about a subject that can affect the success of your GP efforts. A downside of traditional training is that it is often not integrated into the business strategy of the organization, or it fails to provide the right connections at the level needed. The five steps involved in Adult Learning tell you what to do, not how to do it. Aligning it to the culture of your organization is up to you.

Where do you apply Adult Learning strategies?

You apply Adult Learning techniques when you need to design training or awareness programs for your GP Team, and for expanding the benefits of GP throughout your organization, along your supply chain or into your community.

When are Adult Learning strategies useful?

Adult Learning is useful whenever there is a need for an increase in knowledge, an improvement in skills or enhancement of attitude in your GP Team.

Who benefits from Adult Learning?

Adult Learning benefits everyone involved in the training program:

- program designers have a better idea of how to increase the value and effectiveness of learning,

- teachers understand what the learners need to know, and
- students are more likely to buy into the learning process and be more confident as their involvement was secured in the process of program development.

The results of effective Adult Learning obviously benefit your whole organization. The organization will be better able to foster improvement, and will make the most of its investments in training and awareness.

Additionally, the enthusiasm and satisfaction of the learners can spread to others who could eventually be involved in the system of change that GP fosters. Enthusiastic adult learners are good champions for change within your organization, they can also be ambassadors of GP within their community

Ponder Point – User Notes

Adults learn through accidents, by making mistakes or through humour. Humour can be used in conjunction with examples of accidents and mistakes to enhance learning.

The reaction to the type of humour used is dependent on a number of variables such as gender, age and culture.

While Adult Learning is a serious matter, injecting humour into the learning process can have a positive physical reaction and provide business benefit. Research has shown that people's problem-solving abilities yield better results when they are preceded by laughter.

Affinity Diagram

What is an Affinity Diagram?

An Affinity Diagram is a Brainstorming tool (11·1) that can help a group generate a large number of ideas individually and then cluster the individual thoughts into groups of related ideas.

The KJ Method is a specific approach to an Affinity Diagram, which was developed in Japan by Dr. Jiro Kawakita. It is a very effective way of reaching consensus in group decisions, especially on controversial issues.

The steps for conducting an Affinity Diagram session follow.

a) Select a group facilitator who is neutral to the issue and knows the Affinity Diagram methodology.

b) Invite the right people, including all interested parties. This could be your GP Team and others as appropriate.

c) Clearly present the issue to be discussed in a full sentence. It can be phrased as a statement or a question.

d) Have each individual write down a number of ideas. 20 is a good number. A rule of thumb is that the number of ideas generated should be equal to 1.5 times the number of people. Ideas should be descriptive, but concise, and should include both a noun and a verb. Between 5 and 7 words is sufficient.

e) Have the individuals share their ideas with the group, allowing for clarification but NO judgments about the ideas. After two rounds through the group you can ask if there are more, different ideas to be contributed.

f) Have your GP Team place the ideas in different categories. Don't restrict the number, but it will usually be around five. During this stage, no talking is allowed between the participants, but no restrictions are applied to the number of times an idea can be placed/removed from any category.

g) Write headings for each category.

h) If the group is large, consider sub-dividing into small groups of three or four (or more) and have them write in readable language a couple of paragraphs that express the ideas in one category. If the group is small, then have the whole group work on one category at a time.

i) Share the results with the group as individuals and see if any modifications are needed. This step might not be necessary if the group worked together in the last step.

TIP Today there are many software programs that can help create an Affinity Diagram. However, the best tools continue to be sticky notes such as Post-It notes, file cards, a stack of paper made from recycled stock, a roll of tape, and thick non-toxic markers of different colors. The focus should be on the exercise, not the technology.

Why is the Affinity Diagram useful?

The Affinity Diagram is useful in helping the group step out of individual positions and creating a group position on an issue. This is done by motivating lateral thought instead of linear thought. The absence of speech reduces the potential for rock logic. It promotes cooperation amongst GP Team members. It can help break through longstanding communication barriers.

How will the Affinity Diagram help you?

The Affinity Diagram is one of the most simplest and efficient techniques for making group decisions. By using neutral statements you can encourage consensus.

Where do you apply the Affinity Diagram?

The Affinity Diagram can be applied to any group that has different stakeholders involved in decision-making. It fosters the most important outcome - a group decision, and does not allow the precise balance of the participation of group members to slow the process.

When is the Affinity Diagram useful?

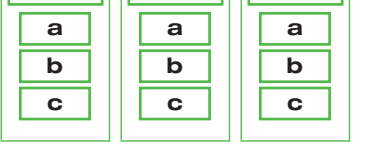
The Affinity Diagram is useful when you need a good understanding of a complex problem and an efficient decision from a group where the stakeholders have different opinions and there is no obvious middle ground.

Who benefits from the Affinity Diagram?

The GP Team benefits from this tool to overcome "team paralysis". Further, the whole organization benefits from regular use of the Affinity Diagram as it helps employees feel empowered to resolve issues themselves.

Ponder Point – User Notes

Should you involve people outside your organization in your GP program if they benefit by your efforts? List up to 7 people that you might wish to involve. An outside opinion can offer a new perspective, and identify opportunities for improved GP that may not have been considered within your organization.



Air Emission Control

What is Air Emission Control?

Air Emission Control is the collective name for methodologies and technologies that aim to reduce or eliminate pollution caused by an organization's emissions into the atmosphere. Air emissions do not respect organizational, property or political boundaries.

TIP Air emissions can be categorized as "sensible" pollutants - detected by human senses or as "insensible" pollutants - not detected by human senses. The latter can occur because its existence is a trace amount, or it has no detectable odour, taste or colour. Believing that air emissions are under control because nobody complains can be a mistake of unpredictable consequences for the organization.

Why is Air Emission Control useful?

Air emissions of any kind are an indication of inefficiency. Their presence is contrary to the objective of Green Productivity as air emissions are uncontrolled. Control of air emissions is a way to achieve your GP objectives and targets regarding air pollution. If well-planned and implemented, it can also be a way of recovering valuable resources from waste streams. Air emissions can manifest as particulate matter or gaseous pollutants.

How will Air Emission Control help you?

Air Emission Control will also help you to meet your GP commitment to continuous improvement. Air Emission Control is also useful because it can facilitate compliance with air pollution legislation and regulations, and is often a good mechanism to help meet or exceed workplace health and safety standards.

Where do you apply Air Emission Control?

Air Emission Control can be applied to any emission the organization sends to the atmosphere. However, those emissions containing valuable materials such as products or usable raw material should be addressed with priority, since their control can help finance other Air Emission Control programs. Techniques for Air Emission Control can include:

- Industrial Boiler emissions
- Acid Bath Fumes
- Chemical Odours
- Gravitational settlers
- Cyclonic collectors
- Bag filters
- Wet scrubbers
- Electrostatic precipitators
- Adsorption towers
- Adsorption columns

TIP One kind of air emission is referred to as fugitive emissions. These emissions are not fully controlled, but in most cases are not accidental. Examples of fugitive emissions are leaks from gas pipelines and valves, venting and flaring of gases, methane emissions from coal seams and vapour given off by petroleum stores.

When is Air Emission Control useful?

Air Emission Control is useful when the emissions of an organization are out of control or poorly understood. It can also be helpful to foster improved results when the expected results for your GP program are not being achieved.

Who benefits from Air Emission Control?

Air Emission Control reflects directly on the economic health of your organization, and on legal and social compliance. Not only does your whole organization benefit from better Air Emission Control, your workers and the community in which you operate also benefit.

Ponder Point – User Notes

Hydrogen sulphide (H_2S) at low levels creates a nuisance smell (like rotten eggs); at higher levels on a longer term basis it can cause teratogenic problems (birth defects). At very high levels, there is no detectable odour to the human nose, but it is lethal.

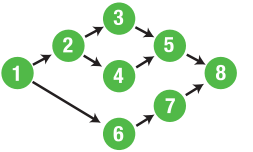
What chemicals do you have in your organization that may have a similar profile?

Air emissions are in the form of particulates or gaseous pollutants.

Air emissions are location-based; Eco-mapping (24.1) can help you remember and explain the important information about each point of emission.

Arrow Diagram

What is an Arrow Diagram?



An Arrow Diagram is a graphic description of the sequential steps that must be completed before a project can be finished.

The steps in constructing an Arrow Diagram are as follows:

1. Select a team that is knowledgeable about the project, its tasks, and subtasks.
2. Record all of the tasks and subtasks necessary to complete the project.
3. Sequence the tasks.
4. Assign a time duration to each task.
5. Calculate the shortest possible implementation time schedule using the critical path method.
6. Calculate the earliest starting and finishing times for each task.
7. Locate tasks with slack (extra) time and calculate total slack.
8. Update the schedule as the project is being completed.

TIP A more complicated version of this diagram is an Activity Network Diagram (4.1).

Why are Arrow Diagrams useful?

Arrow Diagrams are useful because they provide a visual picture of activities to be undertaken to help in the planning and communication of a project.

How will Arrow Diagrams help you?

Arrow Diagrams will help you to understand and manage a complex project or task. By breaking the project down into activities and plotting them out in order, these complex projects will be more manageable.

Where do you apply Arrow Diagrams?

Arrow Diagrams can be applied at the beginning of any GP project in your organization to define timelines and manage the schedule.

When are Arrow Diagrams useful?

Arrow Diagrams are useful when managing any project, but particularly when that project is of major importance to the organization, and the consequences of late completion are severe.

In addition to assisting in the planning and management of a project, like a Gantt Chart, they can be a useful communication tool on the scope and the progress of the project.

Who benefits from Arrow Diagrams?

The Project Manager is the key beneficiary from an Arrow Diagram, but the entire GP Team will also benefit from the clear definition of tasks and timelines that it entails.

Ponder Point – User Notes

In addition to Arrow Diagrams, other key project management tools that can help you improve the implementation of your GP Projects include: Brainstorming, Gantt Charts and Team Tools (11·1, 36·1 and 77·1).

Benchmarking

What is Benchmarking?

Benchmarking is a way of comparing the status or performance of your organization against standardized practices, or with other similar organizations. It can also be used internally to compare similar activities in different locations, departments or operating units within your organization. It is a continuous, systematic process.

The procedure for implementing Benchmarking is simple:

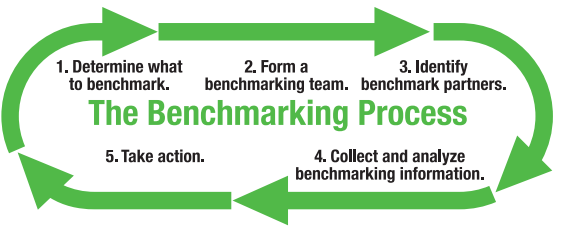
a) Decide upon the parameters that you want to benchmark.

b) Form a benchmark team (this could be your GP Team or include others).

c) Decide against whom or what you want to benchmark. Normalize the parameters you are going to measure (i.e. the parameters of different processes should be measured independently of the internal process and environmental characteristics so that they can be effectively compared).

d) Collect and analyze benchmarking information.

e) Take action (based upon what you learned and what to improve).



Once you have followed these steps, you can see where the gaps are between where you are and where you could be performing.

TIP Benchmarking can either be internal (inside your organization), competitive (against industries within your same market) or comparative (in common areas against all business sectors); they all look to describe the gap between your current situation and best practices.

Why is Benchmarking useful?

Benchmarking is useful because it maps the way from where you are to where you need to be to realize the success of your GP program. It provides a means of gauging the progress of an environmental program while introducing new and innovative ideas for improvement.

How will Benchmarking help you?

Benchmarking will allow you to set objectives and targets clearly aimed at best practices that are currently being applied by others. This is the starting point of your improvement process.

Where do you apply Benchmarking?

Benchmarking should only be applied to processes and parameters that can be normalized; when normalization is not possible Benchmarking can be misleading.

When is Benchmarking useful?

Benchmarking is a useful tool when your organization begins to adopt GP, or when your program is stagnating, and you need some new and innovative ideas. It gives you the direction of improvement in an objective way (as opposed to an intuitive way). It also provides a vision of what your organization could look like if improvements were implemented.

Who benefits from Benchmarking?

GP program developers benefit from this benchmarking tool, as they get a very clear picture of what they are aiming to accomplish and can use this tool to communicate both to management and to the employees.

Ponder Point – User Notes

Do you want to achieve best-in-class, world-class or best practices with your GP benchmarking efforts? There is an opportunity to find potential GP benchmarking partners by contacting your local International Green Productivity Association (IGPA) and inquiring if there are any interested parties.

Brainstorming

What is Brainstorming?

Brainstorming is a commonly used tool for generating ideas in situations that involve several stakeholders. It includes the generation, analysis and acceptance of ideas, which can be employed to solve problems, improve situations, prioritize events or set new strategies to promote GP.

The first step in a Brainstorming session is to recognize and assemble the appropriate group of stakeholders. This could be your GP Team or could include other stakeholders internal or external to your organization. To determine if others should be involved, you should answer the following questions:

a) Who is actually affected by the situation?

b) Who will likely be affected by the resulting solutions?

c) Who has the knowledge, skills and ability to understand the situation?

d) Who has the authority to approve solutions?

e) Who can facilitate the session? This should be someone who is knowledgeable about Brainstorming, but is not one of the stakeholders. The facilitator does not have to be a GP expert.

The second step is a logistic one, you need to get the right location. Normally any meeting room will suffice, but it is important to have the room as conducive to the process as possible. This checklist should help.

a) Is it a comfortable space for the stakeholders? Preferably the room allows a way for them to be face to face.

b) Is there a mechanism for easily sharing ideas? You can use a white board, overheads with transparencies, a laptop and projector, etc. Make sure whoever is recording the ideas can write legibly.

c) Is there privacy for the meeting so that people and the flow of the session are not disturbed during the process?

Once a comfortable place has been provided and your GP Team has been chosen, you need to define in a question the situation that needs to be discussed. Keep in mind what needs to be obtained (e.g. a priority list, a new strategy, a new solution, etc.). This should be done by the facilitator, and opportunity should be given to the members of the GP Team to clarify any questions that they have.

When the situation is clearly understood by every member of the team (sometimes a round to share perceptions is useful to ensure that everyone is clear), free generation of ideas should be promoted. At least two rounds of contributions should be asked of the members. During these rounds, clarification of individual ideas might be necessary but there must not be any criticism or judgment of the ideas (no matter how "off the wall" they might sound).

When all the ideas have been shared, support for ideas should be expressed. It is normal for new ideas to emerge by combining ideas from an earlier round. These improved or combined ideas should be discussed in further detail and as support grows, these concepts will be refined into their final form upon which you can act.

TIP A Brainstorming session works better when everyone is clear about the parameters of the situation at the beginning and there is a consistent understanding of the challenge.

Why is Brainstorming useful?

Brainstorming helps in several ways:

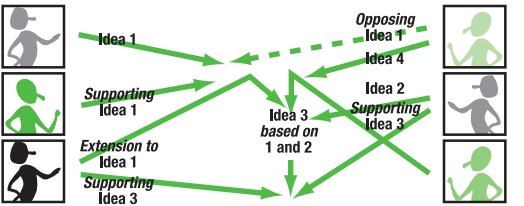
a) you produce solutions that incorporate the perspective of all stakeholders,

b) all stakeholders feel their input was taken into account to develop the solution, so they are more willing to participate in the implementation, and

c) it encourages stakeholders to communicate and consider ideas that might otherwise not have been tabled.

How will Brainstorming help you?

Brainstorming will help you solve problems when different areas are affected (e.g. sales and production) and where the solution will involve both sacrifices and rewards to the different areas. With Brainstorming, you will be able to get the different stakeholders to see other people's points of view and to find the best solution for the organization, not just the best for the individual stakeholder.



Where do you apply Brainstorming?

Brainstorming is applicable to any situation where the current condition or results are not desirable, and where normal or previously used resolution strategies have not provided the desired outcome. It is used where more than one stakeholder is involved. There are other Brainstorming techniques for individual application.

When is Brainstorming useful?

Brainstorming will come in very handy when there are a number of different stakeholders and where the process for generating new ideas must be free of judgment and criticism.

Who benefits from Brainstorming?

The greatest benefit logically goes to the organization. However, Brainstorming enables the stakeholders to think outside the box. They are able to see the full puzzle, not just their individual pieces. It can foster systems thinking benefiting not only the members of your GP Team but the whole organization.

Ponder Point – User Notes

Have you personally been charged with the challenge to brainstorm for your organization? Here are two choices.

One *– As GP has the potential to improve your community's prosperity, is there someone from your community that you could invite to participate with you?*

Two *– Brainstorm using PMI, a thinking tool created by Edward de Bono[1].*

PMI stands for Plus, Minus, Interest.

Make a number of suggestions to improve the situation you are trying to change. For each one, conduct a PMI exploration. Face a different direction to think about the idea from the following perspectives:

P = Plus - Write down the good things about an idea regardless of whether you like it or not.

Change direction.

M = Minus - Write down all the bad things about an idea. Again, consider not whether you like it or not, just the things that strike you as being potentially negative.

Change direction again.

I = Interest - Beyond what is positive or negative, what do you find interesting about the idea?

When you are finished, see where there are more points or where one of the PMI comments has a stronger pull.

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[1]De Bono, Edward. (1985). De Bono's Thinking Course. NY: Facts on File, Inc.

Certification and Registration

What is Certification/Registration?

Both terms (Certification and Registration) are normally used in the management system area to refer to third party verification of your management system through auditing.

The audit process is conducted by an organization with no commercial links to your organization (i.e. not a supplier or customer). Accredited registrars perform an audit of your management system and if it conforms to specifications agreed (e.g. ISO 9001 or ISO 14001, 46·1 and 47·1) then they will issue a certificate stating your conformance. Accredited registrars are also independently audited and have to meet certain standards.

TIP Certification/Registration is not the only option for demonstrating conformity to specifications. Consider your business drivers before making this important decision.

Why is Certification/Registration useful?

Certification/Registration is useful to demonstrate to others that you have implemented a robust and credible management system that conforms with stated requirements.

How will Certification/Registration help you?

Certification/Registration can help you demonstrate to your top management and external stakeholders that you have achieved external validation of your management system. In some cases, it can help you meet supplier requirements.

Where do you apply Certification/Registration?

Certification/Registration can be applied to any management system (or to products) for which there are standardized processes or specifications.

When is Certification/Registration useful?

This level of validation is useful when you want to demonstrate to others your conformity with a specification using external, independent and impartial means. It is useful when your business has higher risks and you need to provide your stakeholders with assurance.

Who benefits from Certification/Registration?

The market gets the benefit of being informed that an organization's products or services have met certain requirements. The organization benefits from reassuring itself that it conforms to a set of standards or requirements established by a multi-stakeholder approach. In addition, your customers and other stakeholders may find comfort in this level of validation. The advantages of this for your organization include priority access to business and reduced trade barriers.

Ponder Point – User Notes

The International Organization for Standardization (ISO) has many technical standards. In the area of management systems the two important standards relate to quality (QMS/ISO 9001) and environment (EMS/ISO 14001). The value of the standard itself is not in whether or not you certify to it. Its value is based on implementing and maintaining a robust and credible system that improves your business and profitability. Either standard allows you to self-declare once your organization has met all the requirements. You may also obtain confirmation of your conformity by getting validation by a party external to your organization. This includes second party assessments by suppliers or customers. Additionally, for ISO 14001, there is an application of an auditing procedure conducted by specially trained professional accountants that can provide you with recognition of your EMS (29.1).

Visit www.14000registry.com for details.

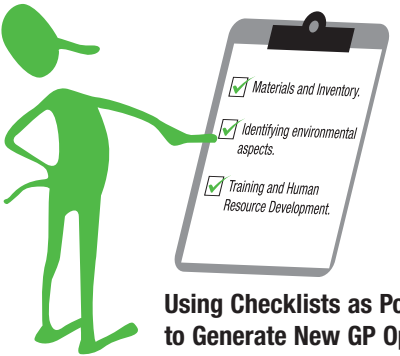
Checklists

What is a Checklist?

A Checklist is a set of questions or verification points (checkpoints) that an organization needs to monitor or address on a periodic basis.

The categories on a Checklist can include such issues as maintenance, compliance either with legislation or with internal codes of practice, equipment check up (pressure, temperature, etc.), availability of equipment (e.g. fire fighting equipment).

TIP When developing a checklist, always make sure that the checklist's format conforms to your organization's culture, and that members of the GP Team who are going to use it have been properly briefed with respect to its contents. The checklist can be written in bullet form or as a series of questions.



Using Checklists as Pointers to Generate New GP Options

Why are Checklists useful?

Checklists are useful aids to jog memory. They also can reduce variations between evaluations conducted by different members of the GP Team. This prevents the team from forgetting issues that need to be verified.

How will a Checklist help you?

A Checklist will help you in two precise ways:

a) it will provide you and the members of your GP Team with a guide for performing a review or an audit of the GP program, and

b) it will permit the data collected to be easily assembled for further analysis.

Where do you apply a Checklist?

A Checklist comes in very handy on any kind of routine inspection to ensure that all areas or requirements have been addressed. It can also be useful for verifying training efficiency through discussions with employees.

When is a Checklist useful?

A Checklist is useful when you have either multiple criteria or repeat evaluations over time since it provides a method for reducing variability between each evaluation.

Who benefits from a Checklist?

A Checklist will benefit those responsible for conducting evaluations. It serves to add clarity and consistency in the evaluation program.

Sample Checklist in Question Format

1. Are there written product specifications, process specifications and work instructions? If they are written in more than one place, do they all agree? Are they legible? Are they conveniently accessible to the GP Team?
2. Do the specifications define the relative importance of different environmental characteristics? Are advisory tolerances on a process distinguished from mandatory tolerances on a product? If Control Charts (16·1) or other control techniques are to be used, is it clear how these relate to the GP project specifications?

3. Are standards for visual defects displayed in the work area?
4. Are the written specifications given to the worker the same as the criteria used by inspectors? Are deviations from specifications often allowed?
5. Does the worker know how the product is used?
6. Has the worker been adequately trained to understand and perform the steps needed to meet the specification? Has the worker been evaluated by test or other means to see if he or she is qualified?
7. Does the worker know the effect on future operations and product performance if the specifications are not met?
8. Does the worker receive specification changes automatically and promptly?
9. Does the worker know what to do with defective raw material and defective finished product?
10. Have responsibilities in terms of decisions and actions been clearly defined?

Ponder Point – User Notes

How do employees know if they are doing right things correctly?

Record keeping and information management is a fundamental challenge to any organization. Without good records improvement can be more difficult. Their absence can hinder your organization's management as there is less or poor evidence of success. Checklists are an easy way to guide employees in their GP efforts and provide a means of recording progress.

Check Sheets

What is a Check Sheet?

A Check Sheet is a means of recording data. A Check Sheet can be a record of a past activity, or a means of tracking observations to enable you to see trends or patterns in an objective manner. It is a simple form of keeping some statistical measures of data needed to prioritize events or to develop new GP projects.

Normally a Check Sheet will track events per time; it can also be used to track the number of events per location. This data can then be used as input for a Concentration Diagram, an Eco-Map or a Pareto Diagram (15.1, 24.1 or 56.1).

Examples of issues to be tracked can be: spills per month, corrective maintenance calls per week, hazardous waste generated per working hour, etc.

Case Study

Number in a week

Number of instances lights were kept on by customer after leaving the room.

Number of instances water was left running by the customers.

Number of customers who demand daily change of room linens, towels...(unused)

A hotel was trying to develop environmentally sound options for their rooms. To devise such options, the Green Productivity team decided to use Check Sheets to study the behaviour and habits of their customers. Behaviours studied included energy consumption, water consumption, cleaning and laundry requirements.

The results helped the hotel management assess those habits that were the potential problems to be addressed first.

Options included:

- using room key controlled light switches, which switch off upon removal of the key from the holder
- putting banners and instructions for customers to conserve water
- instructing guests to identify used linen for laundry by placing it on the floor or in a basket

Note: A Check Sheet is different than a Checklist, which is used to ensure that a series of actions have been undertaken (13·1).

TIP When presenting the results of a Check Sheet, place the events in order with most occurrences at the top the least number of occurrences at the bottom. This will help you highlight the main issues quickly.

Why are Check Sheets useful?

Check Sheets are useful because they provide objective evidence (versus subjective evidence) about occurrences of an event.

How will a Check Sheet help you?

A Check Sheet will provide you with data that is sufficiently convincing to demonstrate the need for a program to implement a solution. Design your Check Sheet to be clear and concise, this will make it easier to use.

Useful Identifiers:

a. name of the GP project
b. location of data collection
c. name of person recording the data, if applicable
d. date (an event or a duration)
e. other data for clarification

Useful Descriptors:

f. column for recording the defect/event name
g. column(s) for recording date(s) where data collection occurred
h. totals for each cell where data is recorded
i. totals for each row and column of data

Where do you apply a Check Sheet?

A Check Sheet is commonly applied when you have difficulties assessing information that is subjective (i.e. "we have many unused waste bins") to make it objective (i.e. "three waste bins were not used in two days during the last week").

When is a Check Sheet useful?

A Check Sheet is useful when you need a quick assessment to quantify a trend or pattern when there is not time or money for a full statistical analysis.

Who benefits from a Check Sheet?

A Check Sheet is used mostly at the planning stage by members of your GP Team who are responsible for planning new strategies/programs/improvements. They can get quick confirmation that their idea is working, or where improvement is needed to correct the GP project.

Ponder Point – User Notes

As Check Sheets are a low cost easy-to-use tool they can give your GP Team quick insight into whether or not a process is working according to plan. Make sure that before applying the Check Sheet, your GP Team understands the criteria. Is their definition of 'environmentally sound" consistent?

Concentration Diagram

What is a Concentration Diagram?

A Concentration Diagram is a diagram (which can be in the form of a layout), which shows where some problem is occurring or has occurred in the past. This allows you to focus your attention on reducing variation or eliminating the problem.

Examples of problems that might be investigated by a Concentration Diagram include spills, leaks, accidents, high internal inventory, etc.

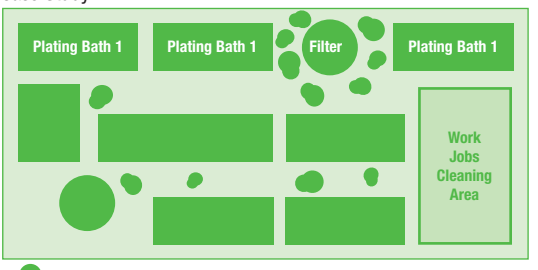
To develop a Concentration Diagram, start with the Plant Layout (57·1), in whole or in part. Most importantly, it must be a manageable area of the organization.

Once you have the Plant Layout you will need historical and actual information of what you want to chart (e.g. energy use).

Plot the information collected on the layout to show where the problems have been detected. You can further distinguish problem areas by altering the icons you use to indicate differences in the severity of a problem.

This will show areas where the problem appears to be "concentrated". These are your "hot" areas where most attention must be placed.

Case Study



An electroplating shop observed high flow in its floor drains. The Green Productivity team monitored the locations of the spills along the production line for a period of time, using concentration diagrams. The diagram revealed a particular plating bath and the next dragout recovery unit as the area with the maximum number of spills. On checking the area it was found that a filter located between the two tanks (for continuous filtration of plating bath solution), increased the dragout spills during operation. Relocation of the filter solved the problem and the flow into the floor drains was reduced.

TIP You can use different coloured markers to show related problems on the same diagram (e.g. leaks and spills).

Why are Concentration Diagrams useful?

Concentration Diagrams provide a fast and efficient way to chart the information on important issues tied to the places in which they happen. This can be a starting point for a cause and effect diagram, called a Fishbone Diagram (33·1) or for prioritizing areas where GP programs should be focused.

How will a Concentration Diagram help you?

A Concentration Diagram will provide you with initial insight on where to focus your GP programs, identifying the weakest areas of your process from an issue standpoint.

Where do you apply a Concentration Diagram?

You apply Concentration Diagrams to any process within your organization.

When is a Concentration Diagram useful?

A Concentration Diagram is useful as a starting point for improvement programs such as Good Housekeeping practices (37·1). It can help you set priorities within your GP program.

Who benefits from a Concentration Diagram?

The Concentration Diagram will benefit the leader of the GP program in terms of setting priorities. It can help you focus the initial efforts of your GP program on the more important areas, which normally can provide the greatest improvement and higher returns.

Ponder Point – User Notes

Eco-maps (24·1) utilize the Concentration Diagram concept and the two techniques can often be used in harmony.

Control Chart

What is a Control Chart?

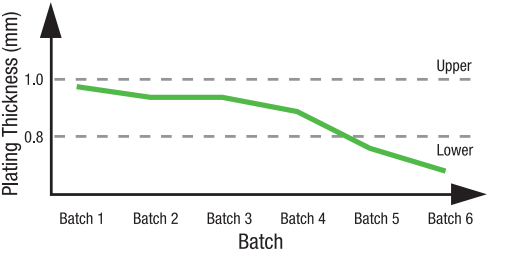
A Control Chart is a graphic representation of how a variable behaves over a period of time in relation to set limits. There are many types of Control Charts; the following instructions will provide you with a basic approach.

To develop a Control Chart, you need to decide three things:

1. what variable (parameter) are you going to measure?
2. what is the maximum accepted value for this variable (upper limit)?
3. what is the minimum accepted value for this variable (lower limit)?

With this information you draw a Cartesian axis with the lower and upper limits indicated, and then plot the values of the variable over time.

This way, trends and normal behavior are easily seen and corrected before they reach limits.



TIP 'Control' does not necessarily mean that the resultant product or service will meet your needs; it means that the process is consistent. Control limits, the maximum and minimum levels, should not be confused with specification limits. It is preferable to focus on one parameter. When more than one variable is tracked, you need to differentiate the limits for each variable (e.g. temperature, emergency indicators, quality tolerances). This is called Stratification.

Why is a Control Chart useful?

A Control Chart allows you to monitor problems and verify if corrective actions have had the desired effect. The Control Chart itself is not the solution; you still need to take action based on what you learn.

It is also very useful as a prevention tool for critical parameters of your operation that might cause overall problems if they fall outside of specifications (limits). Therefore tracking them can show trends and preventive actions can be implemented to avoid these parameters crossing their control limit values.

How will a Control Chart help you?

A Control Chart will provide you with timely information about parameters that have become critical to your operations. Thus Control Charts become like a pulse monitor for your work process - they can tell you if your processes are healthy or if they need attention.

Where do you apply a Control Chart?

A Control Chart can be applied to any parameter whether to improve efficiency (e.g. products per hour), or to prevent a problem from occurring (i.e. most broken O-rings are found during preventive maintenance).

When is a Control Chart useful?

A Control Chart is very useful when you need to keep close control of a parameter (variable) of your processes to avoid causing a significant Environmental Impact (28·1).

Who benefits from a Control Chart?

The GP Team leader benefits from the use of Control Charts because it clearly illustrates problems that are occurring, or the results of corrective actions implemented. The GP Team leader is therefore able to better allocate resources at hand.

Ultimately, the whole organization will benefit as it allows the direct evaluation of corrective measures and identifies the need for preventive measures.

Ponder Point – User Notes

Once you have the data on your Control Chart, you can ask questions to help articulate the problem. Here are some common questions for investigating an "out-of-control" process. The answers to these are either "Yes" or "No". For every "Yes", your GP Team needs to investigate why this occurs. You can use a Fishbone Diagram in concert with your Control Chart to understand cause and effects (16·1).

1. *Are there differences in the accuracy of the measurements taken?*
2. *Are they caused by the method or instruments employed?*
3. *Are the methods used consistently by all personnel?*
4. *Is the process affected by the environment (e.g. humidity, temperature, pollutant)?*
5. *Has there been a significant change in workplace conditions?*
6. *Is the process affected by predictable circumstances (i.e. wearing out of a part)?*
7. *Were all the personnel involved properly trained?*
8. *Is the process affected by the performance of an employee?*
9. *Has there been a change to the process or to a policy controlling the process?*
10. *Did the problem arise because of human error and the person involved was afraid to report it? (Fix this fast!)*

Cost Benefit Analysis

What is a Cost Benefit Analysis?

Cost Benefit Analysis (CBA) is a financial/accountability tool that translates productivity and environmental benefits into monetary units. It is also referred to as a Profitability Analysis.

All GP projects must reflect an economic improvement for the company either by saving money (reducing or avoiding costs) or producing money. CBA is a way to analyze how, when and in what magnitude this will occur.

There are three basic concepts in a CBA.

Simple Payback: this is the time over which a project will return the initial investment, and it is obtained by dividing the investment capital required by the annual savings achieved.

$$\text{Payback} = \frac{\text{Capital Investment}}{\text{Annual Savings}}$$

Net Present Value (NPV): this is the present value of the future cash flows generated by the project, subtracting the investment's current cost.

If you are mathematically inclined and have a calculator with exponential functions, you can also use the following formula:

$$\text{Present value} = CF_0 \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \frac{CF_n}{(1+r)^n}$$

(When using this formula, CF_x=cash flow in period x, n = the number of periods, and r = the discount rate.)

Note that whenever you do time value of money calculations to find a present or future value (such as NPV), you'll need to specify an interest rate, known as the discount rate. Choosing the appropriate discount rate is a very important part of the process.

Internal Rate of Return (IRR): this is the rate of return on the investment calculated with cashflows. This is a comparison method with the rate of return in the money market.

Normally you will use all three concepts in order to get a clear picture of the cost and benefits of each option in your GP project.

TIP If the NPV of a project is positive, and the IRR is higher than the market cost of money; then the project is profitable. The payback indicator is just a measure that can be adjusted to decide the economical time horizon of the project.

Why is a CBA useful?

A CBA is useful because it provides the GP Team with hard economic data about the projects or options. A GP project that is not financially viable should be revised in order to create options that provide the same productivity and environmental improvements but that are financially viable.

How will a CBA help you?

A CBA will help you by translating your GP projects into economical terms. In this way they can be shared and compete with the other projects your company may be considering outside your GP program.

A simple example of NPV may be useful. If a GP project costing $7,500 is expected to return $2,000 per year for five years, the total would be $10,000. At first glance, the project looks profitable. Under the Simple Payback method, the project would appear to pay for itself in 3.75 years. However, using NPV analysis you can determine that if the cost of borrowing (called a discount rate) on the project was 10 percent, the NPV of the expected returns would be $7,581.60. In other words, if you had $7,581.60 today and invested it at 10 percent, after five years you'd wind up with $10,000, the same return as your GP project. Thus, it looks as if the expected additional return on the project has shrunk to about $81. It may not be worth the time and effort unless you can determine other benefits such as reduced Environmental Impact (28.1) or social benefits.

Where do you apply a CBA?

A CBA must be applied where economic issues are a deciding factor for a GP project. However, they are still useful to do where budgets are not as critical to demonstrate the value of GP to your bottom line.

When is a CBA useful?

A CBA is useful when you want to analyze different GP options and the costs associated. They can also be conducted where the risks and rewards of adopting GP are being scrutinized. It can help to prioritize projects and illustrate where the greatest opportunity for your investment exists.

Who benefits from a CBA?

A CBA is particularly valuable as it can provide the GP Team with a tool to communicate their ideas to management. In addition, the whole organization can start to understand the power of GP. It translates projects that are normally isolated by operational and environmental jargon, to a language that is spoken by the whole organization: money. In this way, projects involving productivity and environmental improvement can be justified and compared with other capital projects being considered by the organization on a level playing field. Often the perceived economic impacts of GP can be used as a barrier to change. Traditional assessments of this kind can demonstrate that GP is worthwhile.

Ponder Point – User Notes

A CBA can be conducted even when there is no capital investment required. The following tables demonstrate a case study for a situation involving a capital investment, and one without.

White Water / Fiber Reuse in Pulp and Paper Industry

Capital Costs:

Saveall Equipment	$345,985
Saveall and White Water Pump	
Materials	$374,822
Piping, Electrical, Instruments & Structural	
Installation	$397,148
Engineering	$211,046
Contingency	$140,403
Equipment Life	15 years
Borrowing Rate of	
Interest	15%
Total Capital Costs	**$1,469,404**

Annual Savings*	$350,670
Financial Indicators	
Simple Payback Period	4.19 years
Net Present Value	
Years 1-15	$359,544
Internal Rate of Return	
Years 1-15	21%

**Annual operating cash flow before interest and taxes*

Combined Scour-Bleach in a Cotton Textile Unit in Egypt

Savings in:	Conventional:	Combined:
Chemical Costs	(1.1)	107.0
Water Use	3.8	0
Steam	16.5	0
Electricity	3.4	0
Labour	9.0	0
TOTAL per ton	31.6	107.0
Annual Production	591 tons	591 tons
ANNUAL SAVINGS	**18,622**	**63,249**

Data Points

What are Data Points?

Data Points refer to a set of collected facts. Data Points can be used to highlight problems, to answer questions and to improve productivity and environmental performance. Data may be fixed or variable.

There are two main types of data:

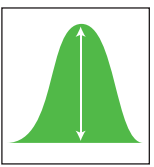
a) **qualitative data:** data which you (or your GP Team) give as a value-based response founded in subjective criteria such as ideas, feelings, experiences, etc. Words will likely be part of the data gathered.

b) **quantitative data:** data that has been obtained by objective measures and is presented in numeric description.

If you want to work with the absolute significance of your data, you might need to transform it from qualitative to quantitative using tools such as a Decision Matrix (19·1). However if you want to see trends you might be able to work directly with qualitative data. For example, you can reflect in a Histogram (41·1) the value your GP Team gives to certain factors (e.g. customer satisfaction).

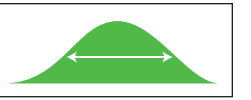
Through analysis of data, you can often see trends and values in more detail. This means you already have quantitative data. For this data there exists mainly two categories of analysis you can do:

a) **central tendencies:** these are measures indicating where the mainstream of the data is found, and includes:



- mean: this is the average of the data
- mode: this is the value that has been repeated most frequently in your sample
- medium: in ranking the order of data, this is the centre number, for which 50% of the data is greater and 50% is lower.

b) dispersion tendencies: these are measures of how close to the mainstream the data is situated. There are several types of these measures, but the most practical are the 'variance' and the 'standard deviation':



- variance(s): the variance is a calculation of how far away the data is from the mean, and averages this distance for all data points. To obtain the value of the variance, you perform the following exercise:

  a) calculate the average of the data

  b) subtract the average from each data point (this result is called the individual error)

  c) multiply each individual error by itself (squared individual error)

  d) add all the squared individual errors, and divide by the number of data points; this is the variance

- standard deviation (s^2): follow the same steps as for variance and then multiply the variance by itself.

Both these measures will tell you how much of your data is represented by the central tendency (especially by the mean). The larger the variance and standard deviation value, the more disperse your data is, and the less descriptive it is of a norm. They can also be helpful in assessing the degree of variation occurring in a process.

TIP Most commercial spread sheet programs provide data analysis functions such as mean, mode, variance and standard deviation.

Why are Data Points useful?

Data Points are useful because they give you insight into the issue you are trying to analyze, whether it is qualitative or quantitative.

How will Data Points help you?

Data Points will help you to organize your data for use with other tools, or to help process it into information, on which decisions can be based.

Where do you collect Data Points?

Collect Data Points from wherever you need to analyze a situation and have a need to understand what the data that you have collected really represents.

When are Data Points useful?

Data Points are useful when you need to better understand the picture that you are getting from your data, and when you need to format your data in order to use specific performance enhancing tools. It is important to note that numbers alone may not give you the whole picture. A combination of quantitative and qualitative information may be necessary to complete your understanding.

Who benefits from Data Points?

The use of Data Points enables the user to turn data into usable information on which to base decisions. Understanding the source of information benefits the GP Team members, the leader and ultimately the whole organization.

Ponder Point – User Notes

You can increase the performance of your GP Team when they are confident in the data and in their ability to apply the right tools to the available data. It can also enhance their confidence in problem solving.

Decision Matrix

What is a Decision Matrix?

A Decision Matrix is a tool that converts qualitative data into quantitative data, by using evaluation criteria.

To develop a Decision Matrix you:

a) identify what options you have.

b) decide what criteria you are going to use.

c) select a scale or a weight for each or all the criteria.

d) evaluate every option in accordance with the criteria and scale, thus deciding the best option.

TIP Using a logarithmic scale when weighting the criteria will provide a wider differentiation between the options, making it clear which option is better for your organization.

Why is a Decision Matrix useful?

Often decisions must be based on qualitative data that is hard to analyze. This data is also normally shadowed by personal impressions and feelings, so the discussions about best options sometimes slide from the strategic level to the personal level.

With a Decision Matrix, everyone can participate in a process that leads to a group decision with quantitatively compared data.

How will a Decision Matrix help you?

A Decision Matrix can reduce personal conflict between options selected from a qualitative standpoint. It can also allow the GP Team to compare its own needs, values and envision the different options, understanding which better fits with the GP strategy.

Where do you apply a Decision Matrix?

A Decision Matrix is applied whenever there are several options and several qualitative criteria for the path forward; and this criteria are not easy to compare.

When is a Decision Matrix useful?

A Decision Matrix is needed to clarify the relative risks and rewards of any path forward where the decision includes qualitative measures, or quantitative measures that are not directly comparable. A Decision Matrix can help you when you are trying to assess the significance of Environmental Aspects and Impacts (28.1) where there is no quantitative data available.

Who benefits from a Decision Matrix?

Planning areas will benefit from the use of this tool, but since the Decision Matrix can be used also as a group decision tool; the whole GP Team benefits from its use.

Ponder Point – User Notes

A Decision Matrix can be used to help you set priorities. A sample matrix is provided.

Prioritize the concerns using the following ranking system:

- ***1-4*** → *not urgent, lower concern*
- ***5-8*** → *medium urgency, greater concern*
- ***9*** → *urgent and critical*

ISSUE OF CONCERN	RANK	PROPOSED SOLUTION	PROCESS TO ACHIEVE	TEAM MEMBER RESPONSIBLE FOR THE ACTION

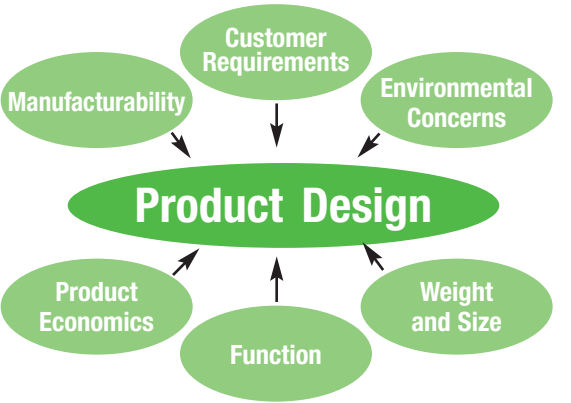
Design for Environment (DfE)

What is a Design for Environment?

Design for Environment (DfE) is the systematic integration of environmental considerations into product design. It does not mean that a product is designed solely for the environment or that the environment is the only consideration.

TIP DfE considers the potential environmental impacts of a product throughout its life-cycle. A product's potential environmental impacts range from the release of toxic chemicals into the environment to consumption of nonrenewable resources and excessive energy use. DfE does not have to be expensive and can save significant resources in the long term.

Product Design Consideration



It may help you to visualize DfE opportunities by creating a Flowchart (35.1) that identifies all the stakeholders who are involved in the product's life cycle.

Why is Design for Environment useful?

Design for Environment is useful because it provides a holistic perspective of the interaction of the product and the environment from cradle to grave. Armed with such information, decisions can be made on how environmental impacts can be avoided through better design, not treated afterwards.

TIP A refined approach to DfE has been introduced. Products designed under the concept of cradle-to-grave may end up in landfills at the end of their life cycle. Now there is a push to create products with cradle-to-cradle cycles. These materials are perpetually circulated in closed loops. Container glass for example if recycled back into a new glass container is an example of cradle-to-cradle. Maintaining materials in closed loops maximizes material value without damaging ecosystems. Closing the loop does not mean there is no environmental impact. It may reduce the severity of a negative impact, or turn it into a positive one.

How will Design for Environment help you?

Design for Environment will help you overall in lowering production costs through efficient resource utilization, reducing environmental impacts, and improving environmental performance.
More specifically, it can help you to:

- Reduce the environmental impact of products/processes.
- Optimize raw material consumption and energy use.
- Improve waste management/pollution prevention systems.
- Encourage good design and drive innovation.
- Cut costs.
- Meet user needs/wants by exceeding current expectations for price, performance and quality.
- Increase product marketability.

Where do you apply Design for Environment?

Design For Environment should be applied every time a new product is conceived, in the idea generating phase. This way the overall performance of the product will be enhanced. However DfE principles can help in re-designing products in combination with Life Cycle Assessment (50.1).

When is Design for Environment useful?

As it offers new perspectives with a product and business focus, the point of application for DfE is early in the product realization process. Decisions are made using a set of values consistent with industrial ecology, integrative systems thinking or another framework.

Who benefits from Design for Environment?

Production and operation managers benefit from DfE by realizing reduced costs and liabilities related to their environmental aspects. Product users benefit from a lower environmental burden and potentially reduced maintenance and disposal costs downstream. This can lead to an increase in product sales, benefiting the company's overall bottom line.

Ponder Point – User Notes

It is often thought that small business perceive DfE to be time-consuming and too expensive to implement. Larger entities are more likely to have the capital to invest in commercializing a DfE product. However, small businesses should not shy away from the potential to use DfE where they control design. Brainstorming (11.1) can help you invent a better product that may allow you to collaborate with another company to establish a niche market opportunity. There are financial rewards and environmental benefits available to you if you can redesign your products to simulate natural flows. These may be shared with your customers and your community.

Design of Experiments

What is Design of Experiments?

Design of Experiments is a statistical approach to problem solving. More precisely it determines the effect of changes that are introduced into a process under controlled conditions. Its developers and promoters present it as the most accurate problem solving technique and probably the only tool to systematically solve chronic problems.

While they may be correct, the downside of Design of Experiments is that it is relatively complex. It requires specialized and highly trained persons to apply it, taking time and requiring a substantial amount of information.

So Design of Experiments can be described as a very powerful but resource-intensive tool for solving problems, more or less the equivalent of an organ transplant in medicine.

The basis of Design of Experiments is to compare the effects of different variables and avoid the interactions between them by detecting them. There have been numerous examples of decisions where Design of Experiments would have helped achieve a better solution.

A case study that is commonly referred to was that of a factory in the US that in the mid-20th century was forced to pay relocation costs of nearby residences because of an incidence of tuberculosis that was supposedly caused by its operations. However, when the community moved the tuberculosis rate continued. The problem was not the company, it was the health conditions that the people lived in, which did not change with moving the community. A good Design of Experiments would have shown the influence of each factor and provided elements for a better decision.

TIP Design of Experiments does require statistical training and hands on practice. An organization wishing to apply this tool as part of its GP process should train its members using Adult Learning (6·1), to achieve the necessary level of mastery in this field.

Why is Design of Experiments useful?

Design of Experiments is useful because it allows information that comes from experimenting to be solid and precise, avoiding misleading data. It helps to truly understand the cause and effect of activities undertaken and their interactions. While this technique is more difficult to do, the potential benefit is substantial.

How will Design of Experiments help you?

Design of Experiments will help you by providing the precise path to carry on an experiment. It also outlines the precise way to analyze the data and arrive at conclusions that are suitable for decision making.

TIP There are 8 criteria that you should follow to ensure the success of this technique.

1. Set precise objectives - what is it you are trying to solve?

2. Measure responses quantitively - if applied to visual inspection for quality the use of a pass or fail response is too vague.

3. Replicate to dampen uncontrollable variation (such as noise) - the more times you repeat the experiment and get consistent results, the higher your chance of success. Control Charts (16.1) are useful to track the results.

4. Randomize the Run Order - some changes are time-dependent. For examples, if your photo-copier is jamming (and you are wasting paper as a result), changing certain variables may indicate that at specific times of the day the humidity is causing a variance in the quality of the paper, leading to the machine problems.

5. Block out known sources of variation - such as shift changes, raw material batch, machine differences. This will help to narrow the focus.

6. Know which effects (if any) will be aliased. Aliased means that you have changed two or more things the same way at the same time.

7. Perform a sequential series of experiments. By executing the experiment in an iterative manner, the information gained in one test can be incorporated into the next run.

8. Confirm you results. After your investment in planning, implementing and recording your results, double check them to ensure that you are correct.

This can mean the difference between a successful GP project and one that needs to be stopped or redesigned.

Where do you apply Design of Experiments?

You apply Design of Experiments where you have found a chronic problem in productivity, quality or environmental performance and do not see an obvious solution to it.

When is Design of Experiments useful?

When you need to solve a chronic problem and your normal problem solving techniques cannot get to the root cause and solve it (most commonly because of variable interactions).

Who benefits from Design of Experiments?

Design of Experiments is intended to solve a chronic problem, and stabilize the process as a result. Not only can this help those involved in that aspect of the process, problems of this nature are usually not insignificant. Therefore it is likely that the whole organization will derive benefit, which is important given the investment required to use this tool.

Ponder Point – User Notes

Now, more than ever before, marginal improvements in a manufacturing process, although useful in the short term, will not provide the needed levels of quality, reliability, or economy of production. Serious rethinking of not only what products you produce, but how you produce them, is critical to making the breakthroughs that will give you competitive advantage in a growing green global marketplace.

Design of Experiments can help you track fugitive emissions. Some process flaws may be small relative to a spill, but the continuous slow release of a gaseous compound can cause environmental damage and be a drain on your profit.

Greater gains are obtainable by moving from the mindset of coping with waste after the fact, to managing at the end-of-pipe to integrating environmental concerns into the design stage (see Design for Environment, 20·1).

Design of Experiments can help you with your existing process. Do not discount the opportunity of a complete rebuild. A Cost Benefit Analysis (17.1) can help you determine whether to improve your existing system or rethink the whole process.

Improvements in environmental quality can be as significant as those in process quality when you apply a systems approach to making the changes in the design phase. The evolution of quality control confirms that design is where attention should be focused.

Ecological Footprint

What is an Ecological Footprint?

An Ecological Footprint refers to the land and water area that is required to support a defined human population and their material standard indefinitely, using prevailing technology. While first developed as a planning tool for communities, refinements are being made to apply this to single organizations and individuals.

It accounts for the size and effect of the impacts i.e. "footprints" on the earth's ecosystems made by an organization. It is a simple way to represent relative sustainability based on a number of complex interlinked factors such as human population numbers, consumption patterns and technologies used.

Your organization's Ecological Footprint is a measure of all your environmental impacts.

TIP An Ecological Footprint is a good way to visualize the sustainability of your organization in terms of development, not only environmental performance. Remember that GP is a holistic strategy. As an umbrella approach, it has many tools to support you as you work towards sustainable development.

Why is an Ecological Footprint useful?

It is a good conceptual tool. An Ecological Footprint rates your organization relative to the rest of the world. It shows the magnitude of your environmental burden from a larger scale and a more holistic view. As such, it can be used as an input into your Benchmarking efforts (10·1) to provoke thought.

How will an Ecological Footprint help you?

An Ecological Footprint can help you understand the importance of the flows of energy and matter to and from any defined economy (even as small as your organization). It can be used as a visioning tool in a Brainstorming session (11·1), prior to conducting an Energy or Material Balance (26·1 and 51·1).

There are five assumptions to consider:

1. It is possible to keep track of most of the resources people consume and many of the wastes people generate.
2. Most of these resource and waste flows can be converted into the land area that is required to maintain these flows.
3. These different areas can be expressed in the same unit (hectares or acres) once scaled proportionally to their biomass productivity. In other words, each particular acre can be translated to an equivalent area of world-average land productivity.
4. Since these areas stand for mutually exclusive uses, and each standardized acre represents the same amount of biomass productivity, they can be added up to a total.
5. This area for total demand can be compared with nature's supply of ecological services, since it is also possible to assess the area on the planet that is biologically productive.

There are websites that you can visit and if you answer a set of questions, your footprint is assessed for you.

However, if you want to get people to think about the idea of an Ecological Footprint as part of an ongoing learning process, have them keep a record of their consumption-related expenses. Categorize them as housing, food, transportation, goods and services. Record the quantities and the costs. Have them access one of the free calculators on-line to determine their footprint.

Where do you apply an Ecological Footprint?

An Ecological Footprint analysis can be used in the planning phase to promote thinking about an organization's total burden on the ecosystem in which it operates (here the term operates includes all its Activities, Products or Services, 5·1).

When is an Ecological Footprint useful?

An Ecological Footprint is useful when you want to assess the impact of your whole organization on the ecosystem. It is not a precise analytical tool compared to Design of Experiments (21.1) but can be useful to provoke new ideas. It can be used as a Benchmarking tool (10.1).

Reviewing your results and updating your Footprint annually can help you share information about the success of your GP program.

Who benefits from an Ecological Footprint?

An Ecological Footprint is a good planning tool. Members of your GP Team can benefit from seeing how your organization compares to others. It can motivate Brainstorming (11·1) about improvement options, and it can enhance community relations if it is made public (e.g., a corporate report).

Ponder Point – User Notes

Some of those who are involved with the development of the Ecological Footprint process have offered a different perspective on Sustainability: Satisfying lives for all within the means of nature-now and in the future.

The average American uses 24 acres to support his or her current lifestyle. In comparison, the average Canadian lives on a Footprint 30 percent smaller (17 acres), and the average Italian on a footprint 60 percent smaller (9 acres). Visit ***http://www.rprogress.org/programs/sustainability/ef/quiz/*** *to see how your own Footprint compares.*

Sustainability requires living within the Earth's carrying capacity, i.e. what it naturally inputs, manufactures and outputs. To measure the extent to which humanity satisfies this requirement, data that translates human demand on the environment into the area required for the production of food and other goods, together with the absorption of wastes has been calculated.

The demands humans have placed on the Earth may have exceeded the biosphere's regenerative capacity since the 1980s. According to a preliminary assessment, humanity's load corresponded to 70% of the capacity of the global biosphere in 1961, and grew to 120% in 1999.

Accounting for Humanity's Use of the Global Biosphere
http://www.pnas.org/cgi/content/abstract/142033699v1

Ecology

What is Ecology?

Ecology is the scientific study of the interrelationships among organisms and between organisms, and between them and all elements, living and non-living.

TIP Ecology in some cultures is confused with the term environment, so you might find issues related to the topic of environment under the heading of ecology.

Why is an understanding of Ecology useful?

Ecological knowledge is useful because it permits you to make informed decisions about how your organization interacts with the environment.

How will an understanding of Ecology help you?

Ecological knowledge will provide you with better tools and skills to assess the interactions between your organization and the environment (i.e., evaluation of Environmental Aspects (28·1)). It will enable you to better understand the true costs, risks and consequences of your business decisions.

TIP Quite simply everything you do has an impact. Breathe in, you are taking in air to extract oxygen required by your body to function properly. Breathe out, you are expelling carbon dioxide, this is the air emission you produce.

Plants take CO_2 from the air and utilize it in photosynthesis. This is the process that converts energy in sunlight to chemical forms of energy that can be used by plants. Plants are the basis of food for all animals, including humans. Keeping this cycle free of problems is a good idea.

Where do you apply Ecological Principles?

Ecological principles should be applied in all business decisions in order to give them a more holistic view.

When is Ecology useful?

It is useful whenever there is a decision that affects a change in your business process, including the choice of raw materials and suppliers. If everyone thought about what the impact of their next action prior to execution, and acted to minimize the negative aspects, this one small act would have significant positive impact on the environment.

Who benefits from an understanding of Ecology?

Understanding ecology even from a high level can result in savings to your business, a reduction in legal liability, and the potential for repositioning yourself for competitive advantage. Ecological knowledge benefits the organization's decision-makers, giving them a fresh perspective and an understanding of the longer term potential benefits of your GP program.

Ponder Point – User Notes

Applying ecological knowledge does not mean you have to be a scientist with a Ph.D. Here are some simple guidelines that could help you improve decisions and result in substantial benefit over time.

Everything you do is underlined by a contract with Mother Nature. As a result, there are five key principles for you to keep in mind.

One – *everything you do has an impact. Nothing happens in this world without affecting something else, so take care to minimize the impact of each and every step you take.*

Two – *ultimately you have ONE supplier, the SUN, (no replacements, no substitutes, no alternatives), hence do nothing to weaken your supplier agreement.*

Three *– you have to deal with the distribution network -* ***called photosynthesizers.*** *They have an iron clad contract with your supplier that union leaders would be envious of, it cannot be dropped or circumvented.*

Photosynthesizers are the distribution network; they convert solar energy into chemical energy. Only green plants can do this.

Four *– all products and services are customized; hence there are many distributors within the network to ensure the customer gets what he or she needs.*

This is why biodiversity is important: maximize your supply chain options.

Five *– all production is based on energy which comes from your one supply source. There are two sub-clauses.*

1. *Energy is neither created nor destroyed, it can only change form. Ergo there is NO SUCH THING AS "THROW IT AWAY," because there is no "away."*
2. *No transformation is 100% efficient, so plan your production process to utilize every iota of energy, waste not a BTU or a Joule.*

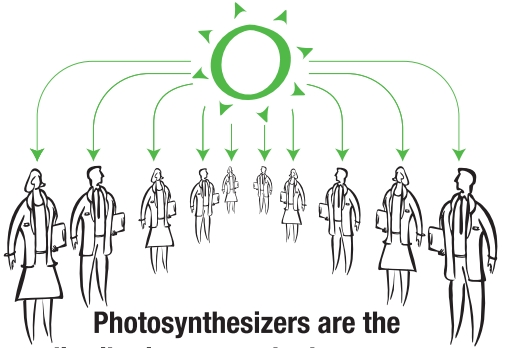
TIP You can not stop Climate Change as part of your first quarter plan, but one action can cause a positive reaction. Here are three simple suggestions that anyone can do.

Turn off your car or moped when it is not in motion.

Walk whenever you can.

Don't smoke.

Ecological relationships of note.



Photosynthesizers are the distribution network, they convert solar energy into chemical energy.
Only GREEN PLANTS can do this.

Each Customer is Unique!

This is the place called

AWAY

Eco-Mapping

What is Eco-Mapping[1]? What is an Eco-Map?

Eco-mapping is a visual process whereby you can quickly and simply identify where in your plant you have Environmental Aspects (28·1). An Eco-map is a reference to the diagram that uses the Plant Layout (57·1) to graphically express the situations where attention must be given in order to improve production or environmental performance.

Start with the Plant Layout - it can be the whole plant or a specific area within the plant (as long as the whole process that concerns you is included). Each Eco-map must be a manageable area of the organization (i.e. use one map for each floor) to be used effectively. Use one Eco-map to capture areas of concern for each issue such as:

- Water
- Air
- Solid Waste
- Energy
- Wastewater
- Others as required

Once you have the Plant Layout you need to address areas where problems are suspected. Problems might be actual (leaks, hazardous waste production in large scale, noise, etc.) or they can be potential (possible spills, high inventory of hazardous materials, etc.).

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[1]Eco-mapping© is a copyrighted shareware tool created by Heinz Werner Engel of Belgium for mapping the location of environmental problems and inefficiencies. Within minutes a small business can see the value in Green Productivity.

While you can use your own symbols on the map to signal where the main problems are, the following might help:

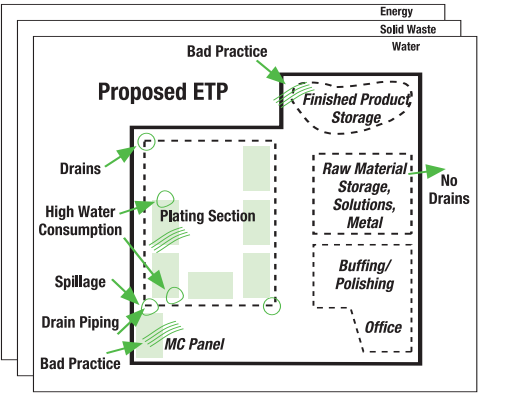
A hatch of lines indicate there is an issue that is a low priority that should be monitored and reviewed again in the future.

A dotted circle around an area indicates small problems or lower risk issues.

A solid circle around an area indicates major problems. The thickness of the line can be used to indicate how severe a problem is.

A solid circle with a thick red line* drawn across it indicates a problem that is risking the plant's operation.

* green line shown due to printing limitations of this page.



TIP Eco-Maps can show a great deal of information quickly. If you use Mylar or wax paper to create your Eco-maps for each theme, you can overlay the maps and identify where you have zones of multiple overlapping problems. This may change your priority for taking action.

Why are Eco-Maps useful?

Eco-Maps are useful, because they permit a fast, highly visual understanding of where the major problems are within an organization. They do not require significant training to use and can be implemented in a day. This way, more energy can be spent on problem solving rather than problem identification.

How will an Eco-Map help you?

An Eco-Map will provide you with a clear picture of where your opportunity areas lie, and identifies the major risks your organization is taking in its current state. A good Eco-Map will help you plan and select appropriate solutions to your environmental problems.

Where do you apply an Eco-Map?

If your business is small, the baseline map you create outlining the Plant Layout (57·1) can cover the whole operation. If your operation is larger, make sure that each Eco-map includes the whole process within the facility.

When is an Eco-Map useful?

An Eco-Map is useful when you are starting the environmental review of your organization. This way your programs and problems are clearly viewed and the major opportunity areas are highlighted. It can also be useful when you monitor your progress as it gives you a visual image of your improvements.

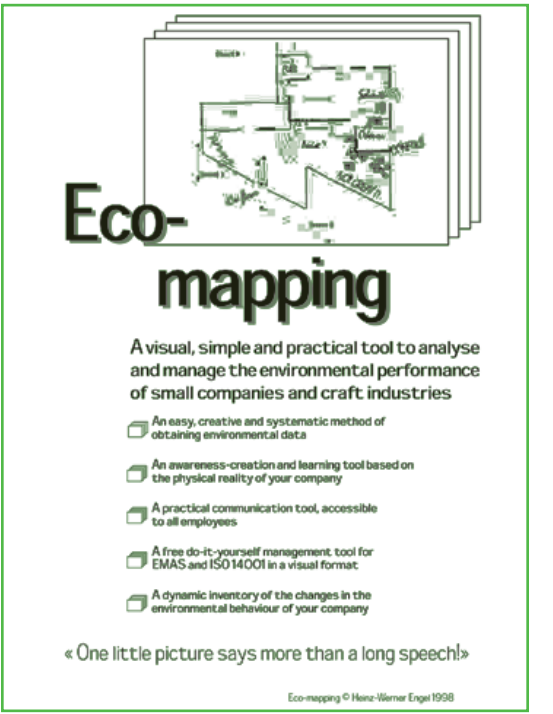
Who benefits from an Eco-Map?

An Eco-Map will benefit all project managers; but especially all GP or environmental program managers and production staff. Spider Web Diagrams (73.1) can be a good tool for presenting the changes facilitated by Eco-mapping.

Ponder Point – User Notes

Eco-maps have proven particularly amenable to the resources and level of technology of small business. They require little training, a paper and pencil is an adequate tool box.

Eco-maps should be update periodically to stay current with production changes and identify new challenges and opportunities.



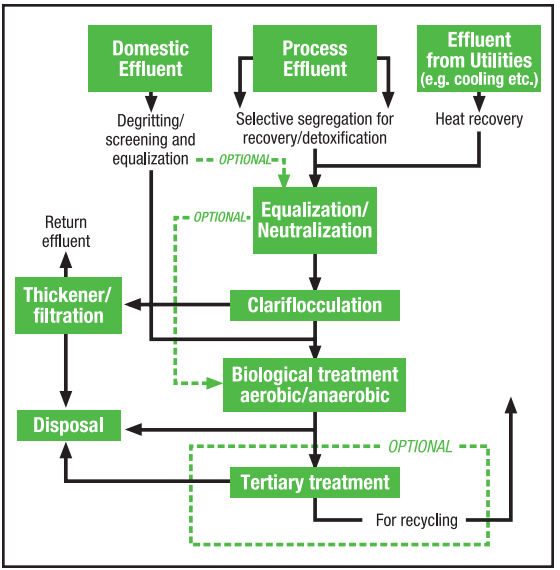
Version 1 of Eco-mapping is available on-line at ***www.inem.org*** *and* ***www.14000registry.com****.*

Effluent Pollution Control

What is Effluent Pollution Control?

Effluent Pollution Control is the general name for all processes, activities or programs aimed at reducing the pollution in the wastewaters of the organization. Industry typically generates effluent in three ways. One is from domestic sources – the wastewater from your offices, administration buildings and canteens. A second source is from the industrial process itself. The third way is through the releases from cooling water operations and washings.

TIP Water pollution can be chemical (solvents, metals, etc.), biological (bacteria, etc.), or physical (solids, temperature). A good effluent control program will address all three.



Why is Effluent Pollution Control useful?

Through Effluent Pollution Control you can recover valuable resources from the waste streams in your industrial process. These may be utilized by your own operations or sold as a raw material to another business.

In addition, if collected, heavy metals or toxic chemicals can be managed in a proper manner, thus reducing your impact on the environment. You can reduce the biochemical demand (BOD) created by domestic effluent so that the receiving waters are useable by those downstream of your plant (which might be where you live).

As well, you may be able to capture water from your cooling tanks and recycle it, thus reducing your costs, and in some cases where water is scarce, ensure that you have enough water for your process.

Additionally, proper control of effluent pollution can enable you to meet or exceed regulatory requirements.

How will Effluent Pollution Control help you?

The control of effluent pollution brings you into a position where you can better manage the impacts of your business on the environment. It can help cap costs, reduce risk and legal liability. It may also allow you to meet a specific Environment Objective and Target (30.1 and 31.1) that you have as part of your EMS efforts for improving your GP position.

Where do you apply Effluent Pollution Control?

Effluent Pollution Control can be applied to any discharge of the organization, however, effluents with high environmental/safety risks must have a priority.

When is Effluent Pollution Control useful?

It is useful when the discharges of an organization are out of control. It is also useful when the effluents are within your controlled limits, but fail to meet your expectations for improvement. Using Control Charts (16.1) can help you track this.

Who benefits from Effluent Pollution Control?

Effluent Pollution Control reflects directly on the economic health of the organization, and on legal and social compliance. As a result the whole organization, as well as those in the community, benefit from better Effluent Pollution Control.

Ponder Point – User Notes

Pollution is a sign of lost profit. It is an indication of lower productivity. Rather than look at this challenge as a waste issue, can your GP Team see this as an opportunity? By looking at the wastewater stream as a source of a potential new product, a business opportunity with someone else in the community can emerge. The incentive may be the chance to enhance the quality of life in their own neighbourhoods. This can be accomplished in a Brainstorming session (11·1).

Energy Balance

What is Energy Balance?

Energy Balance is a technique similar to Material Balance (51·1), which aims to produce information on where and how the energy in the organization is being used. It is a quantitative accounting of the energy flow in your process.

Steam			**Products**
Type	Quantity		Item Heat Content Qty.
			P1
			P2
Electricity			**Energy Losses**
Quantity	kW		Item Heat Content Qty.
			1
			2
Fuel Consumption			**Wastewater**
Item	Quantity		Item Heat Content Qty.
Coal	–		Process
Oil	–		Condensate
Any Other	–		Cooling

PROCESS

Based on a simple principle of Ecology (23·1) - energy is neither destroyed nor created, only transformed - then energy going in equals energy going out plus energy used. In an ideal situation energy going in should be equal to energy used, however some kind of energy loss is unavoidable (there is no continuous motion machine). Nevertheless your efforts to minimize energy loss are important to your GP efforts.

To calculate an Energy Balance, develop a Process Flow Diagram (61·1) for your production process. Establish a calculation base linked to production (e.g. 100 units produced). Select the appropriate energy units (e.g. Joules, Standard Oil Barrels, etc.) and transform your energy feedstock (electricity, fuels, etc.) and all your

energy needs into this unit. By subtracting your energy needs from your energy feedstock you can get an understanding of the magnitude of your energy loss.

Next, identify where this energy loss is occurring. Classify the loss by importance (a Pareto Diagram is useful here, 56·1).

TIP Energy Balances can be done for the whole organization or for a discreet part of the organization (e.g. product lines). While the larger scale can give an indication of the magnitude of the opportunity that lies within the organization, the smaller scale is often more useful in identifying specific target areas for action.

Why are Energy Balances useful?

An Energy Balance is useful, because it gives objective information on where and how much energy is being lost. It can also be used as a planning tool to speculate on the impacts of changes related to new inputs or improvements in process.

How will Energy Balances help you?

Energy Balances will provide you with a head start for developing programs to reduce your dependency on energy. Once these are incorporated, you can use Energy Balance to confirm real improvements against your expected results. Often reductions in energy use can result in direct gains in cost savings.

Where do you apply Energy Balances?

You may apply Energy Balance to your whole organization, however you may find it more useful to target a specific area where energy consumption is high.

When are Energy Balances useful?

Energy Balances are useful in planning and monitoring. The results are useful to demonstrate to top management that your GP efforts are providing the organization with an appropriate financial return. Improved energy efficiency is important to your GP program.

Who benefits from an Energy Balance?

An Energy Balance is an information tool, users of this information who benefit from it include operation managers, energy efficiency program managers and anyone responsible for energy use within the organization. When it results in reduced energy consumption and the related dollar savings, your GP Team will benefit, so too will the organization in terms of an improvement in cost control. These cost savings may be passed downstream to your customers and make you more competitive.

Ponder Point – User Notes

Energy is Mother Nature's currency. The closer you can align your production process with the way in which natural flows occur, the greater chance you have of improving productivity and at the same time reducing your impact on the environment. Challenge your GP Team to find a way to better align your process with nature. Is there a system in nature that you could emulate? Try this in a Brainstorming session (11·1).

Energy Conservation

What is Energy Conservation?

Energy Conservation is a series of activities/programs, designed to prevent, mitigate and correct energy leaks or loss throughout your organization.

These activities include:

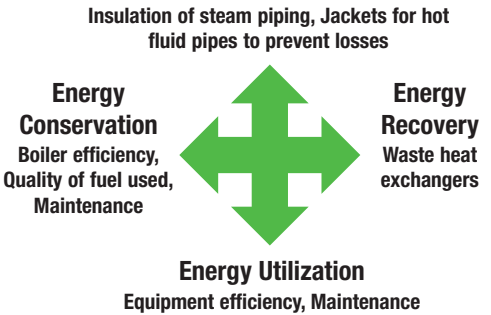
a) **Energy Transfer:** reducing unwanted energy transfer (e.g. irradiated heat), or re-designing to benefit from energy transfer (e.g. steam recovery),

b) **Energy Conversion:** avoiding energy loss during energy transfer operations,

c) **Energy Utilization:** improving the efficiency with which energy is used and how it should be used, and

d) **Energy Recovery:** using energy from waste streams (potential or actual) to feed other processes.

TIP Checklists (13·1) are useful to verify if energy management polices are being implemented. Check Sheets (14·1) are useful to find where energy leaks or losses originate.



Why is Energy Conservation useful?

Energy Conservation is a way of reducing costs by preventing valuable energy from being wasted. Energy Conservation is critical to GP.

How will Energy Conservation help you?

Energy Conservation will help you to improve the efficiency from a productivity standpoint (i.e. doing better with less). It will also help you reduce the consumption of energy which will lead to better environmental performance.

Where do you apply Energy Conservation?

Energy Conservation should be applied wherever the amount of energy used is measurable.

This may be achieved by:

- selecting a more environmentally sound fuel
- optimizing fuel use
- reducing transmission loss
- reusing or recycling heat loss

When is Energy Conservation useful?

Energy Conservation activities are useful throughout the organization, wherever energy is being used.

Who benefits from Energy Conservation?

Energy Conservation activities directly benefit the whole organization financially and environmentally. Other stakeholders may also benefit indirectly by the increased access to energy in the grid and lower local temperature effects.

Ponder Point – User Notes

Insulation is a key factor in the conservation of energy, our best answer to a concerted, global effort to reduce energy usage and to slow climate change. The equation is simple; better insulation adds up to energy saved and a reduction in greenhouse gases.

Thermal insulation can be said to regulate the movement of heat energy from hot to cold. In cold climates insulation is useful for keeping buildings warm. Insulation is equally important in climates where you want to maintain cooler temperatures.

Is there a way to jointly benefit from a community conservation program? Where are you located relative to other industries? Can your waste heat be tapped and sold as an energy source for another business?

Environmental Aspects, Impacts & Significance

What are Environmental Aspects (EAI&S)?

Environmental Aspects are the possible causes of changes in the environment that arise from the activities that you do, the products that you produce or input into your operations, or the services that you offer.

What are Environmental Impacts?

Changes to the environment, either adverse or positive, that occurs in whole or in part because of your Activities, Products and Services (5.1) are called Environmental Impacts. Everything that you do does not necessarily have a negative impact. Nor is everything everything that you do significant. An organization needs to determine what its environmental aspects are to prevent them from having negative impacts that cause environmental damage.

What is Significance relative to Environmental Aspects and Impacts?

Given the scientific laws of Ecology (23.1), any activity, product or service causes an Environmental Impact. An organization needs to classify its Environmental Aspects by the level of significance. While much of what you have or do results in impacts that by themselves are small or contained, they can add up to immeasurable magnitudes. It is therefore critical to your GP success to understand those impacts that might cause a great change in the environment.

TIP To see the relationship between:

- the things you have or do (aspects of your Activities, Products and Services (5.1)),
- the impact that this has on the environment and
- the goals you set for yourself (as Objectives and Targets (30.1 and 31.1)), flip back to the chart on page 5.3.

ASPECTS	OBJECTIVES	TARGETS
Activity: Rice Cultivation		
Consumption of water.	Reduce water use by researching direct seeding of pre-germinated rice and other dryland techniques.	Have research completed by year end 2005.
Use of pesticides.	Adopt mixed promotion approach to planting to reduce need.	Reduce pesticide use by 50% within two growing seasons.
PRODUCT: Air conditioner (consumer operation of unit and end of life - disposal)		
Use of electricity.	Encourage the consumer to use less energy.	Reduce the operating temperature by 5% based on last year's operating temperature by end of current year.
Generation of solid waste.	Reduce consumer solid waste generation from disposal of packaging by reducing quantity of packaging materials used.	Achieve 35% reduction in packaging material for current product line by 2008.
SERVICE: Transportation & distribution of goods & products (fleet maintenance)		
Emission of oxides of nitrogen (NO_X).	Increase positive impact on air quality by improving effectiveness of fleet maintenance.	Achieve 25% reduction of NO_X emissions by 2008.
Generation of waste oil.	Manage oily wastes in conformity with requirements.	Achieve 100% conformity with oily waste disposal requirements at service centres within one year.

Source: ISO 14004:2004 with minor adaptations

TIP Using a Decision Matrix is a good way of defining that which is significant. Significance is a relative concept, and is the subject of great debate. There are many variables that can alter one's perception of what is significant. Perceptions can also change over time. Two people within your GP Team may not agree on the same variable. Therefore, using a basic matrix can help the consistency with which this concept can be applied. The matrix would include a consideration of:

- the scale of the impact
- the severity of the impact
- the probability of occurrence
- the duration of the impact

You may wish to include stakeholders outside your organization in your determination. These people may have an interest or a different perspective as they may be affected directly or indirectly by your organization's environmental aspects.

Failure Mode Effect Analysis (32.1) is another tool that can be used to determine significance. In ISO 14001 (47.1) some organizations determine significance against aspects and others against impacts. It is a good idea to record what indicators you use to determine significance for consistency.

Why are EAI&S useful?

The knowledge about environmental aspects and their significance permits the development of Environmental Objectives and Targets (30.1 and 31.1) to improve your environmental performance.

How will EAI&S help you?

Environmental Aspects will help you to define the elements of your business that cause the most important (significant) interactions between your organization and the environment. This is likely where you have the biggest risk factors and the most cost. Once you understand what your significant Aspects are, you can establish

priorities for your GP programs to improve both your productivity and your environmental performance.

Where do you apply EAI&S?

Environmental Aspects should be identified organization-wide. The GP Team should then conduct the significance assignment to determine which Aspects require priority in your GP program.

When are EAI&S useful?

Whenever an organization wishes to manage its environmental interactions and not be managed by them. When an organization understands and manages their significant Environmental Aspects, they are less likely to have control imposed by law, or other third parties who do not understand your business process.

Who benefits from EAI&S?

Understanding what your Environmental Aspects are, and determining which ones are significant can lead to direct bottom-line benefits for your organization. They are also central to the development of your Environmental Management System (EMS) (29·1), and a requirement of ISO 14001 (47·1). Indirect benefits may be passed down the supply chain and into the community in which you operate.

Ponder Point – User Notes

Eco-maps are an excellent tool for helping you to understand what it is you have or do that undermines your GP goals, and hence for identifying your Environmental Aspects. Eco-mapping is a simple, elegant visual process that can be done at minimal cost by the smallest organization (24·1). Large companies often start their assessment of what to improve by focusing on compliance. In smaller companies it may be better to first gain an understanding of what it is that you have or do within your business that causes environmental damage. This can lead to breakthroughs placing you ahead of compliance. This will give you a competitive advantage.

Environmental Management System

What is an Environmental Management System (EMS)?

An Environmental Management System (EMS) is the part of the overall management system that addresses the impact of an organization's Activities, Products and Services (5·1) on the environment.

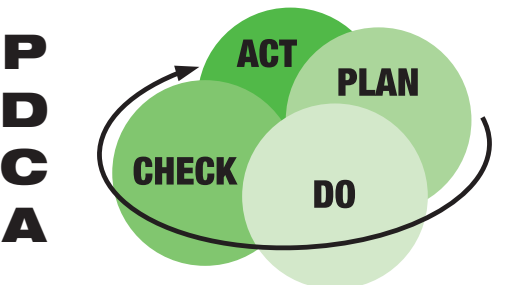
Environmental Management Systems are often based on the Plan, Do, Check Act (PDCA) model, which includes:

Plan - identifying Environmental Aspects and establishing Environmental Objectives and Targets (28·1, 30·1 and 31·1);

Do - implementing training and operational controls;

Check - monitoring and corrective action; and,

Act - implementing environmental programs, conducting reviews, and continually improving.



TIP The ISO 14000 (47·1) series of standards outline the world's most widely recognized brand for a systematic approach to environmental management.

Why are EMSs useful?

An Environmental Management System allows your organization to identify and take control of the Environmental Impacts (28·1) that it generates.

How will an EMS help you?

An Environmental Management System will help you by identifying those things that you do that impact on the environment, and developing procedures to avoid or minimize that impact.

Where do you apply EMSs?

You apply an Environmental Management System to any organization of any type or size within a defined Scope (71.1) determined by you.

When are EMSs useful?

They are useful whenever an organization wishes to understand its impacts on the environment and gain control over them. Very often Environmental Impacts (28·1) are associated with waste and significant savings can result from improved management.

Who benefits from EMSs?

Environmental Management Systems are a tool to improve the efficiency of your Activities, Products and Services (5.1), so their implementation will benefit the whole organization. Improved relationships with suppliers and customers can result from the consistent management and reduced impacts of your organization.

The surrounding community can also benefit from reduced Environmental Impacts, and the knowledge that your organization will work to prevent future accidents or impacts in a systematic manner.

Ponder Point – User Notes

A great deal of discussion has occurred regarding the relationship between an Environmental Management System and compliance with environmental regulations that may apply to your organization. Environmental regulations may help you identify subject areas that relate to the impact you may have on the environment and hence where you should focus your environmental management efforts. Conversely, an Environmental Management System can be a tool for managing and enhancing your compliance with environmental regulations.

It is important to understand that these two issues are very different, however. An Environmental Management System does not add any additional legal requirements to your organization, nor does it mean that you have to be 100% in compliance at all times for an Environmental Management System to be a helpful addition to your organization.

Some regulations focus on reporting activities without much guidance on ***how*** *you can improve the environmental performance of your business. Eco-mapping (24.1) does provide guidance by helping you identify where issues exist specific to your operations. Once you have identified where your problems and opportunities for improvement are, then a cross-check with regulatory matters is advisable.*

Environmental Objective

What is Environmental Objective?

An Environmental Objective is an overall environmental goal. Sometimes it is quantitative (e.g. reducing hazardous waste by 5% over the next five years), sometimes it is just a direction (e.g. reducing water consumption). Often Environmental Targets are where quantitative information is developed (31·1).

TIP Significant Environmental Aspects (28·1) and your Environmental Policy are two of the main inputs for creating environmental objectives.

Why are Environmental Objectives useful?

Environmental Objectives state a sense of direction for the organization's environmental programs, supporting the policy of the company and identifying priorities for managing your environmental concerns.

How will an Environmental Objective help you?

Building on the direction chosen, you can set a level of environmental performance that you wish to achieve. An objective is a useful communication tool for conveying what you plan to do to improve on your organization's environmental performance.

Where do you apply Environmental Objectives?

You apply Environmental Objectives in the establishment of your GP program. Your objectives are developed once you understand which of your Environmental Aspects (28.1) are significant.

When are Environmental Objectives useful?

They are established in the planning process for your GP program, and are useful for assessing your performance against your expectations. Your results can also be shared with top management

to demonstrate the value of your GP efforts. If appropriate you may wish to share them with customers, regulatory bodies, peers in your supply chain, or your community.

Who benefits from Environmental Objectives?

Your GP Team benefits directly by having a clear understanding of the expectations you have for your GP program. Operations will benefit when they understand how Environmental Objectives are linked to production operations, and the impact of these improvements.

Ponder Point – User Notes

Environmental Objectives are specifically defined in ISO 14001:2004 as the "overall environmental goal, consistent with the environmental policy, that an organization sets itself to achieve". ISO 14001 (47·1) also requires that your Environmental Objectives and Targets (31·1) are documented. When reviewing these it is necessary to consider:

- *Legal and other requirements*
- *Your significant environmental aspects*
- *Technological options*
- *Financial, operational and business requirements*
- *The views of interested parties (which means that you need to understand who the relevant stakeholders are).*

Pollution prevention is a consideration when setting your Environmental Objectives. You can refer to:

- *Effluent Pollution Control (25·1),*
- *Solid Waste Management (72·1),*
- *Off-site and On-site Recovery and Recycling (54·1 and 55·1), and*
- *Waste Segregation (86·1) for more information.*

Environmental Target

What is an Environmental Target?

An Environmental Target is a quantitative environmental goal of an organization that when completed moves the organization closer to the realization of its Environmental Objectives (30·1).

Normally Environmental Targets contain the following details: magnitude of improvement desired, persons responsible, activities required to complete the target, resources needed to undertake the work, and the time frame in which the target should be met.

TIP Environmental Targets are tied to your Environmental Objectives (30.1), and are important criteria to track in your EMS (29.1). Refer to 28.2 for a chart outlining the connection between Environmental Objectives and Targets.

Why are Environmental Targets useful?

Environmental Targets provide information on day-to-day activities that will help your organization move toward better environmental performance. Progress against these targets can be measured to assess the success of your GP program.

How will an Environmental Target help you?

Environmental Targets are usually part of a GP program. They help you understand and focus on what you are trying to attain in terms of environmental improvements in a specified timeframe.

Where do you apply Environmental Targets?

You apply Environmental Targets wherever you have set yourself a goal in the form of an Environmental Objective. Targets are very specific to an area or point of concern where environmental improvement is needed.

When are Environmental Targets useful?

Targets are the practical, measurable goals you set for yourself in the planning phase. During implementation they help you keep on track, and are important points when you monitor your own performance. During a review process, they serve as evidence of the value of GP when you report to top management or others about your GP efforts and results to date.

Who benefits from Environmental Targets?

Your GP Team benefits directly by having a systematic approach towards the management of environmental issues. They also help your GP Team focus on exactly where change must occur. Operations benefit when the environmental targets are linked to production, helping them to understand the link between environmental enhancements and productivity improvements.

Ponder Point – User Notes

Environmental Targets are specifically defined in ISO 14001:2004 as the "detailed performance requirement, applicable to the organization or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to meet those objectives." Read up on Environmental Objectives for a better understanding of the relationship between Environmental Objectives and Targets (30·1).

Failure Mode & Effect Analysis

What is Failure Mode & Effect Analysis?

Failure Mode & Effects Analysis (FMEA) is a simple yet effective method of evaluating worst possible scenarios and taking preventive actions in order to reduce the effects of a possible failure.

There are 8 steps in FMEA:

1. Describe the product or process
2. Define the functions involved
3. Identify potential failure modes
4. Describe the effects of failure
5. Determine the causes of failure
6. Describe detection methods/current controls
7. Calculate the risk
8. Take action to correct and assess results

The criteria for evaluating the risk of a possible failure (Risk Priority Number) consist of three characteristics:

a) detection: if the problem has a very high probability of being detected then the value is 1 (one), if it has a low probability of being detected then the value is 10 (ten), anything in between is graded accordingly,

b) likelihood of occurrence: where 1 is very low likelihood, and 10 is very high; and then anything in between is graded accordingly,

c) cost liability due to failure: where 1 is very low, and 10 is very high; and again anything in between is graded accordingly.

After you have the three grades for your option; you multiply them by: (detection x likelihood x cost). The result will be in the 1 to 1000 range. The higher the Risk Priority Number, the higher the level of the risk. Normally anything ranked over 700 will be considered as high priority and should be tackled as soon as possible.

Failure Mode Effect Analysis

GP Option	Direct use of dyebath	Restrict reuse only for disperse dyebaths 
Problems Leading Failure	Shades not matching with standard	Shades not matching with standard 
Detection	9	9
Likelihood of Occurence	8	8
Cost Liability Due to Failure	8	8
Risk Priority Failure	576	576
Corrective Measure	Restrict reuse only for disperse dyepaths 	

TIP FMEA can be tracked on a periodic basis to ensure that efforts continue to be focused on reducing the total risk that the company is facing.

Why are FMEAs useful?

The fundamental purpose of FMEA is to evaluate risk, and to recommend and take actions to reduce risk. Despite its long name it is simply a decision analysis activity. This type of analysis is useful in ranking your options in a way that enables you to compare them against their associated risk, allowing you to make informed decisions.

How will FMEAs help you?

FMEAs will help you rank your improvement projects in two ways. First, by understanding which of these have high risks associated with them and second, by prioritizing those that address existing risks.

FMEAs are intended to result in preventive actions. They are not "after-the-fact" exercises done to satisfy a customer or solve a non-conformity issue related to obtaining certification status (to ISO 14001 or ISO 9001, 47·1 and 46·1).

Where do you apply FMEAs?

FMEA is applied whenever options are available to solve a problem. They can also be used to redesign options to minimize the risks associated with them.

When are FMEAs useful?

FMEA is particularly useful in the Planning phase when you are evaluating different options. It introduces an important consideration that is often forgotten - what happens if your GP project fails? Brainstorming (11.1) can help to think through the potential problems. If this is being applied to a technology or a process, there may be a list of troubleshooting options that might spur ideas.

Who benefits from FMEAs ?

Those involved in Planning are definitely the major beneficiaries of FMEA. However plant managers, operation managers and project managers get a benefit from the information obtained by using and tracking FMEA, and the overall minimization of risk within the organization.

Ponder Point – User Notes

Quality of a product used to be controlled more through inspection in a confrontational atmosphere. FMEA was developed to encourage suppliers to prevent problems from occurring rather than waiting for them to occur and then addressing them. Similarly, FMEA can be a very effective tool to understand the potential problems that failure to improve environmental management could bring.

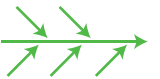
Fishbone Diagram (Ishikawa)

What is a Fishbone Diagram?

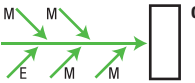
A Fishbone Diagram is designed to identify cause and effect relationships. It does this by guiding you through a series of steps in a systematic way to identify the potential or actual causes that generate an effect (which can be a problem or an improvement opportunity). It is also known as an Ishikawa Diagram after its creator.

The following steps are used to create a Fishbone Diagram:

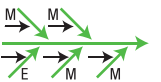
a) Start by clearly defining the issue and place it in a box to the centre right of where you are going to draw the diagram.



b) Using arrows, draw a "five bone" diagram, where the horizontal arrow shall end at the issue box.



c) Label each of the diagonal "bones" with one of the following: Man, Machine, Material, Method and Environment (4M - 1E).



d) On the M and E lines draw a horizontal arrow for each cause of the problem that fits in that category.

The causes of the issue are now clearly identified and plans can be made as to how to avoid problems or improve positive relationships.

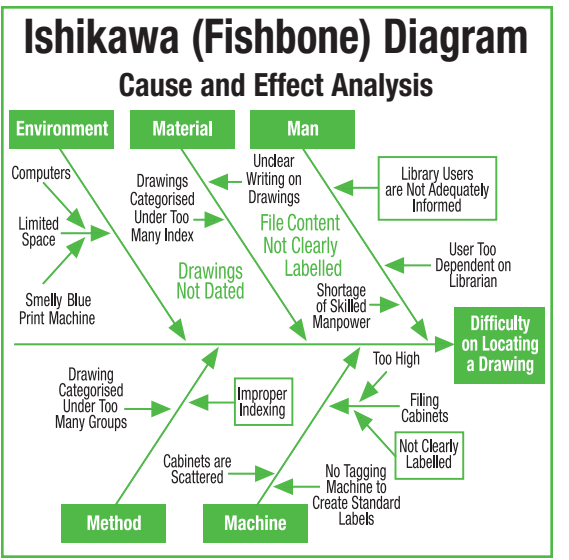
TIP The best 'experts' on the root cause to a problem are normally the people nearest to the problem. Make sure that they are involved in the development of the diagram as well as in the solution. This will increase the acceptance of change.

Why is a Fishbone Diagram useful?

A Fishbone Diagram is an evolution of the "see and fix fireman approach." It is systematic, in that it allows for a thinking process as opposed to a reflex process. It also provides a means to explore all angles of a problem leaving aside any personal viewpoints.

How will a Fishbone Diagram help you?

A Fishbone Diagram will present you with the causes of your problem or the reasons that you are not improving as you should. This allows you to study the causes, decide which ones you can control and which ones you cannot. Based on those that you can control, you can then start developing improvement programs with specific targets in mind. It allows you to get to the root of the problem, not the symptom.



Where do you apply a Fishbone Diagram?

A Fishbone Diagram is applied in all situations where there can be multiple causes of an issue; which is normally the case in a real life situation.

When is a Fishbone Diagram useful?

It is useful when you have a problem that is likely caused by diverse factors, or where complex relationships can sometimes mask the source. It is particularly helpful to ensure that your GP Team avoids the trap of history (i.e. repeating the organization's mistakes). The Fishbone Diagram, will help you systematically chart these factors (causes).

Who benefits from a Fishbone Diagram?

The Fishbone Diagram is an efficiency tool; it helps your GP Team solve problems, not instill temporary measures that waste time, money and environmental resources. Ultimately, the whole organization benefits from the accurate analysis of a problem.

Ponder Point – User Notes

You may see that many of the diagrams have a reference to nature – Fishbone, Tree, Spider Web (82·1 and 73·1). *Perhaps in the titles you select for your GP programs you should use the name of the organism or natural system you are trying to emulate to foster a sustainability-based mindset.*

The idea is to do ***better with less****.*

5S Technique

What is the 5S Technique?

The 5S Technique is a set of management techniques that can be used to lean your organization's operation change behavioral attitudes regarding spatial management.

The 5S Technique encompasses five steps that should be implemented one at a time, in order, moving on only after each step has been mastered. Note that a step is achieved when it has become part of the organization's daily operation – it converts to a habit. Every step means a visible change in the way the organization operates.

The 5S or five steps are:

1. **Seiri:** (organization) it refers to putting things in order, changing management practices so that your organization can be organized (e.g. lean management). It means get rid of things that you do not need, they just take up space and use up energy.
2. **Seiton:** (proper arrangement) not only should the movement of products be easy and efficient, from a functional perspective, you should also establish a neat layout so that you can get what you need when you need it.
3. **Seiso:** (cleaning) a clean organization means that it keeps its space and resources in top order. Cleanliness is more important these days because of higher quality expectations, food quality requirements, and zero tolerance for dirt or defects. It means eliminating trash from your workplace. Cleaning can be a form of ongoing inspection.
4. **Seiketsu:** (standardization) all practices and operations should be standardized. The quality of the product and the process used should be independent of who is operating what in the organization. The focus here is on visual and colour management. It means keep things organized, neat and tidy to eliminate distractions from your process.

5. **Shitsuke:** (discipline) to adopt new behavioral patterns everyone must be committed and (self) disciplined enough to adopt the changes required for success. Without discipline an organization will revert to those habits that caused problems or inefficiencies. It means that personnel are trained and skilled to do even difficult tasks that are necessary.

When these five steps have been achieved, your GP Team will feel empowered to take on improvement programs, including those that require major changes, adapting quickly to take advantage of opportunity.

TIP 5S programs should change the way your organization operates. It is very easy to feel the air of excitement that usually accompanies an organization that has adopted 5S, the atmosphere is charged positively.

Why is the 5S Technique useful?

The 5S Technique is a great way of standardizing operations and focusing on what is really needed for the organization to operate efficiently. It is like a physical fitness program for your organization, once it is physically fit, it can take on new challenges.

How will the 5S Technique help you?

The 5S Technique will provide the framework for your organization to become a more productive and effective organization.

TIP Eco-mapping (24·1) research indicates that just as 80% of the problems are location-based, 50% of these problems can be solved by Good Housekeeping (37.1) The 5S is a good approach to institutionalizing this benefit.

Where do you apply the 5S Technique?

Even though the 5S Technique could be applied on a specific area of the organization; it should be applied organization-wide; in order to get the most benefit out of the process.

When is the 5S Technique useful?

The 5S Technique is useful when you are looking to improve the standardization, efficiency or discipline within your organization. Symptoms that are well treated by the 5S Technique include: unorganized documentation, high internal inventories, high absenteeism, poorly defined functions and roles, the “everybody is doing everything” syndrome and an untidy work environment.

Who benefits from the 5S Technique?

The 5S Technique is designed to benefit the organization as an entity. However, individual employees can feel more productive and energized by the cleansed atmosphere. The potential benefits of 5S are not just attitudinal, there are cost savings to being more efficient.

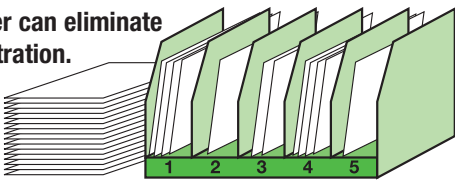
Ponder Point – User Notes

5S has become popular in other countries as a way to improve manufacturing practices. In English, the five steps have been re-written to be:

- *Sort - "When in doubt, find it a new home or recycle it."*
- *Straighten - A place for everything, and everything in its place*
- *Scrub/Shine - Clean it up*
- *Standardize - Standardized processes, including cleaning and housekeeping*
- *Sustain - Make it a way of life*

It is the basis for lean manufacturing, which mirrors GP's philosophy of greener and better productivity.

Order can eliminate frustration.

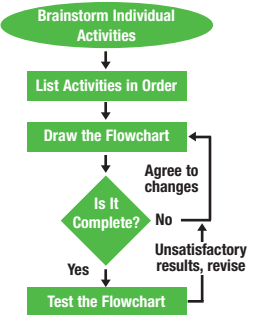


Flowchart

What is a Flowchart?

A Flowchart is a graphic representation of a sequence of steps needed to carry out an activity.

Flowcharts usually employ standardized shapes to impart consistent meanings; the following five are the most commonly used.



It normally starts with a hemi-elliptical symbol to indicate a milestone, normally the text inside the box will say “START”. This same shape is used to indicate the end of the flowchart in which case it will normally contain the word “END” inside.

A rectangular box is used to express instructions.

A diamond shape with two arrows is used to show alternatives or decisions. Normally each arrow will be labeled either with “Yes” or “No” to indicate what follows either option.

This symbol is used to indicate that something needs to be documented (normally referring to paper documents). When this symbol appears “stacked” it indicates that several documents will be developed.

A circle with either a letter or a number identifies a break in the Flowchart; look for a continuation elsewhere on the same page or another page.

TIP The best way to verify if a Flowchart is correct is to ask someone who is unfamiliar with the process to describe it by only using the diagram.

Why are Flowcharts useful?

Flowcharts are a useful standardized communication tool. They are commonly used as visual aids tied to work instructions and other "on the floor" documents. They are very flexible and easy to use as an input into your project, or as a visual depiction of the project itself.

How will Flowcharts help you?

Flowcharts will help you explain your process in training sessions, or when you want a team to follow a certain path. Also they can be very helpful as reminders to the people of how a task is done on the floor.

The process for developing Flowcharts is as follows:

1. Determine the boundaries of the process.
2. Identify the steps involved.
3. Establish the sequence of steps.
4. Check to make sure that you have used the correct symbols.
5. Test the chart for completeness.

Where do you apply Flowcharts?

Flowcharts are widely applicable, but they will come in handy for understanding and communicating processes and steps in projects to others. They are useful as aids in the standardization of procedures. They are also great training aids.

When are Flowcharts useful?

Flowcharts will be very useful if you want to communicate a process (or a path forward) to a broader audience than the members of your GP Team. The diagram helps you explain your precise points of improvement under your GP program.

Who benefits from Flowcharts?

Flowcharts benefit the members of your GP Team directly as it is a way to review progress and plan for continued improvement. It also helps others outside your GP Team who will have to understand the process to appreciate the improvements made. It can help non-technical people obtain a clear picture of your progress and where they may play a supportive role.

Ponder Point – User Notes

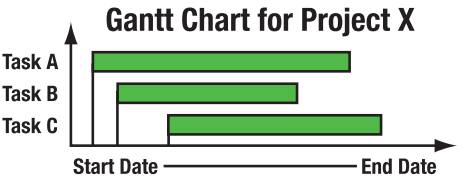
One of the simplest yet invaluable tools is the Flowchart as it allows you to get a "big picture" or systems perspective. At the same time you can understand the component parts of the process and their potential interrelationship. It can be used very effectively in training to help your GP Team understand the 'Ecology' of your process (23·1).

Gantt Chart

What is a Gantt Chart?

A Gantt Chart is a simple horizontal bar graphic of activities versus dates. It is a tool to measure your progress relative to your plan.

Here is a basic example of a Gantt Chart:



To develop a Gantt Chart:

1. Plot the time your GP project/program is going to last on the Abscissa (horizontal axis)
2. On the Ordinate (vertical axis), place the sub-activities needed to complete the whole GP project/program
3. Draw a bar at the vertical level of the activity showing the duration of each of the activities

TIP To estimate activity duration it might be useful to use a formula for estimating time:

$$ST = \frac{PT + 4xET + 0T}{6}$$

Where:

PT is the most time that the activity can possibly take,

ET is the expected time that it will take,

0T is the least time the activity will take and

ST is the estimated time, and use ST on the chart.

Why are Gantt Charts useful?

Gantt Charts are a very simple and understandable way of monitoring the progress of your GP project/program activities.

How will Gantt Charts help you?

Gantt Charts will help you in two main ways. First they will provide you with a visual representation of your activities and their time frames. Second it will allow you to communicate in an easy way with other member of your GP Team on the status of your GP project/ program.

Where do you apply Gantt Charts?

Gantt Charts should be applied to any GP project/program to define progress and clarify tasks. They help to co-ordinate shared people/ resources in projects with multiple activities.

When are Gantt Charts useful?

When you are managing a GP project/program that has multiple activities, a Gantt Chart is highly recommended, especially if you require labor input from others to complete these activities. It helps you to understand the relationships between activities, i.e. whether they must be sequential, or can be conducted in parallel

Who benefits from Gantt Charts?

Gantt Charts will benefit both the GP project/ program manager and all those involved in completing activities within the GP project/program.

Ponder Point – User Notes

If you have a GP project that has several tasks, the Gantt Chart can help you show progress, and task relationships. You can colour code your progress and use the Gantt Chart as the basis of your project updates.

Good Housekeeping

What is Good Housekeeping?

Good Housekeeping, whether practiced at home or in your organization refers to keeping a space clean, tidy and safe. Its purpose is to maintain quality, minimize material loss, and to prevent accidents from occurring.

TIP With Good Housekeeping it is easier to see when an anomaly occurs. Avoid letting operational problems go undetected until the damage is significant, and a problem that was just a bad habit turns into an emergency. *Turn insight into action immediately.*

Why is Good Housekeeping useful?

Poor Housekeeping has caused many accidents in the past, whether through tripping over material left out of place, or blocking access to emergency response equipment. Good Housekeeping is used to reduce environmental and safety risks.

Good Housekeeping practices can also enhance a GP Team member's sense of belonging and pride in being part of a clean, organized and safe organization. As a result, member commitment and productivity will improve.

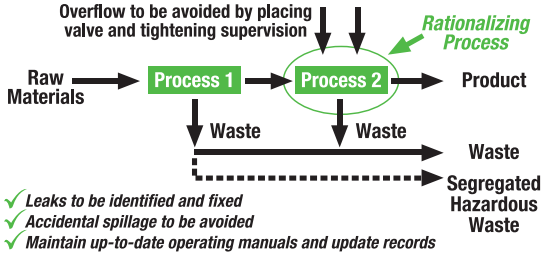
How will Good Housekeeping help you?

Good Housekeeping is essentially a habit that should be instilled within your organization. It will allow you to:

- rationalize the use of raw materials, water and energy inputs
- reduce the volume and/or toxicity of waste, wastewater and emissions related to production
- conserve material and energy
- improve working conditions and occupational health and safety

It will also provide a great example for employees of how things should be done.

Good Housekeeping to Reduce Waste Stream



Where do you apply Good Housekeeping?

Good Housekeeping should be applied throughout the organization. It is relatively inexpensive, and can pay big dividends to the organization.

When is Good Housekeeping useful?

Good Housekeeping will always be useful - like keeping oneself in good health! It is particularly useful as a starting point for your GP Program as it is very hard to implement other improvement programs if Good Housekeeping is lacking in the organization. Eco-mapping (24·1) has shown that up to 80% of the problems are location-based, 50% of these can be solved by Good Housekeeping.

Who benefits from Good Housekeeping?

All the areas of an organization benefit from Good Housekeeping strategies. However, the GP Team in particular can benefit – as opportunities are much easier to identify in a tidy organization.

Ponder Point – User Notes

Nobody else wants to clean up your mess: always leave something cleaner than you found it! A tidy area also looks more professional, and instills confidence in your employees and your customers.

Additionally, it is easier to see if there is a problem emerging when Good Housekeeping habits exist. It is difficult to notice a leak in a pipe if there is always water on the floor.

Graphs

What is a Graph?

A Graph is a generic term for many different symbolic representations of data, such as:

- Charts and plots including Control Charts, Scatter Diagram, Flowcharts, etc. (16·1, 70·1 and 35·1).
- Diagrams such as an Interrelationship Diagram, Spider Web Diagrams, and others (45·1 and 73·1).
- Visual aids that help transmit information on Standard Operating Procedures to GP Team members or the rest of the organization (74·1).

TIP When writing any kind of information remember that "a picture speaks a thousand words".

Why is a Graph useful?

A Graph is useful because it can transmit large volumes of detailed information to the user extremely fast. Graphic presentations are easier to understand than an equivalent passage of text.

How will a Graph help you?

A Graph will provide you with a tool for communicating that can:

- Overcome language barriers
- Minimize technical jargon
- Convey complex ideas instantly

Where do you apply Graphs?

Wherever you need to present:

- information with more than one complex parameter, e.g. efficiency vs. production
- relationships between data, e.g. time vs. production
- technical information to people outside your area of expertise and/or language group

When are Graphs useful?

Graphs are useful whenever information needs to be analyzed or transmitted, especially when it is to be transmitted to a broader group than those who generated it, who may not have an in-depth understanding of the processes.

Who benefits from the use of Graphs?

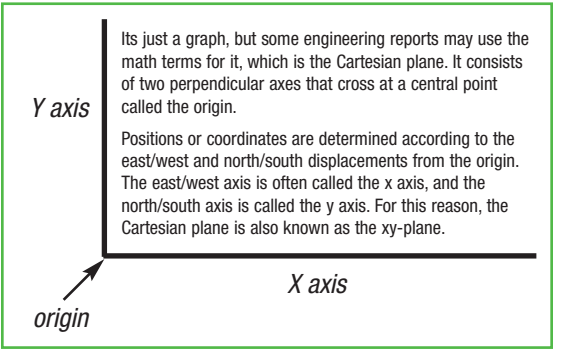
The GP Team benefits from seeing a visual summary of information which can aid in understanding and analysis. The whole organization can also benefit from the use of visual tools that help transmit information that needs to be shared in a better and faster manner.

Ponder Point – User Notes

Have you thought about a situation where some members of your audience are illiterate? Or where the audience comes from various cultural areas where no language can serve as the common denominator. Graphs can be a very important tool to help you create a common understanding where diversity exists.

Its just a graph, but some engineering reports may use the math terms for it, which is the Cartesian plane. It consists of two perpendicular axes that cross at a central point called the origin.

Positions or coordinates are determined according to the east/west and north/south displacements from the origin. The east/west axis is often called the x axis, and the north/south axis is called the y axis. For this reason, the Cartesian plane is also known as the xy-plane.



Green Purchasing

What is Green Purchasing?

Green Purchasing is the establishment of purchasing policies within an organization to ensure that purchasing decisions include environmental factors as one of the deciding criteria.

Green Purchasing makes use of environmentally related information about the products and services that an organization wishes to acquire.

TIP Life Cycle Assessment (50·1) information is particularly helpful in the implementation of Green Purchasing.

Why is Green Purchasing useful?

Green Purchasing, together with Design for Environment (DfE), (20·1) are the "beginning of pipe" techniques to prevent pollution and environmental and safety related costs and liabilities instead of treating them later. Just as DfE has Environment as one of the criteria considered in design, the Environment is one part of the risk assessment made.

Environment is one of six criteria you need to consider in a strategy and plan for Green Purchasing.

How will Green Purchasing help you?

Green Purchasing will help you by making your input streams more useful to your process. Up to 70% of the costs associated with environmental issues are acquired through purchase. Eliminating these problems at the source is a **SMART** idea.

Where do you apply Green Purchasing?

Green Purchasing is applied by establishing purchasing policies and criteria throughout the organization. A good strategy that is developed with expertise from purchasing and your green experts is a worthy investment. This strategy then is then integrated into a policy and plans are made to implement them.

TIP A Cautionary Note: All too often a Green Purchasing policy is developed by those with green expertise in the absence of purchasing expertise. These policies tend to focus on end of pipe issues and are short-lived in a misbegotten attempt. Throwing money at waste management is not a successful strategy. Involve your purchasing experts in this process.

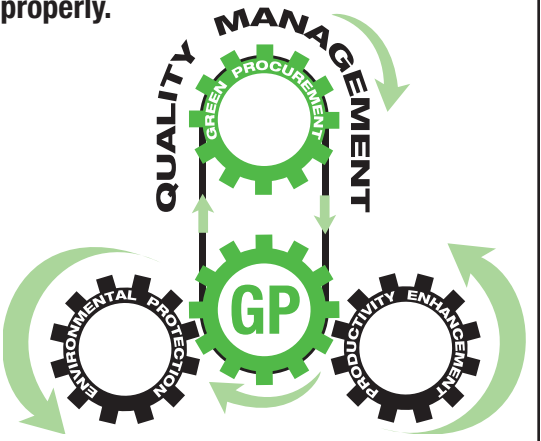
When is Green Purchasing useful?

Green Purchasing will help at the front end to prevent unnecessary costs and environmental problems from coming into your company. Keep in mind that Green Purchasing does not mean poor economic decisions; it means that the price tag does not tell all the truth about the total costs of a product or service.

Who benefits from Green Purchasing?

Green Purchasing can propel the department upwards and forwards in the organization. Properly implemented, your GP Team would work with the procurement department to change policies and implement practical directives on what to buy and what to avoid. The idiom “the cheaper the better” is not accurate when sourcing products and services. Products that are cheaper up front, may turn out to be much more expensive in the longer term.

Green Purchasing can be a significant driver of change IF it is implemented properly.



While these tools and techniques can be viewed in isolation, together they can be used to create synergy and enable you to do a better job, produce a better product with less energy and effort.

SMART spending can reduce the time needed to fix purchases with poor environmental quality. Operations can receive better environmental quality products so operational problems are reduced. Green Purchasing can help you choose products with less environmental and safety burdens which will benefit your entire organization.

S – *SPECIFIC*
M – *MEASUREABLE*
A – *ACCURATE*
R – *REALISTIC*
T – *TIMING*

Ponder Point – User Notes

A quick review of the history of purchasing since 1950 is useful to understand where the profession has been and where purchasing as a process is headed. This discussion will help in the understanding of the value of purchasing in promoting GP.

In the 1950s, the purchaser's role was to execute requisitions in a market that was hungry to buy in a world of isolated economies, focused on rebuilding business after wartime. Decisions within an organization were made in other departments; purchasing was a clerical job in a department. In the 1960s, competition for purchasing dollars began and marketing to win a customer's favor grew (so did golf). In the 1970s, the oil crisis caused disruptions that made purchasers concerned about the continuity of supply from vendors. Price, not cost, remained the focus of the purchasing function. In the 1980s, purchasers had to deal with double-digit inflation. Vendors were squeezed each time there was a transaction in a "price fight" where little else seemed to matter. However, coming through the 1980s and into the 1990s there was the realization that quality was the ticket to a growing international marketplace, and a venue for managing suppliers to achieve a value-added product. Through the 1990s people started to realize that Green Purchasing could bring substantial savings to an organization, a trend that continues today.

Green Productivity Methodolgy

What is Green Productivity Methodology (GPM)?

It consists of six major steps. These steps are referenced as Success in Six (76·1). Each step can be completed by following specified tasks. There are thirteen tasks.

STEP 1: ***Getting Started***	
Task 1	Team Information
Task 2	Walk through survey and information collection
STEP 2: ***Planning***	
Task 3	Identification of problems and causes
Task 4	Setting objectives and targets
STEP 3: ***Generation, Evaluation & Prioritization of GP options***	
Task 5	Generation of GP options
Task 6	Screening, Evaluation & Prioritization of GP options
STEP 4: ***Implementation of GP options***	
Task 7	Formulation of GP Implementations
Task 8	Implementation of selected options
Task 9	Training, awareness building and developing competence
STEP 5: ***Monitoring and Review***	
Task 10	Monitoring and evaluation of results
Task 11	Management Review
STEP 6: ***Sustaining GP***	
Task 12	Incorporating changes into organizations system of management
Task 13	Identifying new/additional problem areas for continuous improvement

TIP The methodology can be applied in organizations that are not-for-profit. It has been found useful in community development projects as well. Communities in Vietnam have been using Green Productivity in a cluster process.

Why is GPM useful?

The methodology provides you with a clear understanding of how to start Green Productivity, right through to the steps you need to take to continually improve progress.

How will GPM help you?

The methodology helps you improve environmental performance within the productivity framework. It can show you how to be more productive while using fewer resources. The net result can lead to a lower environmental burden and reduced costs.

Where do you apply GPM?

The methodology can be applied to your organization either in whole or in part. It is your choice. Factors that affect this decision include the size of your organization, the nature and scale of the challenge you are trying to address, and the number of processes you have. External factors may also affect the extent to which you apply your GP efforts.

When is GPM useful?

The methodology is a cyclical activity. Your need may start in the design phase of a new product. It may occur when you are trying to address problems in an outdated process. You may even be starting a new business and want to use Green Productivity as a strategic approach to differentiate your product or services from the conceptual stage in a start-up of a new business.

Who benefits from GPM?

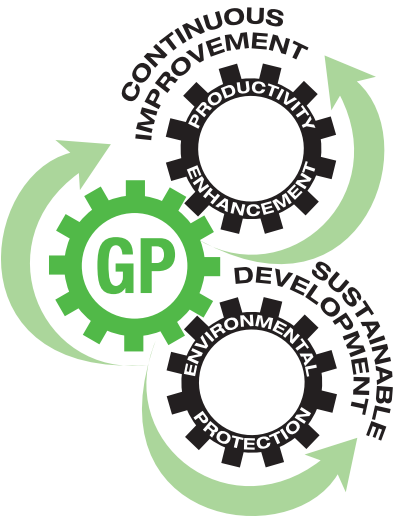
The methodology has several beneficiaries, the initial one being you, the user. You may be assigned the responsibility to lead your company's Green Productivity efforts. Or you may be one of the people invited to join your organization's GP efforts. Knowing what steps you need to follow, what tasks you need to complete in sequence can instill confidence, regardless of your role.

Decision makers within your organization and external influential stakeholders can gain an understanding that you are acting in a logical, orderly manner to progress. Potential investors will find this useful information too.

Ponder Point – User Notes

While the methodology does not have the same status as an international standard such as ISO 14001 (47·1), using the methodology is useful for similar reasons. Other people have tested it out already so the problems have already been eliminated. Learning from other people's mistakes is less expensive.

See the influence of Green Purchasing on GP on page 39.3



Innovation is a primary driver of economic growth. Green Productivity greens the process of innovation.

Histogram

What is a Histogram?

A Histogram is a simple vertical bar chart. It groups data points to show frequency.

To develop a Histogram, you need to categorize your data in segments. These segments should include all the data points and should be the same magnitude (ex. 0.1-5.0, 5.1-10.0, 10.1-15.0, etc.).

Once you have placed all your data points in the specified categories, you graph the category by drawing a horizontal bar the size of the occurrences (number of data points) inside the category. This will show data patterns.

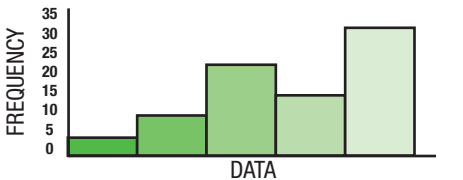
TIP When there are a large number of data points to be charted, using a percentage Histogram can be more descriptive.

Why are Histograms useful?

Histograms are useful because they present data trends in huge amounts of data in a simplified manner without losing any statistical information. You can still obtain statistical indicators: mean, standard deviation, variance, etc. from a histogram without returning to the original data.

Histograms give you:

1. center (i.e. the location) of the data;
2. spread (i.e. the scale) of the data;
3. skewness of the data;
4. presence of outliers; and
5. presence of multiple modes in the data.



How will Histograms help you?

Histograms will provide you with data trends that can be valuable information in target setting and program development. The Histogram can be used to answer the following questions:

1. What kind of population distribution does the data come from?
2. Where are the data located?
3. How spread out are the data?
4. Are the data symmetric or skewed?
5. Are there outliers in the data?

Where do you apply Histograms?

Histograms should be applied when huge amounts of data are available, but the same amount makes the total data unmanageable.

When are Histograms useful?

Histograms are a very useful communication tool when you require objective evidence to demonstrate to your GP Team and management the order in which priorities are to be tackled by the program.

Who benefits from Histograms?

Your GP Team benefit from using Histograms since this tool organizes data for them enabling easy recognition and communication of priority areas.

Ponder Point – User Notes

This tool can help you see the trends with more qualitative data.

Hoshin Kanri

What is Hoshin Kanri?

Hoshin Kanri is the Japanese program for policy management. It integrates top management's role in policy development with a PDCA cycle of management for the organization.

Hoshin Kanri is normally emphasized as policy deployment; however Hoshin Kanri establishes an even more aggressive approach than just deployment. It encompasses the phases of policy planning, policy development, policy deployment and policy review.

The great addition of Hoshin Kanri to the Total Quality Management (80·1) philosophy is that it asks for a review of the plans. Most organizations using Hoshin Kanri will plan every year for the next five years, so each year they will review and amend the plans with the developments of that year. This produces a stronger plan for the close future of the organization.

TIP Hoshin Kanri requires the active participation of the top management in your GP program. Many organizations implementing Hoshin Kanri have even designed new organizational charts with the top management at the bottom to transmit this idea.

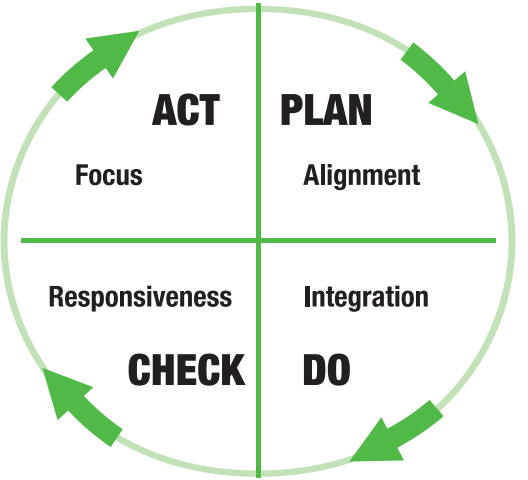
Why is Hoshin Kanri useful?

Hoshin Kanri is useful because it allows the organization's top management to periodically review its positions and share them with the rest of the organization.

How will Hoshin Kanri help you?

Hoshin Kanri will provide the organization with a disciplined plan for actively involving the top management in policy development and its deployment to the rest of the organization. Its primary value is to focus activity on the key things necessary for success. If your

company is comfortable with the benefits of Statistical Process Control (75.1), and is now integrating TQM or TQEM (80.1 or 79.1) as a management approach, Hoshin Kanri can serve as a directional tool to integrate your existing success in quality into a holistic management approach.



Where do you apply Hoshin Kanri?

Hoshin Kanri is applied in organizations that wish to design their future, instead of reacting to it. The policies established using it will apply to the entire organization.

When is Hoshin Kanri useful?

Hoshin Kanri is used when there is a need to plan your GP strategy for the whole organization, and to do this on a continuous basis. It is particularly useful during the early phases of your GP process.

Who benefits from Hoshin Kanri?

The top management and those in your GP Team get a direct benefit. The clear commitment and communication established by Hoshin Kanri position the GP effort for success, making the organization the ultimate benefactor.

Ponder Point – User Notes

Having top management's commitment to your GP program is important as it can mean the difference between success and failure and acts to motivate your team and all those impacted.

Industrial Field Visits

What is an Industrial Field Visit?

An Industrial Field Visit is precisely that, a visit to another industrial organization. This might include visits to customers, suppliers, partners or simply industries in the market that publicly open their doors.

TIP When at an Industrial Field Visit, taking notes is normally not politically correct. It is important to explain the purpose of the visit in advance so that your host is comfortable with questions. Preparing questions in advance and sharing them with your host can reduce this anxiety and ensure that your host has the information that you are looking for accessible.

Why are Industrial Field Visits useful?

Industrial Field Visits provide a unique opportunity to see how others have addressed problems and how these problems have been detected. It is a chance to learn from someone else's mistakes or successes.

How will Industrial Field Visits help you?

Industrial Field Visits will provide you with hands-on knowledge or experience from someone who has or has had the same problems that you are facing. It can also demonstrate the success of a GP program, which in turn can help you to initiate your own program or improve on your existing program.

Where do you apply Industrial Field Visits?

You should use an Industrial Field Visit, when you are going to implement a new GP program (e.g. ISO 14001, 47·1) in your organization. Going to an organization where this program has been already been implemented will give you a better idea of what it is you are about to face, and may help you to avoid some costly mistakes.

When are Industrial Field Visits useful?

They are useful when you require experience on the implementation of a GP option or want to understand how someone else solved a problem. Learning from others who have already walked that road can save time, money and resources.

Who benefits from Industrial Field Visits?

Your GP Team can get direct benefit from seeing for themselves what is expected from a GP program they are about to start, or what it looks like in action. Seeing a successful operation can help motivate your team to achieve similar successes.

Ponder Point – User Notes

Prepare your GP Team properly for the tour. It is not a sightseeing trip. Taking a Plant Layout (57·1) of your own challenge or data articulating your own challenge is a good idea. It is also a good idea to reciprocate when you are ready, as it may encourage a deeper exchange of information that could provide your GP efforts even greater benefit.

Input Material Changes

What are Input Material Changes?

Input Material Changes are changes in the feedstocks of the organization's processes that are meant either to reduce the environmental burden or to promote productivity (including some that can do both).

The most widely used Input Material Change is to change a Hazardous Product for a Non-Hazardous Product (e.g. solvent-based paint changed to water-based paint).

TIP Referencing the Material Data Safety Sheets (MSDS) for your products can outline information about which products have the highest safety, health and environmental aspects. Place them on a "transferable" list, to target their substitution.

Why are Input Material Changes useful?

Input Material Changes allow very significant changes without altering the organizational processes.

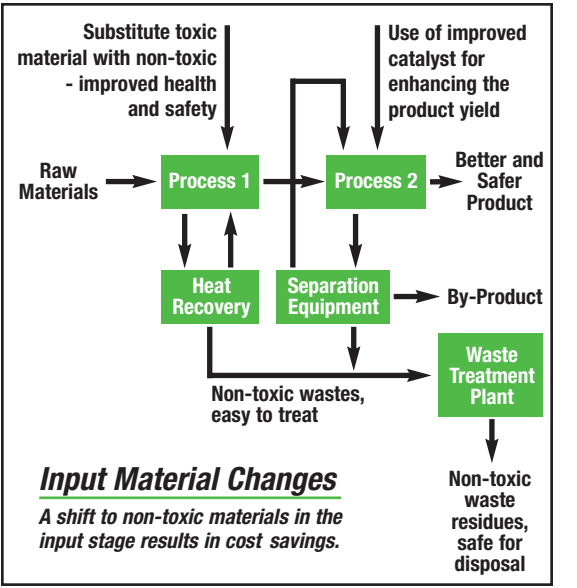
How will Input Material Changes help you?

Input Material Changes will allow you to leverage noticeable improvements with little effort (management stories of dramatically improved environmental performance with a simple telephone call are abundant).

Where do you apply Input Material Changes?

Input Material Changes shall only be applied where it has been established that there are clear benefits in environmental terms and/or monetary or productivity terms. This can be achieved through changes to materials that:

- Are less toxic,
- Are more easily treated,
- Make the workplace safer, or
- Are more efficient, specifically that require less energy.



When are Input Material Changes useful?

Input Material Changes are useful when the problem is caused by a characteristic of the input material that does not positively impact the final product (this includes packaging). It is useful to monitor the marketplace for new developments in input materials that may be more environmentally desirable, or more effective in your processes.

Who benefits from Input Material Changes?

Purchasing can benefit by being able to source materials that are lower cost. The department where the substitution occurs may have less paperwork to manage if the move is to a non-toxic material as these materials are typically outside regulatory report requirements.

Waste costs can be reduced, improving the overall bottom line. Customers can also benefit as the product or service that they acquire from you may carry less real cost. In turn, your own organization can benefit as you become a preferred supplier by eliminating certain undesirable components of your products. If the changes result in improvements to the environment outside your plant, the community benefits as well.

Ponder Point – User Notes

Payback for Input Material Changes can sometimes occur very quickly. In one operation, a simple switch from a solvent to a water-based cleaner tripped a series of cost savings and improved worker health and safety. It also resulted in lower absenteeism as fewer employees suffered from headaches. The water-based cleaner had a citric odour to it and employees actually commented on how pleasant it was to be in the area. Further, they were encouraged to bring plants and line the windows outside – a workplace environment need not be sterile to still follow the 5Ss (34·1).

A Material Safety Data Sheet (MSDS) is designed to provide both workers and emergency personnel with the proper procedures for handling or working with a particular substance. An MSDS includes information such as physical data (melting point, boiling point, flash point etc.), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill/leak procedures. These are of particular use if a spill or other accident occurs.

Interrelationship Diagram

What is an Interrelationship Diagram?

An Interrelationship Diagram is a graphic representation of what activities or ideas drive change and what their outcomes are. There is a cause and effect relationship that exists.

Developing an Interrelationship Diagram is a logical process that will chart the cause and effect of your organization's activities. This includes the visualization of multiple connections between different ideas, using lateral thinking over linear thinking.

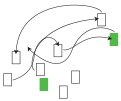
The way to develop an Interrelationship Diagram includes the following steps:

(b)

a) Make sure you have all the people you need, including those outside your GP Team.

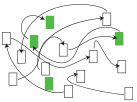
b) Agree on the issue or statement of the problem.

c) Assemble all the ideas. These could have been generated in a Brainstorming session (11·1) or through another mechanism.


(e)

d) Look for connections - ask: "What things influence this concept?"

e) Continue until you have finished with all the connections and then review the diagram.


(f)

f) Find out which are the core elements. This is done by selecting those elements which have the greatest number of arrows entering them (effects) or going out of them (causes) and graphically differentiate the core effects and causes.

TIP Using different colors to mark the core causes and core effects greatly improves the communication potential of the Interrelationship Diagram.

Why is the Interrelationship Diagram useful?

The Interrelationship Diagram is very useful to determine root causes of problems and understand the impacts of your GP project/program.

How will the Interrelationship Diagram help you?

The Interrelationship Diagram will allow you to identify and understand your main causes. It can come in very handy to exploit the information from a Fishbone (Ishikawa) Diagram (33·1).

Where do you apply the Interrelationship Diagram?

It allows you to systemically identify, analyze and clarify cause and effect relationships that would be useful to note before you select the best solution to a problem.

When is the Interrelationship Diagram useful?

Its utility is evident when:

- the relationship between ideas are not easy to understand.
- there is a need for a very strict sequence to be followed.
- you are looking for the root cause of an outcome.

Who benefits from the Interrelationship Diagram?

Your GP Team benefits, as well as the leader of the team, as an understanding of cause and effect improves decision–making. When these decisions bring positive returns to the bottom line, the whole organization benefits.

Ponder Point – User Notes

Once you complete this diagram, the drivers identified can be used as the goal in a Tree Diagram (82·1). As you have seen in other discussions, GP does not intend for the tools outlined in this book to be used in isolation. They provide you with insight on how to move your GP efforts forward in small steps or in leaps and bounds.

ISO 9000

What is ISO 9000?

ISO 9000 is both one standard and a reference to a series of standards developed by the International Organization for Standardization (ISO). It provides a standardized model for a Quality Management System (QMS, 65·1), created through international consensus.

ISO 9001 is the specification standard in this series. An organization can self-declare its conformance to the requirements or obtain external validation, usually by third party Registration/Certification (12·1). As with other management system models developed by ISO, the model is based on Deming's PDCA cycle for continual improvement (Plan-Do-Check-Act).

Currently there are more than half a million sites worldwide that have obtained a third party registration to ISO 9001. In some cases, customers require their suppliers to obtain this level of validation to remain in the supply chain.

TIP A quality management system will yield its best performance when fully integrated with the organization's overall management system.

Why is ISO 9001 useful?

ISO 9001 is useful because it provides the minimum requirements for implementing a quality management system within your organization.

How will ISO 9001 help you?

ISO 9001 can help you by outlining the requirements of an effective quality management system for you to begin to address quality in your organization, or as a means to improve your existing quality management system to one that meets an internationally recognized model.

Where do you apply ISO 9001?

The requirements in ISO 9001 can be applied to any type or size of organization. It can form the start of your organization's adoption of a systematic approach to the management of quality.

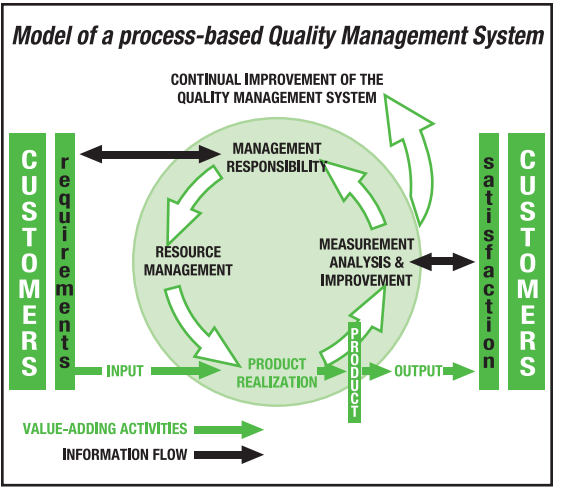
When is ISO 9001 useful?

ISO 9001 is helpful when:

- implementing a quality management system,
- you wish to meet or exceed customer expectations for ensuring consistency in your process,
- you decide that adoption of the international standard is valuable as part of an export strategy, or
- you wish to demonstrate to other stakeholders through verification that your organization's quality management system conforms to the requirements of ISO 9001.

Who benefits from ISO 9000?

Initially the quality management department will benefit as it instills a process for ensuring consistency. However, as quality is an organization-wide function, its effects can be felt throughout the whole organization. The implementation of a quality management system that conforms to ISO 9001 and follows guidelines in other standards within the series, will provide benefit to the whole organization. Indirectly, customers can benefit from the confidence that you have a robust and credible QMS that meet or exceed international standards. ISO 9001 is now being positioned as a best-in-class tool.



Source: ISO 9001:2000 with minor adaptation

Ponder Point – User Notes

Often ISO 9001 is marketed as a certified QMS. However, ISO 9001 is a voluntary standard and it is not a requirement of the standard to be certified by a third party. It can be used to guide improvement in part or in all of your existing QMS efforts, although you cannot claim conformity unless you meet or exceed all the requirements in the standard.

Regardless of the type of verification your organization chooses, the focus of your efforts should be on implementing and maintaining a credible and robust QMS. ISO 9001 can be implemented along with ISO 14001 (47·1) as their core framework is similar.

Visit ***www.iso.org*** *for more information.*

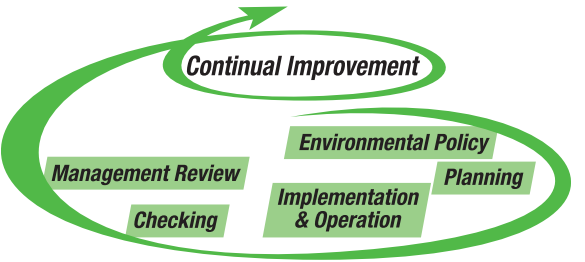
ISO 14000

What is ISO 14000?

ISO 14000 is a series of environmental management standards developed by the International Organization for Standardization (ISO), which provide requirements, guidelines and tools for implementing Environmental Management Systems (EMS). It provides a standardized model for an Environmental Management System (29·1), created through international consensus.

ISO 14001 is the requirement standard of the ISO 14000 series. Today it is the most widely recognized standard for environmental management in the world. There are four ways you can show your successful adoption of ISO 14001. You can self-declare. You can be audited by an interested party such as a client. You can be audited by a party external to your company or obtain Certification/Registration (12.1). Consult your marketplace to decide which options suits your organization. As with other management system models developed by ISO, the model is based on Deming's PDCA cycle for continual improvement (Plan-Do-Check-Act).

Environmental Management System Model for this International Standard



NOTE: This International Standard is based on the methodology known as Plan-Do-Check-Act (PDCA). PDCA can be briefly described as follows.

Plan: *establish the objectives and processes necessary to deliver results in accordance with the organization's environmental policy.*

Do: *implement the processes.*

Check: *monitor and measure processes against environmental policy, objectives, targets, legal and other requirements, and report the results.*

Act: *take actions to continually improve performance of the environmental management system.*

TIP An Environmental Management System (29.1) will yield its best performance when fully integrated with the organization's overall management system.

Why is ISO 14001 useful?

ISO 14001 provides the basic framework for establishing an Environmental Management System (29.1). It provides a consistent means by which you can establish processes and procedures that will lead to solutions related to the impacts that your business has on the environment.

Note that in Green Productivity, ISO 14001 is the framework for a systematic approach. If you consider GP as an umbrella strategy for improving your productivity, enhancing your bottom line and distinguishing yourself in the marketplace, then ISO 14001 should be thought of as the frame supporting this umbrella.

How will ISO 14001 help you?

ISO 14001 can help as it outlines the requirements of an effective Environmental Management System to enable you to address the environmental issues in your organization. It also provides a means to improve your existing Environmental Management System to one that meets an internationally recognized model.

Where do you apply ISO 14001?

The requirements in ISO 14001 can be applied to any type or size of organization. It can form the start of your organization's adoption of the systematic management of the relationship that it has with the environment. It can be applied to a division of your organization or across the whole organization. If a smaller business unit is chosen, you will need to be able to explain the exclusion of other parts of your organization. The Scope (71.1) of your EMS should cover all components of a process if you chose to apply it to part of your organization.

When is ISO 14001 useful?

ISO 14001 is useful as a means to establish continual improvement in your business even when there is no specific driver. Often something happens to initiate your interest. It may be a recurring non-compliance with an environmental regulation, the request of a client, a response to a contract lost to a competitor with ISO 14001 in place or as a result of the recognition that your business is at risk without a systematic approach to environmental management.

Who benefits from ISO 14000?

Initially the environmental management department will benefit as it instills a process for ensuring better management of your Environmental Aspects (28·1) consistently. However, as Environmental Impacts occur at any part of the organization, the benefits of an EMS can be felt throughout the whole organization. The implementation of an Environmental Management System that conforms to ISO 14001 and follows guidelines in other standards held within the series, will provide benefit to the whole organization.

Other stakeholders, including customers, suppliers and the community in which you operate may also receive benefit from your EMS. As well, the presence of a robust and credible EMS that meets or exceeds the requirements of ISO 14001 is a means to

demonstrate your commitment to compliance with environmental laws. If a problem does arise, you have a means to show that you have acted with due diligence.

Ponder Point – User Notes

Due diligence from a corporate perspective is the level of judgment, care, prudence, determination, and activity that a person would reasonably be expected to do under particular circumstances (see Ponder Points under 18000, 48·1).

In some jurisdictions, due diligence can serve as a legal strategy if your organization is charged with an offence.

Often ISO 14001, as ISO 9001 (46·1), is marketed as a certified EMS. However, ISO 14001 is a voluntary standard and like ISO 9001 it is not a requirement of the standard to be certified by a third party. It can be used to guide improvement in part or in whole of your existing EMS. However, you cannot state conformity unless you meet or exceed all the requirements in the standard.

The focus of your efforts should be on implementing and maintaining a credible and robust EMS. ISO 14001 can be implemented along with ISO 9001 as their core framework is similar.

*Visit **www.iso.org** for more information about these standards.*

Another tool that can help you start your EMS is Eco-mapping (24·1).

Eco-mapping is an excellent tool to help you determine where your potential and actual risks reside within your business.

18000

What is OHSAS 18000?

OHSAS stands for Occupational Health and Safety Standard. OHSAS 18000 is a series of two standards: OHSAS 18001 and OHSAS 18002 which provide requirements and guidelines respectively for implementing a Safety and Health Management Standard. Based on the British Standard BS 8800, OHSAS 18000 was developed by a group of standards bodies, certification bodies, registrars and consultants and was first published in 1999. It is not an ISO standard.

While the OHSAS 18000 standards were not developed through ISO, or using the ISO consensus process, it has gained great acceptance. In 2002, amendments were made to both standards to consider user demands and better align these standards to ISO 14001 and ISO 9001 (47·1 and 46·1).

TIP A Health and Safety management system will yield its best performance when integrated with the organization's overall management system.

Why is OHSAS 18001 useful?

OHSAS 18001 provides the basic framework for establishing an Occupational Safety and Health Management System.

How will OHSAS 18001 help you?

OHSAS 18001 management system can help you improve the safety and health of the employees of your organization. It can also be a communication tool to help you to demonstrate to others that your health and management system meets certain requirements.

Where do you apply OHSAS 18001?

OHSAS 18001 can be applied in any type or size of organization. It should be applied as a first step toward the systematic management of health and safety issues within an organization.

When is OHSAS 18001 useful?

OHSAS 18001 requires business to demonstrate that their system for managing Health and Safety pro-actively:

- seeks to eliminate or minimize risks to employees.
- complies with all national and international legal requirements.
- continually strives to improve their performance in the areas of Health and Safety.

Similar to ISO 14001 and ISO 9001, the use of an internationally supported standard is a way to gain acceptance for your company in a global marketplace. Also, in parallel to the two ISO management system standards, OHSAS 18001 has the option for external assessment and certification, if desired.

Who benefits from OHSAS 18001?

The aim of the OHSAS 18001 specification is to prevent, control and reduce hazards and risks within the working environment. While the members of the health and safety department may be more comfortable with the confidence that a systematic approach provides, ultimately, anyone involved in the outcome, improved workplace conditions, will benefit from the application of this system. In addition, top management can demonstrate to its board of directors, customers, the community at large and to regulatory bodies that they have a mechanism for meeting compliance requirements and can demonstrate due diligence.

Ponder Point – User Notes

When applied to occupational health and safety, due diligence means that employers take all reasonable precautions, under the particular circumstances, to prevent injuries, illness or accidents in the workplace. This duty applies to situations that are not addressed elsewhere in the occupational health and safety legislation.

To exercise due diligence, an employer must implement a plan to identify possible workplace hazards and carry out the appropriate corrective action to prevent accidents or injuries arising from these hazards.

In some jurisdictions, demonstrating due diligence is important as a legal defense for a person charged under occupational health and safety legislation. If charged, a defendant may be found not guilty if he or she can prove that due diligence was exercised. In other words, the defendant must be able to prove that all precautions, reasonable under the circumstances, were taken to protect the health and safety of workers. While this aspect may not be of particular concern in your local market it is something that you may wish to consider for your export markets.

Sample Risk Assessment for Safe Systems at Work for Health and Safety Procedures	
Hazard:	Contact with Electricity
Control Methods:	Elimination Instruction
Persons at Risk:	Delete from list as appropriate Staff Third Party Contractors Members of the Public Emergency Services
Risk Rating:	5 x 2 = 10
Existing Controls:	Insert Details specific to your operations.
Recommended Controls:	
1. Inspect all electrical equipment at least annually. 2. Ensure the person(s) working on the electrical system is competent. Confirm that they are (a) qualified electrician(s), a member of a relevant inspection/installation accredited body. 3. Require employees to report defective electrical equipment to the Operations Manager without delay for isolation. 4. Work should only be permitted on isolated supplies. 5. Identify all circuits that need breakers. Install or upgrade as appropriate. 6. Electrical systems should be inspected by an electrician at least every five years. Any new systems, or new parts of the original system, should be certified at the end of the installation by an electrician. 7. Maintain records and ensure that are accessible in times of emergencies to ensure prompt action.	

Source: www.ohsas-18001-occupational-health-and-safety.com with adaptations

KAIZEN

What is KAIZEN?

KAIZEN is the Japanese word for gradual, orderly continuous improvement, and that is precisely what it is. KAIZEN is a strategy that puts every member of the organization, from top management down, continuously on the watch out for improvement options.

This is done using systematic review and auditing procedures on the process, using Brainstorming (11·1) and group decision tools in order to see where improvement opportunities may lie.

All operations of the organization are subject to improvement, and the KAIZEN approach is that nothing has improved enough as to stop improving it. This is parallel to the reality of GP; it is a marathon without a finishing line.

TIP KAIZEN is synergistic with Total Quality Management (80·1). Similarly it is a part of Total Quality Environmental Management (79·1).

Why is KAIZEN useful?

KAIZEN is useful, because it provides continuous advances, probably small ones, but the 1000 km road starts with one step. It is a way of beginning and sustaining the culture of change towards sustainability.

How will KAIZEN help you?

KAIZEN will provide you with the strategic framework to implement all kind of programs and projects directed at continuous improvement. It does so by fostering the behaviour necessary to adopt a sustainable lifestyle at work, at home and during play.

Where do you apply KAIZEN?

KAIZEN is to be applied as an organizational way of doing things, everyone from top management down should be involved and trained in Kaizen techniques, and the scope of its implementation should be organization-wide. It does not involve capital investments or technological purchases.

When is KAIZEN useful?

KAIZEN has proven itself as one of the best approaches for Quality Control, since it does not wait for something to go wrong before it takes action. An organization implementing KAIZEN techniques will soon be ahead of possible problems, proactively preventing them from happening in the first place.

Who benefits from KAIZEN?

KAIZEN as a strategic framework for Total Quality Control, benefits the whole organization and beyond. Benefits extend to customers, users, and the community in general through various channels.

Ponder Point – User Notes

As KAIZEN means continuing improvement in personal life, home life, social life, and working life, it has a very strong alliance with the philosophy of GP. When applied to the workplace, KAIZEN means continuing improvement involving everyone - managers and workers alike. When one applies GP in the same vein as KAIZEN, you realize that the combined power of these concepts fosters the systematic and strategic approach to evolve towards sustainability, which does not stop at the boundaries of the company.

There is only one thing that you need to implement KAIZEN in your GP– believe.

Life Cycle Assessment

What is Life Cycle Assessment?

(Environmental) Life Cycle Assessment (LCA) is a powerful and sometimes complex tool that provides information on the environmental impacts of a product throughout the different stages of its life. This is described as its life cycle.

There are four main stages in a formal Life Cycle Assessment:

1. Goal and Scope Definition:

The goal and the scope of the LCA must be clearly defined before the LCA is conducted.

2. Life Cycle Inventory:

An inventory of all the Environmental Aspects (28·1) inside the defined scope that need to be developed.

3. Life Cycle Impact Assessment:

The Environmental Impact (28·1) of each of the aspects identified in the Life Cycle Inventory stage should be calculated.

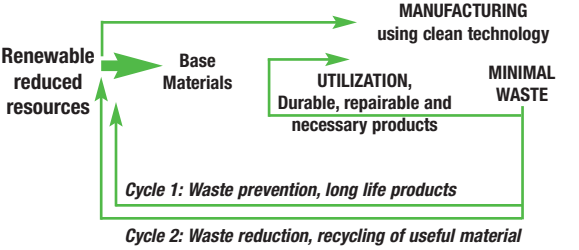
4. Improvement Assessment:

The possible reduction of environmental burdens should be identified and recorded throughout the life cycle. The report of the LCA should be congruent and compatible with the defined scope and goal (comparative LCAs must have a peer review as part of their report). Some approaches break the Report stage out as a fifth one.

TIP There is a tendency for LCAs to be used to 'prove' the superiority of one product over another. This has brought the concept into disrepute in some areas. Care must be taken to apply the tool appropriately.

Life-Cycle Assessment

The basic premise is that product design should take LCA and environmental advantage into account and in ***life cycle engineering*** *approach should be adopted to maintain sustainable development.*



Why is Life Cycle Assessment useful?

Life Cycle Assessment is useful because it produces information about the whole life cycle of a product. From this knowledge base, resources for improvement can be focused where the environmental burden is higher.

How will Life Cycle Assessment help you?

Life Cycle Assessment will help you to compare the same products through time, identifying improvement opportunities throughout the life cycle of the product. It is also useful in comparing products with the same functions. LCAs enable you to quantify how much energy and raw materials are used, and how much solid, liquid and gaseous waste is generated at each stage of the product's life. As all products have some impact on the environment, LCA can be used to identify those components that have heavier burdens. This allows you to identify ways to improve the product in your GP program, reducing its Environmental Impact (28·1).

Where do you apply Life Cycle Assessment?

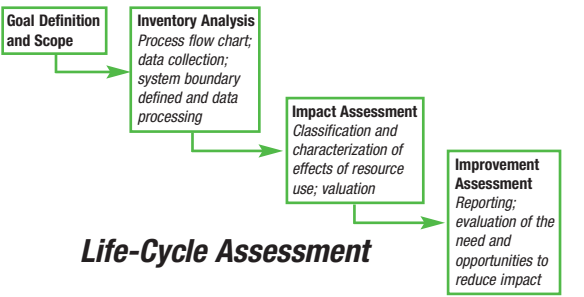
Life Cycle Assessment can be applied to any product that needs to be studied throughout its whole life cycle in order to understand its environmental impact (e.g. automobiles, washing machines, paints, etc.). It generally does not include second generation impacts, such as the energy expended to fire the bricks that are used to build the kilns to manufacture a raw material.

When is Life Cycle Assessment useful?

Life Cycle Assessment is useful where there is a need to define less obvious opportunities for improvement. It tends to be seen as a lengthy and very detailed exercise, although it needn't be. However, breaking down a product into fine detail can aid in identifying the use of scarce resources, and lead to an alternate, more sustainable component substitution.

Who benefits from Life Cycle Assessment?

Despite its resource-intensive nature, Life Cycle Assessment is very useful for any organization trying to position themselves in a niche market place, or to be unique in a more competitive marketplace. It can provide you with evidence to support a statement that your product is 'environmentally friendly'. If this claim is to be made, it is advisable to use standards for eco-labelling that have been established through multi-stakeholder processes.



Ponder Point – User Notes

LCA requires interpretation of the data and value judgments to be made. Use caution in using the data collected. As the trend for greater disclosure increases, LCA can help you present well-documented information on which accurate opinions can be formed.

It may be smart to cooperate with others in a sector when conducting an LCA. This way the cost can be shared. More serious environmental burdens can be reduced sector-wide. This can lead to reductions in regulatory demands for your sector, yet still allow you to differentiate your product for competitive advantage. Using a common data base does not mean that you are restricted to the same solution. Have your GP Team use a Brainstorming (11·1) session to figure out how to accomplish this.

Material Balance

What is Material Balance?

Material Balance is a technique used to determine where materials (or energy) end, as product, waste, emission, discharge, etc. It is based on the simple principle that matter and energy are neither created nor destroyed, only transformed from one state to another.

It uses a simple accounting principle:

Inputs – Outputs = Accumulation

So if something came into the plant, and is no longer inside the plant, then it must have gone somewhere.

For example:,

- if your water feedstock is 500L per hour;
- your water discharge is 470L. per hour;
- then 30L have exited the plant in some way (with the product, as vapor, filtered to the ground, flowed into another discharge system, etc.).

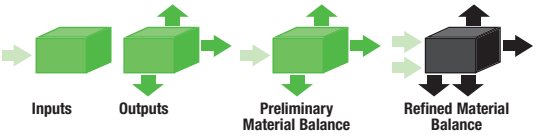
Material Balance will not tell you where the materials (or energy) are, but it will highlight that they are missing. There may be a resultant productivity loss, environmental damage, or breach of safety amongst other concerns that you need to consider in tracking this loss.

TIP Before starting your Material or Energy Balance (26.1) make sure all your inputs and outputs are in the same units and in the same area of production.

For further information on the issue of material and energy balance, you can consult your local library in the Chemical Engineering section.

Steps in Developing a Material Balance

1. Determining Inputs - recording raw materials procurement, water and energy usage
2. Quantifying Outputs - accounting for wastewater, gaseous emissions, solid wastes, energy
3. Selecting a Tie compound
4. Preparing a preliminary Material Balance
5. Evaluating and refining Material Balance



Why is a Material Balance useful?

A Material Balance is useful, because it is an economical and relatively fast way of assessing the flows between your organization and the environment. In some countries Mass Balance (a very accurate kind of material balance) is accepted by law enforcement agencies as a way to report emissions and discharges as a substitute for actual physical measures.

How will Material Balance help you?

A Material Balance will provide you with the magnitude of the flows going in and out of your organization. It will help you detect “hot spots” with objectivity and is a great guide to signaling where a situation of non-compliance might be happening.
For example:

- if your raw material has a sulfur content of 3%
- your product has 0.01% sulfur

- the ratio of raw material to product is 1 ton used for every 1/2 ton produced
- then 59.95 kgs. of sulfur per ton of product are leaving the organization either as waste, as emissions (S_{OX}) or mixed with some emulsifant in the discharges

Where do you apply a Material Balance?

Material Balance is applicable to all the processes in your organization, individually, by groups, or eventually to the whole organization.

When is a Material Balance useful?

A Material Balance is useful when you want to assess the environmental aspects and impacts of the process flows of an organization. This will enable the identification of areas for improvement.

Who benefits from a Material Balance?

A Material Balance benefits the operations management. It helps with planning, with reducing costs of raw materials, with the identification of environmental aspects and impacts and other issues related to the efficiency of the production process. It may enable the opportunity to source alternate raw materials that are more environmentally sound.

Ponder Point – User Notes

Material Balance can enable you to develop a better understanding of the movement of fluids and materials within the process you are trying to improve. It offers a systematic method of monitoring the amount of material or energy you have in each stream or flow. Starting with a Flowchart (35.1) can help you to visualize the opportunity for improvement.

DESIZING

Grey fabric:	500.0 kg
Desizing agent:	4.0 kg
Wetting agent:	4.0 kg
LP Steam:	45.0 kg
Water:	447.0 kg
Total:	**1000.0 kg**

Desized fabric:	950.0 kg
Drain:	50.0 kg
Total:	**1000.0 kg**

BLEACHING

Desized fabric:	500.0 kg
Water 30˚C:	4.0 kg
LP steam:	4.0 kg
HP steam:	45.0 kg
NaOH:	447.0 kg
Wetting agent:	2.4 kg
Peroxide (100%):	6.0 kg
Sodium Hydrosulphate:	4.2 kg
Peroxide stabilizer:	2.4 kg
Total:	**33797.10 kg**

Bleached fabric**:	900.0 kg
Wastewater 30˚C:	24947.1 kg
Vapour loss 80˚C:	350.0 kg
Condensate***:	7600.0 kg
Total:	**33797.0 kg**

DYEING

Bleached fabric:	500. kg
Filtered Water:	10000.0 kg
Soft water:	2200.0 kg
LP steam:	2500.0 kg
Dye:	10.0 kg
Sodium Cabonate:	31.0 kg
Sodium Nitrate:	3.5 kg
Wetting agent:	20.0 kg
Sulfuric acid:	1.0 kg
Total:	**33797.10 kg**

Dyed fabric (90% pickup):	900.0 kg
Wastewater 50˚C:	14215.50 kg
Vapour (60˚C):	150.0 kg
Total:	**33797.0 kg**

FINISHING

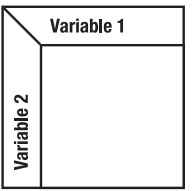
Case Study for a Material Balance from a textile drying mill.

Matrix Diagram

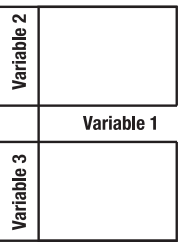
What is a Matrix Diagram?

A Matrix Diagram is a graphic representation of the way two or more variables interact. The shape of the Matrix will depend on how many variables need to be displayed and which interactions are important. The Matrix Diagram might have several forms; the following are the most common.

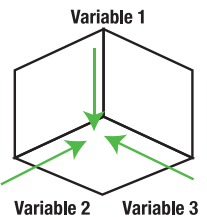
L shaped Matrix



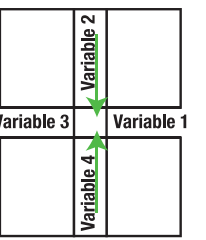
I shaped Matrix



Y shaped Matrix



X shaped Matrix



Whatever the shape, the Matrix will always be constructed after identifying which variables you want to relate and knowing the nature of their interactions.

TIP Software programs exist that can develop Matrix Diagrams of a dozen or more variables using any sort of graphic aids. However, most of the time relationships between two or three variables are strong enough to limit your focus and the effect of the other variables can be ignored.

Why is a Matrix Diagram useful?

The Matrix Diagram is useful when you want to modify a variable and you know there will be some kind of interaction with another one. The Matrix Diagram will illustrate this interaction.

How will a Matrix Diagram help you?

The Matrix Diagram will allow you to understand what will happen to other variables if you modify one of them. It will let you understand the strength of these cause and effect relationships as well.

Where do you apply a Matrix Diagram?

The Matrix Diagram can be applied to any process within your organization when you need to be aware of the interaction between two or more variables.

When is the Matrix Diagram useful?

The Matrix Diagram is useful when planning Product Improvement or Process Modification (63·1 and 62·1) in order to avoid unforeseen results that would reduce the benefits of your GP efforts.

Who benefits from the Matrix Diagram?

The Matrix Diagram benefits the GP Team leader directly. However, results from its use can minimize undesirable side effects of your GP program, benefiting the entire organization.

Ponder Point – User Notes

The Matrix is one of the most versatile tools to improve the quality of your decision-making. Sometimes the simplest tools return very high value.

Nominal Group Technique

What is the Nominal Group Technique (NGT)?

The Nominal Group Technique (also called Pen Name Technique) is a fast way of ranking ideas without the social influence of the group challenging individuals within your GP Team. It allows the team to come to a consensus position quickly.

To benefit from a Nominal Group Technique, follow these steps.

a) Define the issues or problems needing consensus. Be as precise as possible.

b) Assemble the relevant group of people. This may be your GP Team or others joining outside.

c) Agree upon a final list of statements representing the range of ideas with the team's agreement to each change. A white board is useful in this exercise.

d) Using anonymity, have every member assign a weighting of the ideas related to the problem your GP Team is trying to solve.

e) Record the ranked ideas and share them with the group ensuring that no position can be related to the author.

TIP This is a group technique that benefits enormously from intranet working technology, i.e. using a room with networked computers for every member so that they can post their ideas anonymously. At the same time they can see the ideas that are being generated by the group. This technology improves the transparency of the process.

Why is the NGT useful?

The Nominal Group Technique is especially useful when social factors or pressures block free expression of ideas (e.g. hierarchical differences).

How will the NGT help you?

The Nominal Group Technique will reduce the negative social influence within the group allowing for more ideas to be expressed, and fostering creativity. It is also useful to assess cultural issues related to the design of Adult Learning programs (6·1).

Where do you apply the NGT?

The Nominal Group Technique is applied in situations where different points of view exist, and where there is no consensus within the group (e.g. safety requirements).

When is the NGT useful?

The Nominal Group Technique is useful when a holistic overview of an issue is needed in a timely fashion, and the organizational climate prevents the group from acting freely.

Who benefits from the NGT?

Basically the organization is the main benefactor, but there is also a "hidden" benefit. The Technique shows the GP Team that every member is a valuable contributor with unique knowledge and ideas that he or she can put forward regardless of the position they hold within the organization.

Ponder Point – User Notes

This technique is also useful in bringing together a consensus when members are far apart in their perspective and in different locations. The GP Team does not have to be in the same room. However, the facilitator or coordinator must respect the confidentiality of the individual's position and opinion.

Off-Site Recovery & Recycling

What is Off-Site Recovery & Recycling?

Off-site Recovery and Recycling is a "second-best" option after On-site Recovery and Recycling of waste streams (55·1). It typically does not have as many benefits as On-site Recovery and Recycling, but acknowledges that On-site options are not always feasible. Off-site Recovery and Recycling may include looking for alternatives to final waste treatment techniques such as disposal, incineration, controlled confinement, or deep well injection.

TIP Controlled confinement does NOT remove the responsibility for the waste from the original producer.

Why is Off-Site Recovery & Recycling useful?

Off-site recovery and recycling reduces waste, and minimizes risks associated with storing/disposing of harmful by-products.

Off-site technology is especially useful for small to medium volumes of wastes requiring specialized equipment for treatment. A dedicated facility or mobile treatment technology could be most effective in these cases.

How will Off-Site Recovery & Recycling help you?

Off-site Recovery and Recycling will lower the true costs of wastes and reduce the environmental burden of your operations.

Where do you apply Off-Site Recovery & Recycling?

Off-site Recovery and Recycling can be applied to any organization that is generating waste streams that cannot be contained within the organization.

When is Off-Site Recovery & Recycling useful?

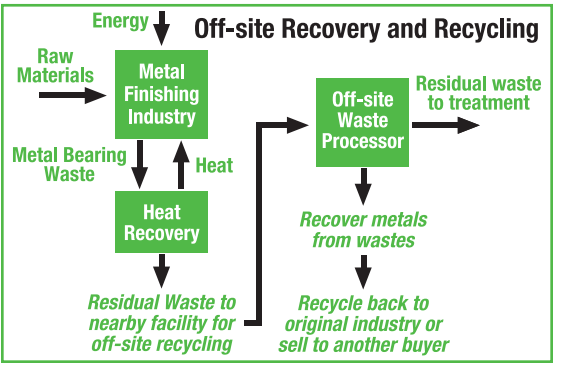
Off-site Recovery and Recycling should be used whenever a waste stream is generated, and On-site Recovery and Recycling is not possible. It is most economical to use Off-site technology for isolated "one-off" or infrequent recovery/recycle activities and On-site programs for continuous activity.

Who benefits from Off-Site Recovery & Recycling?

The organization can benefit from reduced liability and reduced disposal costs associated with their wastes. The surrounding community can also benefit as the environmental impact of the organizations activities is reduced.

Ponder Point – User Notes

Material or waste exchanges, waste brokers, commercial recyclers or co-operative agreements can assist in matching waste generators to potential end-users. It is useful to think about what to do with residual material as part of a contract negotiation. Think of how Green Purchasing (39·1) can be leveraged to help you find by-products from other businesses that may work as a raw material for you. Or can your Green Purchasing experts help you find a purchaser of your by-products that someone else could use?



On-Site Recovery & Recycling

What is On-Site Recovery & Recycling?

On-site Recovery and Recycling means that energy or material waste streams are either recovered or recycled within the organization. Recovering steam resulting from one process and using it to preheat a material flow to the boiler is an example of On-site recovery of energy.

TIP MEN stands for Mass and Energy Networks. This is a tool that helps you visualize the potential of using waste streams of one process as feedstock for another.

Why is On-Site Recovery & Recycling useful?

It is useful in two key ways. First, it examines existing waste streams for valuable resources that could be recovered/recycled. Second, it can be a lower cost alternative to Off-site Recovery and Recycling.

How will On-Site Recovery & Recycling help you?

On-site Recovery and Recycling will lower your waste management and treatment costs, and will reduce the impact of your waste streams on the environment.

Where do you apply On-Site Recovery & Recycling?

IT should be applied whenever feasible, from a liability, investment, and economic recovery standpoint.

When is On-Site Recovery & Recycling useful?

This option can be useful whenever you have waste streams leaving the organization that are either negatively impacting the environment, or contain resources that could be used. It is best employed with less complex waste streams where the components can be easily segregated from the waste stream for reuse. Potential economic benefits (Cost Benefit Analysis, 17·1) may also make this a useful tool.

Who benefits from On-Site Recovery & Recycling?

On-site Recovery and Recycling benefits the organization and beyond in several ways. From a productivity standpoint it means lower costs and reduced liability. From an environmental standpoint, it can lower the number and significance of environmental impacts. From the social standpoint it can mean less environmental burden on the community.

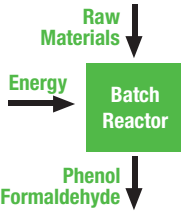
Ponder Point – User Notes

Some industries have been practicing On-site Recovery and Recycling for years. For example, the glass container industry has recycled off-spec material and material left from tank rebuilds or colour changes for decades. Industrial in-house scrap is a logical source for cullet, which is furnace-ready material. Its use saves energy and extends the life of the furnace.

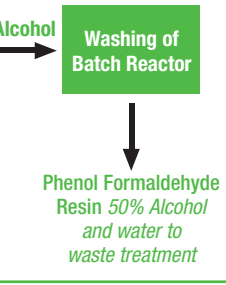
The diagram on page 55.3 shows two cases studies to illustrate this opportunity.

On-site Recovery and Recycle

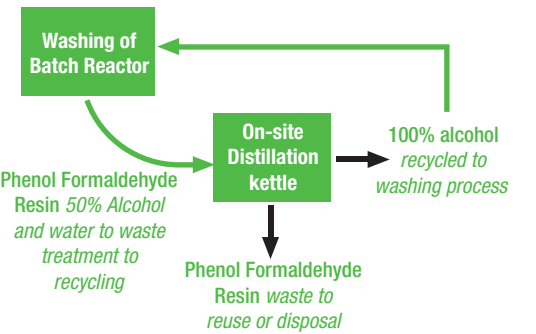
Manufacturing Process



When Product specifications change reactor is washed with alcohol



On-Site Recovery and Recycle

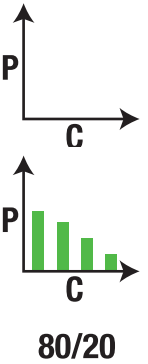


Pareto Diagram

What is a Pareto Diagram?

A Pareto Diagram is a graphic representation demonstrating which problems have the greatest effect on your business.

The following steps create a Pareto Diagram.



a) Draw a Cartesian axis with the problems, related to a major issue, on the vertical axis and the most meaningful unit of measurement. An example of which could be the frequency of occurrence, on the horizontal axis.

b) Place the problems according to the percentage of the frequency of occurrence in descending order from left to right until 100% is reached.

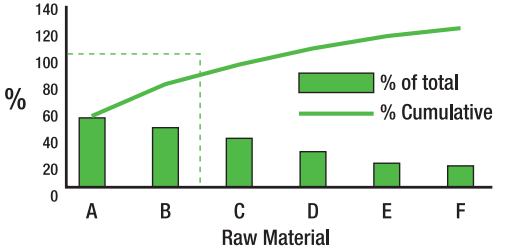
c) Normally 80% of the major issue will be caused by 20% of the problems. You need to focus your attention and resources on these problems.

TIP Using the output of a Fishbone Diagram (33.1) as the input for your Pareto Diagram is a good way of achieving synergy between your GP activities.

Why is a Pareto Diagram useful?

A Pareto Diagram is useful because it provides an objective and clear understanding of what the problems are that need your attention first. It helps you achieve the most for your investment of time and money.

Case Study



In an industry conducting a Green Productivity program, an Ishikawa or Fishbone diagram (33.1) was used to identify some of the causes for the high generation of off-spec products. The causes were as follows:

A Impurities in Chemical A (raw material)

B Low efficiency of mechanical equipment

C High temperature in the process

D Incorrect time period for the batch process

E Operator fault

F Amount of Catalyst B

G Others

The Green Productivity team decided to use Pareto diagrams to determine the major contributors to the problem. Off-Spec production and its corresponding causes were monitored for a period of one month. The number of times each cause contributed was noted and the frequencies were determined. The diagram shown indicates that raw material impurity and equipment efficiency were the major factors. Accordingly, the supplier was contacted and the necessary input material specification was included as a supply condition.

How will a Pareto Diagram help you?

It will allow you to concentrate your efforts on milestones. If you reduce a problem that is responsible for 30% of a major issue by half; you have improved an overall 15%. If you eliminate a problem that is responsible for 3% of a major issue by 100% you have improved an overall 3%. Pareto Diagrams will help you to focus on large achievable changes first and leave the fine tuning for the end.

Where do you apply a Pareto Diagram?

A Pareto Diagram is applied where you have encountered a multifactor issue. This way you can prioritize your GP projects and manage your resources in a more efficient way.

When is a Pareto Diagram useful?

Pareto is most helpful when you have identified a major issue and its contributing problems but you do not know where to start.

Who benefits from a Pareto Diagram?

A Pareto Diagram benefits everyone involved with an improvement project. In particular, the organization benefits by having its resources directed at the most important problem with the greatest opportunity for improvement.

It is also a great communication tool for showing top management and others why you have chosen certain activities as a priority, and what their expected outcomes will be.

Ponder Point – User Notes

Pareto provides you with a very visual format and can be used as an incentive to propel your GP Team to tackle bigger problems. Empowering your team, giving them confidence in what they are doing is important for the long-term success of your GP program.

Plant Layout

What is a Plant Layout?

A Plant Layout is a graphic representation of the dimensions of the building and an articulation of the spatial relationship of activities and processes within the plant as they are actually distributed. These dimensions refer to building location and orientation, machinery, power lines, sewer systems, water lines, steam lines, emergency water lines, etc.

A Plant Layout must be accurate in what it represents. The diagram should contain the following.

a) **Title:** Plant Layouts must contain a title indicating what is contained in the image.

b) **Scale:** The scale of the layout, likely in length units (meters, yards, or other suitable length units according to distances represented).

c) **Orientation:** It must be clear where the Layout is oriented to with respect to cardinal points. Often it is useful to include adjacent buildings or markers in the Layout.

d) **Legend:** Since buildings, piping, machinery and all equipment within the plant will be represented by symbols or icons, these should be very clearly described, including any variable used (e.g. color, texture, width, etc.).

TIP A Plant Layout can be very illustrative when a rendering of the buildings is done. Other dimensions such as pipelines, power lines, equipment, etc. can be included in the building layout. These may be captured either in physical documents, by overlay using wax paper or Mylar, by projection, or in a virtual environment using the appropriate software.

Why is a Plant Layout useful?

A Plant Layout permits planning with factual information and acts as an input to many other processes. When used together with the Process Flow Diagram (PFD) (61·1), they provide a solid basis to understand both the process and the functions of the organization.

How will a Plant Layout help you?

It is useful for the GP leader as part of a library of information needed before changes are initiated. It is the equivalent to the value of X-rays for a physician. It is the way of detecting first hand opportunities to improve and reduce costs.

Where do you apply a Plant Layout?

A Plant Layout is necessary to identify where changes are needed or to ensure that improvements are implemented according to plan. The most informed decisions will be those based on situations where a PFD and a Plant Layout are used in conjunction.

When is a Plant Layout useful?

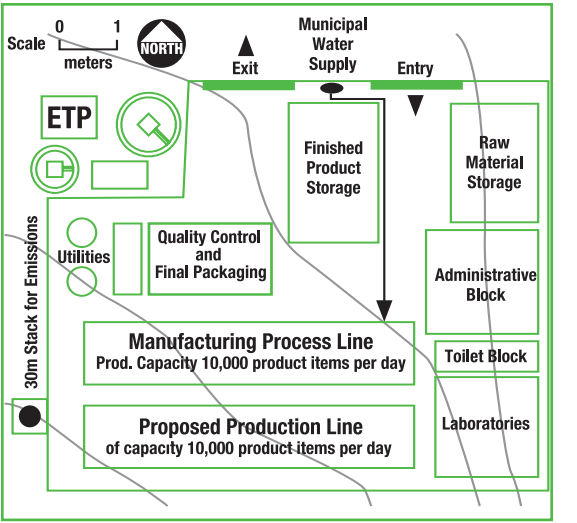
Plant Layouts should be developed early in your GP program and maintained up-to-date during the program and afterwards. They are useful in all decisions involving changes in the organization. They provide the basis for improvement such as changing underground pipelines, detecting leaks, or improving equipment distribution to reduce energy consumption.

Who benefits from a Plant Layout?

Some areas of the organization that receive direct benefits from a Plant Layout are: planning, production management, maintenance, human resources, training, health and safety, environment, and project management. Other areas that can get benefits from data shown in the Layout are accounting, systems, and security.

Ponder Point – User Notes

Eco-maps (24·1) further assist in delineating where problems exist in the planning phase. Include contours of land around the facility. You can get a quick understanding of some of the consequences of change to your processes, especially in close quarters with other facilities.



Preventive and Productive Maintenance

What is Preventive and Productive Maintenance (PPM)?

Preventive Maintenance means taking measures in advance, before corrective action is needed with regard to the functioning of the equipment (some authors have extended it to personnel issues).

Productive Maintenance is when the result of maintenance of the equipment is measured (normally in economic terms, e.g. using Cost Benefit Analysis, (17·1)) and the result is positive (i.e. tuning your car regularly will not only prevent damage, it will also save fuel costs. If the fuel saving is superior to the tuning cost, that is Productive Maintenance).

TIP Preventive and Productive Maintenance should be based on a GP program that identifies both the risks of not fulfilling maintenance requirements and the benefits (in savings) of doing maintenance appropriately.

TPM is an acronym for Total Productive Maintenance which is a systematic approach to Productive Maintenance.

Why is PPM useful?

Preventive and Productive Maintenance is useful as a means for enhancing productivity, minimizing down time and maximizing efficiency. Its about keeping your equipment operating at their peak performance levels as this helps to reduce waste.

How will PPM help you?

This activity will help you as a starting point to standarize your maintenance procedures with preventive and corrective guidelines as well as the identification of maintenance problems.

Where do you apply PPM?

Preventive and Productive Maintenance shall be applied wherever equipment maintenance is needed to prevent production from being interrupted.

When is PPM useful?

It is most useful when an organization wishes to organize its maintenance practices (e.g. classification of equipment by maintenance needs, classification of information, etc.).

Who benefits from PPM?

Preventive and Productive Maintenance benefits the organization by raising productivity and also the environmental impacts (by lowering and controlling maintenance wastes).

Ponder Point – User Notes

How much money is lost when a machine breaks down? There can be serious impacts to the environment when uncontrolled or unpredicted stops in production happen. It is always smarter to be in control – there is less risk, lower costs, and lower liability affiliated with control.

Shutdown periods for maintenance are provided for in your budget, and help you profit by keeping your operations safe and productive. Unscheduled breakdowns ***cost*** *you money.*

Prioritization

What is Prioritization?

Prioritization means assigning value to issues, problems or improvement opportunities and then ranking them accordingly; in order to tackle the highest ranked issues first.

Prioritization requires the setting of a criterion, which can be the effects of solving the problem on the overall situation (e.g. a Pareto Chart), or the cost involved in each option (e.g. the results of a Total Cost Assessment), or any other objective or subjective criteria (e.g. Decision Matrix).

Once a criterion (or several criteria) have been selected, a scale needs to be developed and the issues need to be assessed against the criterion (criteria).

TIP When prioritizing issues, it is useful to use Brainstorming (11·1) to develop the criterion (criteria), the weighting and the measurement or scaling technique that will be used during the assessment.

Why is Prioritization useful?

Prioritization is useful because it allows the objective allocation of resources to projects according to what is more important to your GP goals. Seldom do you find that an organization has limitless resources. There is also an intelligence to doing "first things first".

How will Prioritization help you?

Prioritization will help you by providing a framework for efficiently allocating your resources.

Where do you apply Prioritization?

It is applicable to any situation where you have multiple options, and need to make a choice.

When is Prioritization useful?

Prioritization is useful when you have to allocate limited resources on several options (e.g. more options than resources).

Who benefits from Prioritization?

The GP leader gets a direct benefit by improving the allocation of resources; the results are better planning and better cost control. This ultimately delivers benefits for the whole organization.

Ponder Point – User Notes

The environment is a very complex issue. It may seem at first that you may have undertaken a great deal of work with virtually no resources. Setting priorities can help bring into perspective what it is that you can do first. This can give you more confidence to continue your GP program. A few demonstrated successes can often instill confidence in top management and increase the resources available for future work.

Problem	Severity	Frequency	Cost Implications for Resolving the Problem	Cost of Inaction (waste stream costing)	Score (1-10 scale) 10 is top priority
PRODUCTIVITY					
Material Consumption	High	Always	High	High	9
Product Quality	Medium	82% success	Moderate	Moderate to High	6
Housekeeping	High	Always	Minimal	Moderate	10
ENVIRONMENT					
Legal Compliance	Medium to High	Occasionally on air, always on effluents	High	High	7
BUSINESS					
No. of Rejects from Customer	Minimal	5%	Minimal	High	4

Process Decision Diagram

What is a Process Decision Diagram?

A Process Decision Diagram is a tool based on the "What if?" principle. It is used to deploy events, address contingencies that can occur in a plan and articulate the actions required in order to emerge from the situation successfully.

Even though it can be done either as an outline or as a diagram, the advantage of a diagram is that it is easily communicated to others.

To develop a Process Decision Diagram you should:

a) develop a Tree Diagram (82·1) of the plan to be undertaken.

b) at the end (on the leaves of the tree) ask "What should be done if this does not work out?"(These are normally drawn as clouds).

c) use Brainstorming (11·1) to search for alternatives.

d) classify each alternative as selected or impossible (normally indicated by a (red) cloud with a "X" for impossible, and by a (green) cloud with a "checkmark" for selected alternatives).

TIP A Process Decision Diagram is better developed as a review mechanism when the best option has been decided. It is a means of enhancing success.

Why is a Process Decision Diagram useful?

A Process Decision Diagram will allow your GP Team to have in-hand alternatives to possible problems that may arise during implementation. The solutions to these problems will be the solutions already discussed and prioritized by the team. This fosters buy-in as part of the decision process and enables the team to act effectively in the implementation of their GP projects.

How will a Process Decision Diagram help you?

It will help you by providing you with ready made decisions as well as "yellow lights" – cautionary points where the process might have problems and what to do if these problems arise.

Where do you apply a Process Decision Diagram?

You apply a Process Decision Diagram to a plan that has important resource (including time) constraints.

When is a Process Decision Diagram useful?

A Process Decision Diagram should be applied when the presence of alternatives are necessary to avoid increased costs or delays related to implementation problems that could undermine the success of your GP program.

Who benefits from a Process Decision Diagram?

A Process Decision Diagram will benefit the GP leader and his or her team. Ultimately its results will benefit the whole organization as a cost and time control measure.

Ponder Point – User Notes

"What could go wrong?" Brainstorming (11·1) is a good complementary tool to use. The exercise of walking through the steps prior to implementation also helps to build confidence in your GP Team. Being ready for failure is a good way to avoid it as the team understands the steps which would lead up to a failure, and are ready with alternatives.

Process Flow Diagram

What is a Process Flow Diagram (PFD)?

A PFD is a special kind of flow diagram that maps the processes carried out in the organization, illustrating the mass and energy flows of the organization, from external inputs, to external outputs.

A complete PFD will show all mass and energy inputs to each process and its outputs. For example, the output of a bleaching process might be a flow of water polluted with bleach. This in turn is the input for the first phase in a water treatment process. The PFD should show the processes and their connections through flows.

For a PFD to be useful, it should include all flows leaving the organization be it in products, emissions to air, discharges to water or in solid waste.

TIP When developing a PFD it might be useful to set a process base in units of the number of products, hours worked, amount of a raw material or other data considered appropriate. This will be most helpful in explaining the magnitudes of the process.

Why is a PFD useful?

A PFD is useful because it helps organize all the flow information related to the organization's processes. It permits an understanding of how materials and energy are transformed and where there are waste streams (of any kind) created. This is the first step to real control of the organization's processes.

How will a PFD help you?

It can help you identify areas where you can improve your efficiency and reduce waste. It is also one of the best means for starting the identification of your Environmental Aspects (28·1). It can be used in conjunction with Eco-mapping (24·1).

Where do you apply a PFD?

A PFD should include all components of a process, giving you an overview. It may help you see your operation from a systems perspective or allow you to pinpoint specific points in your process where changes would enable you to do a better job with fewer resources. It is something that remains flexible to adapt or change as improvements unfold in the organization. Audits and process reviews can use them as a baseline of information to demonstrate improvement.

When is a PFD useful?

A PFD will be most useful when improvements in performance are needed. It is a handy tool when an organization has to perform an initial environmental review.

Who benefits from a PFD?

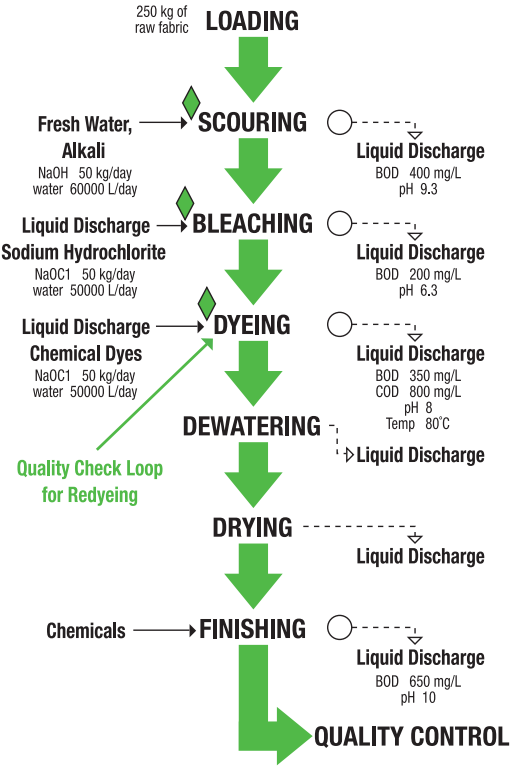
The GP leader and his or her team benefit directly from the use of a PFD to baseline the start of their efforts.

People in training programs can also benefit directly from the graphical information that is shown in a PFD. This tool can make it easier to explain why certain procedures are followed.

Ponder Point – User Notes

A Process Flow Diagram aids the understanding of all the details involved in making a product or providing a service. To test the accuracy and value of your PFD to you, give it to someone else on your GP Team, or outside the team to see if their understanding is consistent with the actual process.

Process Flow Diagram



○ Indicates waste water sampling area.

◇ These operations are conducted in batches and each process batch comprises certain operations such as washes, etc. Fill and draw technique is used. There are about 4 batches a day for each process, i.e. 4 discharges/day.

Process Modification

What is Process Modification?

Process Modification requires developing an alternate process to obtain the same or better quality product while generating less waste. Tools such as Eco-Mapping (24·1), Flowchart (35·1), Process Flow Diagrams (61·1) and Pareto Diagrams (56·1) can be used to help pinpoint areas in the process that are having the most significant impacts on the environment.

TIP When modifying a process, consider what tools can be used to monitor and predict the outcome of your changes. Such tools include Failure Mode Effect Analysis (32·1) and Process Decision Diagrams (60·1).

Why is Process Modification useful?

Process Modification is useful because it can proactively reduce wastes or lower resource consumption at the front end of a process, reducing or eliminating impacts further downstream.

As outlined in Design for Environment (20·1), the real economic and environmental savings occur in design. Too often, emphasis is placed on end-of-pipe solutions.

How will Process Modification help you?

Process Modification will help you reduce your Environmental Impacts (28·1), and enhance your productivity. You can alter a process in part or in whole by applying what you learn from information gleaned in Eco-mapping and using that knowledge to reduce waste or optimize resource use.

Where do you apply Process Modification?

Process Modification should be applied when the root cause of an environmental impact or a productivity loss lies in the actual process design.

When is Process Modification useful?

Process Modification is useful when you need to increase productivity or elevate the environmental performance of a process.

Who benefits from Process Modification?

Process Modification will benefit the organization in two ways. First, it enhances productivity and environmental performance. Second, it allows for the generation of new ideas to take advantage of improvement opportunities.

Ponder Point – User Notes

A periodic review of your whole organization's process by a GP Team is a sound investment. In one case study, a division had made changes to their part of the process but had not informed the purchasing department of the change. The earlier design required a toxic solvent for cleaning a paint line. When the process was changed, the division switched to water-based paint with the following implications. It removed the need for buying the more expensive, toxic cleaner. However, the purchasing department was still buying it.

Other benefits included the:

- ***a)*** *elimination of special storage requirements*
- ***b)*** *reduction of regulatory reporting requirements*
- ***c)*** *lowering of their insurance costs*
- ***d)*** *elimination of the cost and need for special waste handling*

Cost savings from these areas alone provided payback in six months.

Product Improvement

What is Product Improvement?

Product Improvement means using information from tools such as Design of Experiments (21·1), Design for Environment (20·1) and Life Cycle Assessment (50·1) to implement modifications in the product. These modifications will improve the productivity or environmental performance of the product during any of the stages of its life cycle (production, distribution, use or disposal).

TIP When modifying a product for its improvement, care shall be taken with the correlation among the different variables. Changing one variable that causes more environmental damage later in the life cycle is not a GP improvement.

Why is Product Improvement useful?

Product Improvement is an efficient way of correcting root causes of poor productivity or environmental performance generated by improvements in product design.

How will Product Improvement help you?

It can help reduce significant Environmental Impacts (28·1) and productivity problems related to product design. As well, it may spur a series of smaller incremental improvements along the supply chain. If there a particular environmental challenge that you are facing, start with identifying and clearly defining the problem. A Fishbone Diagram (33.1) may help you articulate the cause.

Where do you apply Product Improvement?

Product Improvement should be applied when the root cause of an Environmental Impact or a productivity loss is identified in the actual product design.

When is Product Improvement useful?

It is useful when you need to improve productivity or environmental performance specific to one or more products. It is applied when you are trying to solve an inefficiency in an existing product. This may be triggered by loss in market share to a competitor or when a product is positioned negatively in regulation due to an undesired component such as a toxic ingredient. It may also occur as part of a strategic rethinking of your organization to minimize negative parts of your product(s).

Who benefits from Product Improvement?

Product Improvement benefits extend further than the organization's borders. It can benefit downstream users, and communities where the product ends up. The improvements may enable consumers to recycle the product instead of it ending up in landfill, after its intended use is fulfilled.

TIP Involving your customer in a Brainstorming session (11.1) may be helpful and astute from a business perspective. They may not only provide you with some good ideas, this exchange may solidify your relationship with them.

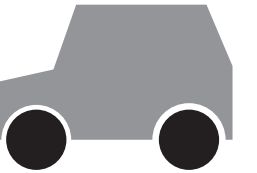
Ponder Point – User Notes

When improvements in products are made, it will be important to market them carefully. The market has expressed an interest in Green Products, although the public is ecologically illiterate and has forced changes to some product based on emotion, not good science.

ISO management system standards do not allow you to make a product claim. However, eco-labelling is increasingly popular and there is an ISO guideline that outlines specifications for a credible environmental claim. In addition, there are other eco-labelling programs internationally, which may state certain performance criteria that need to be met prior to labelling. These programs may be useful to help you understand what you should be striving to achieve with your process improvements.

Product Improvement

How can I improve it?
Can I ...



...make it more modular so that I extend its life cycle, and have customers stay with me to exchange old parts for new?

...change the colour to eliminate a toxic pigment?

...alter the shape to make it more aerodynamic?

...use a different material in manufacturing that is a byproduct without any loss in performance?

Quality Flow Diagram

What is a Quality Flow Diagram?

A Quality Flow Diagram is a graphic representation of how quality requirements are understood, treated, and transformed into process controls.

It mainly encompasses the following four stages.

a) Identify and collect information on your customer requirements.

b) Design management process control information (e.g. work instructions).

c) Execute the work according to designed process controls on previous step.

d) Verify internally and with the customer the results of the planned stages, and improve wherever the opportunity arises.

TIP A Quality Flow Diagram can be used to plan when you can most efficiently apply other tools, such as Pareto Diagrams, Control Charts, and an Affinity Diagram (56.1, 16.1 and 7.1).

Why is a Quality Flow Diagram useful?

A Quality Flow Diagram is useful because it shows the necessary steps and tools to transform customer requirements into daily operational routines.

How will a Quality Flow Diagram help you?

A Quality Flow Diagram will allow a solid framework for your cycle of continuous improvement as part of your quality or environmental management system (Plan-Do-Check-Act). It could help you meet government regulations or guidelines for environmental quality standards.

Where do you apply a Quality Flow Diagram?

A Quality Flow Diagram is applied to a specific process every time there is a new customer or a new customer requirement, whether it relates directly to product/service quality or to environmental issues.

When is a Quality Flow Diagram useful?

It is applied when there are unfulfilled or new customer requirements.

Who benefits from a Quality Flow Diagram?

The objective of a Quality Flow Diagram is to have the organization meet customer requirements in order to continue the business relationship. As a result, both the organization and the customer benefit.

Ponder Point – User Notes

A Quality Flow Diagram could be applied to a sampling program for sediment. It includes a detailed description of the data quality objectives. Essentially it helps to answer:

***WHY** the data is being collected?*

***HOW** it will be used?*

***WHAT** it will be compared to?*

***HOW** it will be interpreted?*

As well, its use enables your GP Team to understand the provisions necessary to ensure that appropriate analytical techniques are selected.

My customer needs a green widget with specific performance characteristics.

There five steps to meet or exceed these requirements. *We will use Control Charts to make sure that we stay within the tolerances required.*

We will use a Checklist to make sure that we produce it right the first time and on time.

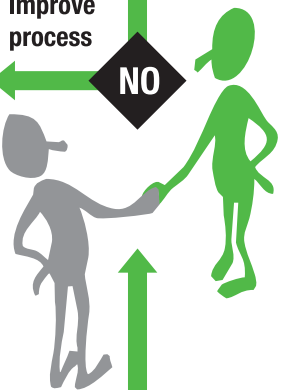
Upon delivery we will check to make sure the customer is satisfied and look for ways to improve, checking with the customer of changes to make sure we meet their specifications.

Confirm good results

YES

Improve process

NO



Quality Management System

What is a Quality Management System?

A Quality Management System (QMS) is the part of the overall management system that ensures that you can meet or exceed customer expectations for quality in products and services.

A Quality Management System includes the development of a formalized quality policy, as well as a planning phase outlining structure, responsibilities and procedures for quality within an organization. It also includes the verification of these procedures and a focus on continual improvement of the system.

TIP The ISO 9000 (46·1) series of standards outline the world's most widely recognized Quality Management System.

Why are Quality Management Systems useful?

Quality Management Systems allow your organization to take control of the quality of your products and services. QMS allows you to put a plan in place for consistency, allowing an organization to determine if preventive or corrective actions are needed.

How will a Quality Management System help you?

It will help you by setting your quality criteria, the procedures to meet these requirements and the actions needed to ensure that these requirements are met on a consistent basis.

Where do you apply a Quality Management System?

You apply Quality Management Systems to any organization of any type or size.

When are Quality Management Systems useful?

They are useful whenever an organization wishes to know how its operations influence the quality of internal and external products or services.

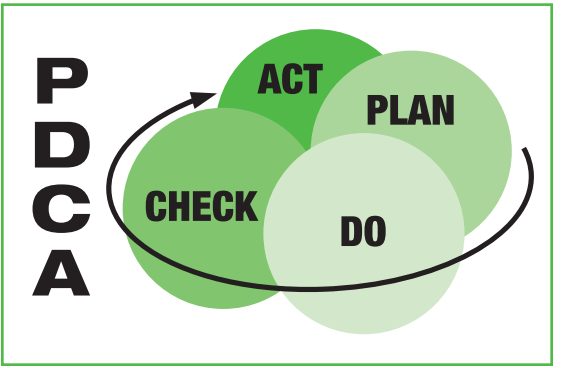
Who benefits from Quality Management Systems?

Quality Management Systems are a quality and productivity improvement tool, so their implementation will benefit the whole organization. Benefits can also extend to the supply chain if applied throughout, improving product quality and the relationships between suppliers, clients and the end customer.

Ponder Point – User Notes

A Quality Management System is not intended to be a stand-alone item, something practiced by a few members of your organization and contained in your quality management manual that sits on a shelf. It is intended to be a living, breathing system that fits into your overall management system, becoming part of the way that you do business.

Most commonly, organizations seek to integrate Quality Management Systems with Environmental Management Systems (29.1). Great lengths have been taken in the way that these systems are structured to ensure that they can be implemented together. Many of the requirements and procedures are the same, and great efficiencies can be recognized by implementing, auditing, and improving them together.



Recycle, Reuse and Recovery

What is "Recycle, Reuse and Recovery"?

Commonly known as the 3Rs; these activities are the basis for reducing waste and process optimization.

They are defined as follows:

1. **Recycle:** means returning a waste stream to the system either to be used for the same type of product as it was originally manufactured, or to be remanufactured into something new.
2. **Reuse:** means returning a waste stream or product to be used for the same purpose repeatedly, and
3. **Recovery:** means taking something from the waste stream of a process and inputting it into the same, or another process so that it can be used as raw material or energy source for another process.

TIP The 3Rs can be more than just an activity or a program – they can become a corporate philosophy that every member of the organization shares. This will not only lead to improved productivity and environmental indexes, it will also aid in creating a better working environment.

Why are Recycle, Reuse and Recovery useful?

The 3Rs provide the basic framework for integration of environmental and productivity activities. They demonstrate that caring for the environment is a wise business decision.

TIP The principle behind Recycling has been slightly redefined. Recycling occurs when a material returns to its original manufac turing activity, such as glass bottles and jars being collected and processed into cullet. Cullet is furnace-ready container glass, colour sorted and contaminant free. This is a high end use.

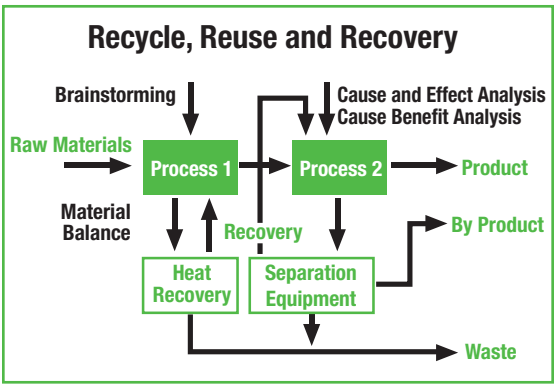
When recycling occurs but the material is managed in such a way that much of its inherent value is lost, this is termed downcycling. In the case of container glass, this would mean it ends up as a substitute for aggregate, or another lower end market application.

How will Recycle, Reuse and Recovery help you?

The 3Rs will provide you with an understandable platform to implement environmental programs that are economically sound at an organizational-wide level. Doing better with less makes good environmental and business sense.

Where do you apply Recycle, Reuse and Recovery?

The 3Rs can be applied throughout the organization. Processes with more waste present greater opportunities for improvement, but even purely administrative areas gain from these programs as they foster a conserver mindset. Savings from the seemingly trivial contribution of isolated acts can add up over time to be significant, especially in larger companies.



When are Recycle, Reuse and Recovery useful?

The 3Rs are useful from both an environmental and productivity improvement perspective. They can help when waste management programs have to be implemented or when increased efficiency is sought in business processes.

Who benefits from Recycle, Reuse and Recovery?

The 3Rs yield a direct environmental and economic benefit, so all areas that are measured by environmental or economic indicators will see improvements from these activities. However, the benefits will be felt by a broader audience because of the environmental benefits, and the spread of the conserver mentality within the workers.

Ponder Point – User Notes

German industrialist Georg Winter owns a diamond cutting operation. In the mid 1980s he extended his commitment to improving environmental performance using the 3Rs as a corporate commitment to enhancing his staff's homelife. He offered to have waste audits conducted to help staff identify how their personal lives could be improved by adopting a conserver or 3Rs perspective. "Over and above the purely business considerations, though, the environmentalist approach must also be seen as a question of lifestyle and job satisfaction. Enhanced job satisfaction grows out of the knowledge that one's work is no longer being done to the same extent at the cost of environment, personal health, and that of one's own children and generations to come." How would your GP Team react to this kind of offer?

Waste by definition refers to something that has no value. The 3Rs is about finding value in materials that has been overlooked. Avoid the term waste if at all possible as it reinforces the throw away mentality that you need to overcome to be successful in your GP efforts.

Resource Conservation

What is Resource Conservation?

Resource Conservation is an environmental, productivity and social responsibility issue. It is based on the need to ensure long-term viability of any resource. In the 1970s, Resource Conservation was focused on natural resources. However, as people, politics and policy started to better understand the challenge, their concern broadened from the environment in isolation to include the conservation of all resources for sustainability to be achieved.

Understanding where your organization fits into the local, regional and global scales of resource consumption and seeing how you are affecting the resource reservoir is important.

To evaluate how you affect natural resources you must look at your consumption of resources in different media, including: air, water, soil and natural resources. Where are you efficient and where are you polluting, and therefore inefficient?

TIP The conservation of natural resources is still the first step for an organization that is preparing itself to work towards sustainable development, moving from the philosophical to the practical.

Why is Resource Conservation useful?

Aside from its moral, ethical and ecological standpoint, Resource Conservation is a very wise financial decision. It facilitates a level of efficiency and effectiveness that allows the business to better control costs, improve its public image and take steps to ensure the longevity of supply sources.

How will Resource Conservation help you?

Resource Conservation will help you financially by reducing the need for remediation, lowering those associated costs and input costs, and ensuring the longevity of supply. It will also help you by reducing Environmental Impact (28·1) through more efficient allocation of your resource needs. In practice, the philosophy of Resource Conservation, embedded in GP, promotes Green Purchasing, and better Waste Management (39·1 and 84·1).

TIP Many of the terms in Greening on the Go have a natural word connection, be it Flowcharts Flowcharts (35.1), Tree (82.1) or Fishbone Diagram (33.1). This is because the very earliest investigation of how to eliminate variance from manufacturing came from studying how nature managed change. Nature is very efficient. It optimizes its production process. So anything you can do to save water, energy, trees, paper is a step towards naturalizing your business and emulating the incredible efficiency of nature.

Where do you apply Resource Conservation?

Resource Conservation polices and procedures should be applied to all of the resource flows of the organization. This is especially important to those resource flows that are deemed to be endangered, either from sensitive ecosystems or limited by short supply.

Conducting a Material Balance is a good way to see where you need to start your efforts (51·1).

When is Resource Conservation useful?

Resource Conservation will always help an organization. Often organizations find that in adopting this philosophy employees tend to streamline in other areas. It sensitizes them to do better with less. Items or activities that are not essential to productivity are eliminated. It does not mean that the organization assumes a Spartan outlook. Rather it takes on a hum of excitement and enthusiasm. Think of it more as the exhilaration you get from the feeling of a perfect golf swing, the hum your tennis racquet emits when you hit the perfect angle, or the surge you feel from an inspiring piece of art or music. There is a `sweet spot` where your organization functions so well that other companies are almost envious. The enthusiasm of employees is contagious.

Who benefits from Resource Conservation?

The organization benefits financially and environmentally from Resource Conservation. In addition, however, the surrounding community and even the global environment can benefit from decreased consumption of resources.

Ponder Point – User Notes

Resource Conservation can lead to new partnerships between your organization and those will similar mind sets in the public or private sector. Once you have an idea of what your prioirites are, try Brainstorming (11·1) with your GP Team to see how these partnerships could result in new business.

Run Charts

What is a Run Chart?

A Run Chart is a tool for tracking trends. It basically lets you see how a pattern is evolving over a specified period of time.

To develop a Run Chart, use the following steps.

a) Decide what the performance measures for the process are; setting the categorization on the y axis.

b) Identify the project's estimated time frame and assign time intervals on the x axis (days, weeks, months, etc.)

c) Gather between 20 to 25 Data Points (18·1) to ensure that you can detect a meaningful pattern.

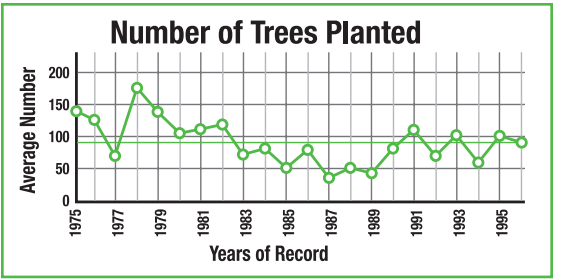
d) Plot the data. Draw a horizontal line at the average value - where the data will look 'centered'.

e) Interpret the results.

Where there is an obvious trend, the relationship will be normalized to "1". To illustrate this point, any progress above an improvement of 21% when 14% was expected will be calculated as 21/14 = 1.5; hence an interval of 1.5 will be used.

Now consider what the outcome will be when the expected progress is not achieved, e.g. 7% occurs when 14% was expected. 7/14 = 0.5; so an interval featuring 0.5 will be charted.

TIP Run Charts give two warning signals that should start an investigation to find the causes: a) when you see seven consecutive points above or below the "1" line or b) when you see seven or more consecutive points decreasing or increasing.



If the "1" line was 90 (the green line), you can see from 1983 to 1989 the planting goal was not reached.

Why are Run Charts useful?

Run Charts are useful because they provide a visual track of your GP project's progress allowing you to detect trends, shifts or cycles. It may help you to see where something is falling behind schedule or if it is going "too fast". Too fast may mean a loss in quality or product.

How will Run Charts help you?

Run Charts will provide you with tracking information that will allow you to develop ideas of what is 'normal' regarding your performance. This information can help you to predict trends, and to focus on the more vital changes.

Where do you apply Run Charts?

Run Charts should be applied before the GP project is started to establish past performance boundaries. It should then be used to monitor your GP project and to understand the nature of variation in your process. It is not useful in projects of very short duration unless they are repeated periodically.

When are Run Charts useful?

Run Charts are useful when you want to compare change before and after the implementation of a GP project.

Who benefits from the use of Run Charts?

The GP Team benefits from understanding just how much progress they have made. The GP project team leader also stands to benefit from its use as a means of monitoring the success of the GP project, which can in turn be shared with top management.

Ponder Point – User Notes

A danger in using a Run Chart is that some may decide that any variation in data is important. Focus on those changes in the GP project that are vital to the process. Testing for simple patterns to look for meaningful trends can be done by applying a Control Chart (16·1). A Control Chart is basically a simplified Run Chart with statistically-controlled limits.

Sometimes mindsets limit the interpretation of the data. Be careful to not let the way you think prevent you from seeing what your data is actually telling you. If you are conflicted by what you see, check your data. If it is correct, and it is still perplexing, involve your GP Team in a Brainstorming exercise (11.1) to determine what the data is really telling you.

7 Wastes

What are the 7 Wastes?

The 7 Wastes is a technique to focus attention on activities where resources are wasted within an organization. It sets the focus on seven key inefficiencies:

a) Waiting: when people are forced to wait for something or someone (e.g. machines to process, internal inventories or late arrival of material inputs),

b) Transporting: unnecessary movement of materials in the facility, or between facilities (e.g. bad layout of the production floor),

c) Processing: process operations that produce waste, along with the product,

d) Inventory: high inventory levels (of anything),

e) Motions: unnecessary movement of personnel or things in the facility (e.g. supervisor office in a different building from staff),

f) Defects: producing defective parts or those having bad quality, and

g) Overproduction: producing to have surplus, exceeding real demand.

TIP The 7 Wastes can be part of a Checklist (13·1) that every area of the organization should include in a report. It should cover what problems they have and what GP projects are being implemented to reduce the 7 Wastes.

Why are the 7 Wastes useful?

The 7 Wastes are useful to find opportunity areas to reduce inefficiency and promote GP. It can begin with an awareness program to point out ways in which the GP Team can help the organization become more efficient.

How will the 7 Wastes help you?

The 7 Wastes will improve the efficiency of your organization by highlighting areas that would improve production and benefit from Environmental Objectives (30·1) and programs.

Where do you apply the 7 Wastes?

The 7 Wastes technique is designed to enhance the efficiency of production. However, administrative and support areas can benefit highly from this technique.

When are the 7 Wastes useful?

Unless there have been (successful) efficiency improvement programs going on for some time at the organization, the 7 Wastes technique will be a useful diagnostic tool.

Who benefits from using the 7 Wastes?

The 7 Wastes technique serves as an organization-wide diagnostic tool, so the benefits will be realized by the whole organization. It can point out where the organization has suffered from poor planning or design, a lack of proper training, the absence of proper control, a lack of discipline or even laziness.

Ponder Point – User Notes

Where human behavior is the cause of any one of the 7 Wastes, it may be better to foster a positive attitude as opposed to disciplining employees. A reward process, coupled with proper training can be an effective way to bring about change.

TIP Reward the GP Team as a group so that they understand working as a team benefits themselves and the company.

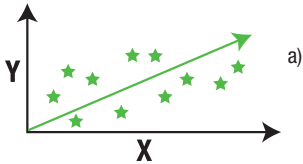
Scatter Diagram

What is a Scatter Diagram?

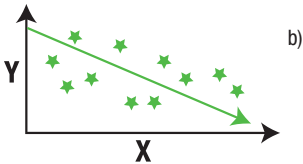
A Scatter Diagram (or Scatter graph, Scatter plot) is used to measure the relationship between two variables.

The Scatter Diagram is a very broad picture of the relationship and will only help to confirm that a relationship exists and what it is. It provides a visual and statistical test of how strong or weak the relationship is.

Typical information from Scatter Diagrams will show the following scenarios.



a) Positive correlation - as one variable increases so does the other.



b) Negative correlation - as one variable increases value the other decreases.

c) No correlation - there is no influence from one variable on the value of the other.

There may be weak indications of possible positive or negative correlations, but the trend up or down is still there.

TIP When using a Scatter Diagram care should be taken that if the relationship is not obvious, the conclusion shall be expressed with caution. It is a good idea to use other correlation verification methods to assess the relationship among variables if the Scatter Diagram is not conclusive.

Why is a Scatter Diagram useful?

A Scatter Diagram is very useful when you need to adjust the value of a variable and are not sure of the influence of this variable on the other.

How will a Scatter Diagram help you?

A Scatter Diagram will provide you with information on the existing relationship between two variables. The stronger the tie or dependency, the greater the likelihood that a change in one will impact the other. It will NOT allow you to predict the cause and effect.

Scatter Diagrams are developed as follows:

1. Collect 50 to 100 paired samples of data that you think might be related. Construct a sheet to identify the categories and list the two variables.

   Example: the number of training sessions taken by a GP Team member (as the category) against the new ideas generated by each GP Team member.

2. Draw the X and Y axis lines of the diagram. Post the variable you think is dependent on the Y axis and the one you think is independent on the X axis.

3. Interpret the data.

Where do you apply Scatter Diagrams?

Scatter Diagrams are the first step on the process of experimental design, Product Improvement or Process Modification (63·1 and 62·1), providing basic information as to what might happen with other variables when certain activities are implemented.

When are Scatter Diagrams useful?

A Scatter Diagram is useful when you need to understand whether two variables are dependent or independent of each other. It can be useful to continue with a cause and effect assessment using either a Matrix Diagram or the Fishbone Diagram (52·1 and 33·1) to find out how tight a connection exists.

Who benefits from Scatter Diagrams?

The GP Team leader gets a direct benefit from using the information visualized in the Scatter Diagram. However, the results of the actions taken based on this information benefit the whole organization.

Ponder Point – User Notes

Japanese quality consultant Kaoru Ishikawa believed that there was no end to quality improvement. In 1985 he suggested that seven base tools be used for collection and analysis of quality data. Among the tools identified was the Scatter Diagram.

Scope

What is Scope?

Scope refers to the delineation of the physical boundary and managerial authority that includes the elements of your organization that are affected or to be considered within your GP project, program or management system.

Often suggestions are made to apply some tools to the whole organization. However, sometimes this is neither practical nor appropriate. The reasons may be financial, environmental, or logistical. Whatever rationale is used should be recorded in case top management or external stakeholders challenge you.

In ISO 14001 (47·1), Scope is characterized by certain criteria. An organization has the freedom and flexibility to define its boundaries for what will be included in its Environmental Management System. It can cover the whole organization or it can be contained to one division or operational unit.

However, once you decide what your Scope is, it is not appropriate to exclude areas within or problems inside that area after the fact. You cannot pick and choose areas or 'pockets' to avoid if the Scope you choose physically or by managerial authority encompasses them. This is like stating "I will follow the law, as long as I think it is right". This is inappropriate; it is not good management.

While there is not the same imposition of compliance as to what will be included in the Scope of your GP project, or program – the same care and logic is still valid. If you avoid the areas with the most significant Environmental Impacts (28·1), you are ignoring the areas that pose the most risk, and offer the most opportunity for environmental and economic benefit.

TIP When setting the Scope for your GP project, program and especially for a management system (ISO 9001 or ISO 14001, 46.1 and 47.1), keep in mind that you may need to communicate it to someone else (customers, suppliers, or the general public).

The credibility of your Scope delineation is one of the criteria by which you may be judged for everything else you do. Consider what stakeholders may think if a steel foundry were to implement a Quality Management System (65·1) for the cafeteria only.

Why is the concept of Scope useful?

The concept of Scope is very useful to define in what areas of your business you want to apply your GP efforts.

How will the concept of Scope help you?

The concept of Scope will help you when defining the breadth and depth of the efforts that you need to apply to your GP program, project or management system. This will also help with the correct allocation of resources and an accurate setting of objectives and targets.

Where do you apply the concept of Scope?

The concept of Scope is applied where you and your GP Team need to have a clear understanding of what will be included and excluded in a new GP program, project or in the planning phase of a management system.

When is the concept of Scope useful?

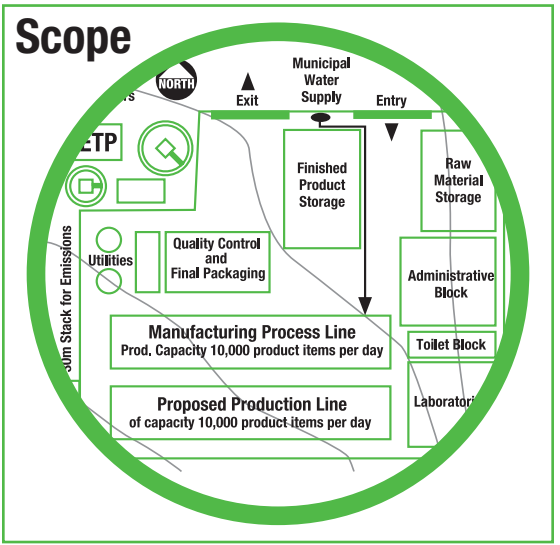
The concept of Scope is useful when you need to clearly define who is involved and where the application is focused in a GP project, program or system. It is established early on as it impacts the resources required for implementation.

Who benefits from the concept of Scope?

The main beneficiaries of the delineation of Scope are the GP Team leader, and the GP Team who aid with implementation. Also those people who work in the areas within the organization that are to be included will benefit.

Ponder Point – User Notes

In a larger organization, when a division is not included, those outside the GP program may appreciate the rationale for why their division is not included. A GP program can carry a sense of prestige. For those outside the trial area, they may need to understand why the other areas were selected. Sometimes the reason is not clear and other workers may feel they are better suited for the start-up of a GP program. Sharing the Scope and the rationale for it can also help build acceptance or support for GP in the rest of your organization.



Solid Waste Management

What is Solid Waste Management (SWM)?

Solid Waste Management is the general name for all processes, activities or programs aimed at reducing the pollution caused by solid wastes. Note the term solid, normally applies to everything in the organization that is managed in a solid container, such as a 50 gallon drum, irrespective of what state the actual waste is in.

TIP The more clear and strict the division of solid wastes into hazardous and non-hazardous, the easier it is to manage both waste streams in an environmentally sound and cost-effective manner.

Why is SWM useful?

Solid Waste Management is an opportunity to recover, reuse and recycle whereby materials, money and energy can be saved. It infers a recovery of valuable materials from the solid waste stream (this might include energy recovery), as well as complying with applicable legislation and regulations.

How will SWM help you?

By recovering valuable materials out of the waste stream, it will help you to lower costs and provide you with sound evidence of compliance with applicable laws and regulations. Additionally, residues from air or wastewater pollution control facilities may end up at your solid waste management facility where further treatment can be considered or disposal in a suitable landfill can be achieved.

TIP If a material has value than it is NOT a waste. Often legislation refers to materials that exist a process as waste. This imposes a negative context and can lead to people mishandling materials to the point they do become waste. Encourage people to think about quality and value and how to manage these materials to be accepted as an industrial feedstock.

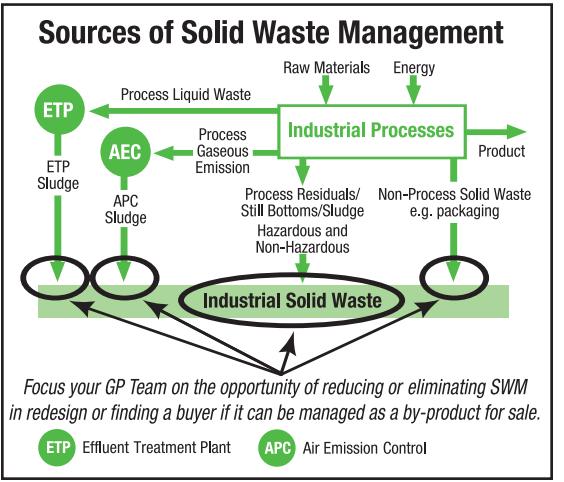
Where do you apply SWM?

Solid Waste Management can be applied generically to any discharge of the organization. However, wastes with high environmental/safety risks must take priority (normally these will be hazardous wastes).

When is SWM useful?

Solid Waste Management is useful as a means of planning and then implementing sound management options, matching the best option to different materials. This is assisted by Waste Segregation (86·1). Solid waste streams can be out of control, in which case they pose a higher risk. What is not measured is not managed – and this is when costs start to escalate.

Also if they are in "control", but the results are not the expected ones, a re-assessment of your options such as Reduce, Recycle and Recovery (66·1) is appropriate. The results of this reassessment may include economic benefits, or reductions in environmental burden and liability.



Who benefits from SWM?

Solid Waste Management reflects directly on the economic health of the organization, and on legal and social compliance. There can be advantages in terms of worker health and safety as well. Hence, the whole organization benefits from better Solid Waste Management. The community in which you operate will also benefit from your improvements.

Ponder Point – User Notes

Understanding what materials are part of your solid waste stream is critical to establishing better operational control, and to opening opportunities for environmentally sound options. This is not always easy. Any form of waste is a form of inefficiency. A key benefit of GP is to use the knowledge gained from this situation to help you do better with less at the front end, before inefficiencies in your business create waste. This is where great gains in GP can be achieved.

Spider Web Diagram

What is a Spider Web Diagram?

A Spider Web Diagram is a graphic representation that will allow you to rate the performance of your GP program against a number of targets using numerous criteria concurrently.

Each axis of the Spider Web Diagram represents a criterion. It can be used during a Benchmarking (10·1) process to show:

- current performance,
- the immediate target or goal,
- what might be an industry average,
- what is considered best-in-class or world class.

TIP Using different colours for the axis is a good way to enhance the communication potential of the Spider Web Diagram. It is important to get varied perspectives to avoid "blind spots" that would prevent progress in your GP program.

Why is a Spider Web Diagram useful?

A Spider Web Diagram will allow the GP Team leader to see where the strengths and weaknesses are in a GP program against established criteria. If the program is found deviating from schedule, plans, or performance, the Spider Web Diagram enables the understanding required to assign additional resources and take corrective action. In this way, the final results of the GP project are not hampered.

How will a Spider Web Diagram help you?

A Spider Web Diagram will allow better control over the performance of different attributes desired in your GP program. It is an easy tool to use, following these steps.

1. Make sure that you have the right people – you may need to invite others not on your GP Team.

2. Select and define the criteria; between 5 and 10 categories is acceptable. You can Brainstorm or incorporate headers from an Affinity Diagram (11·1 and 7·1) to determine the appropriate categories.
3. Draw a circle with spokes, each one assigned one of the criteria. The centre of the circle ranked as '0' - meaning no performance, with the outside of the spoke representing the highest number – optimal performance. Performance can been ranked subjectively or objectively.
4. Rank all the performance criteria. This can be done by each GP Team member individually if it is a subjective assessment. Additionally, it can be done by your GP Team through consensus.

   If the criteria assigned has data that is objective in nature, then record it on the chart.
5. Connect the data and highlight the area within the connected dots. Different colours can be used when it represents data from individuals, or one colour can be used with larger dots.
6. Discuss the results to ensure that you have a clear, consistent interpretation of the data.

Where do you apply a Spider Web Diagram?

A Spider Web Diagram can be used whenever the GP Team wishes to understand its current level of progress, and where priorities should be placed to move forward.

When is a Spider Web Diagram useful?

A Spider Web Diagram is useful when your GP Team wishes to understand how to prioritize efforts to improve performance in a number of areas affecting a project. It can also be helpful in conjunction with information collected through Eco-mapping (24·1). It can be used as a GP progress or report card.

Who benefits from a Spider Web Diagram?

A Spider Web Diagram will directly benefit the overall GP Team through self-assessment. It can also provide the GP Team leader with a sense of what progress has been made. This Diagram's highly visual appearance will help top management and others understand progress made by the GP Team.

Ponder Point – User Notes

A Spider Web Chart is also known as a Radar Chart. Due to the visible distinction it provides between criteria, the Spider Web or Radar Chart can be easily made into a poster to share information in a simple way to the rest of the organization and to plot progress for the GP Team.

Standard Operating Procedures

What are Standard Operating Procedures?

Standard Operating Procedures or SOPs provide a detailed description of commonly used procedures within an organization. Each SOP has a desired outcome (what you want to have happen as a result of the SOP) and a measurement (how you know if it is being correctly followed). You may decide to standardize certain activities across your whole organization.

SOPs can include not only formatting (which by itself is more useful than what it might seem at first glance), but also involve the consistent use of common terminology, and problem solving policies.

TIP You don't have to implement a management system standard to standardize your procedures; this practice however will help you if you decide in the future to implement such a system. They are the first step in the "Say what you do, then do what you say" model of business.

Why are SOPs useful?

SOPs describe how a task is to be performed. This promotes consistency, even when the normal person who may carry out the activity is absent. The idea is to standardize the way a recurring task is handled, so that every time it is done, it is done the same way - both efficiently and safely.

SOPs can be used to help demonstrate due diligence if an accident occurs, as they are usually indicative of a better managed company – providing the procedure is correct.

How will SOPs help you?

SOPs help to establish routine for common activities to minimize variation in the way something is done. In this way, quality can be

maintained and continuous improvement can be clearly seen. Troubleshooting or improving a process is much easier when the process is conducted consistently. Going through the exercise of documenting "what you do" can be an important first step to "improving what you do". Keep language to a minimum. Be clear. It may take a few edits to get an SOP right. Avoid adjectives.

Where do you apply SOPs?

SOPs are applied where there is a routine, reoccurring activity or process. It will identify the person who is responsible, the task that needs to be performed, and what they will do to be consistent in how they perform the activity or ensure the process works. Once the SOP is written you need to ensure that it is implemented properly. This involves training your staff - it is partly a communication tool – and verifying that it is understood and used. A good use of an SOP is in higher risk areas of your operations.

When are SOPs useful?

SOPs are useful when there is any repetitive activity that is part of the organizations' operations or even part of the GP program. They are particularly useful when the absence of an SOP may lead to a significant Environmental Impact (28·1).

TIP There is a tendency when writing SOPs to over-document. The net result is a huge manual that serves as a great paperweight, or to keep doors open in humid weather to increase airflow. But no one reads it.

Who benefits from SOPs?

The presence of an SOP allows the GP Team to identify the related quality, productivity, environmental, health or safety issues in an organized, comprehensive manner. As members in your GP team change, or new ones are brought on side, SOPs can benefit not only the GP Team leader who has to train neophytes, it can make the transition process move more swiftly for the new member.

Ultimately, the whole organization benefits as do others in the community where SOPs make an organization more productive, or prevent accidents from occurring.

Ponder Point – User Notes

Sample SOPs for environmental, health and safety issues are present on numerous government sites and industry sector association sites where there is a need to establish a minimum threshold of care on a particular activity or process. Some SOPs are standardized in the sense that technical realities require consistency regardless of where you are or what you do. A good example of this relates to emergency response procedures or to internationally prescribed SOPs for managing toxics. You do not have to write your own SOPs from scratch in some cases.

Statistical Process Control

What is Statistical Process Control?

Statistical Process Control (SPC) is the application of statistical tools to analyze your business process. Often SPC refers to seven analytical tools, referred to as the 7QC Tools (for quality control), which include:

- Fishbone Diagram (Ishikawa or Cause and Effect Diagram) (33.1)
- Check Sheets (14.1)
- Control Chart (16.1)
- Flowchart (35.1)
- Histogram (41.1)
- Pareto Diagram (56.1)
- Scatter Diagram (70.1)

TIP The literature on 7QC Tools is inconsistent in its listing of the seven tools. Some list Run Charts (68.1), others include Stratification (which is a concept related to a Control Chart (16.1)). This inconsistency is not important; the real issue is that you use the appropriate tool.

Why is SPC useful?

SPC can help you correctly find and define your process challenges to eliminate pollution and accelerate your GP efforts. It can help you change raw numbers coming from inspections and audits into useful information.

How will SPC help you?

Using one or more of the seven tools, you can analyze elements of your process to determine where and when variances cause problems that may lead to pollution. The value in SPC is that it offers simple yet powerful tools. They can be used independently or in combination to pinpoint a trouble spot, be it a recurring spill, a fugitive emission or as part of a broader analysis to reduce Environmental Impacts (28.1).

Where do you apply SPC?

Some of the tools can be applied to your whole process, such as a Flowchart, whereas you may use a Control Chart to identify your performance in a well defined boundary.

When is SPC useful?

SPC is good for trouble shooting an existing process or product. Once they are pinpointed, you can apply solutions using other GP tools and techniques, such as Design for Environment (20.1) or Life Cycle Assessment (50.1).

Who benefits from SPC?

A GP Team leader will find it very helpful as often one of the biggest challenges to be faced is defining the problem properly. Usually what you are given is a mess, and you have to determine what the problem is first. It is not uncommon for environmental problems to be heavily masked in emotion. They are also often complex by the fact that in nature, nothing occurs in isolation, so there may be more than more problem to solve. The GP Team can benefit from being trained in these tools, improving their skills, and making them feel more confident about their GP efforts.

Ponder Point – User Notes

There is a difference between a symptom and the acutal problem. To be effective, the problem solving process must focus on the root cause, not the symptom. Some experts have identified three kinds of errors that occur in problem solving.

Type 1 involves solving a problem that doesn't exist.

Type 2 fails to recognize that a problem does exist.

Type 3 occurs when the wrong problem is solved.

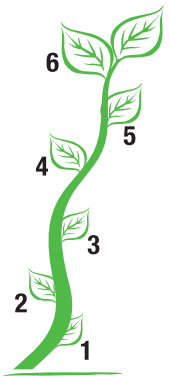
In the environmental area, there may be good cause to add a Type 4 where in solving one problem another is created.

Success in Six-Operationalizing Green Productivity

What is Success in Six?

Green Productivity consists of six major steps that include thirteen specific tasks. In following these six steps, you can move your organization from lower productivity to Green Productivity. GP moves your organization from reacting haphazardly to environmental problems to a position where you can improve your environmental performance and enhance your core productivity. Green Productivity is a methodology:

- what it does or has that impacts on the environment,
- reduces their efficiency,
- adds cost and,
- suppresses their productivity.



The Six Steps are as follows:

1. *Getting started*
2. *Planning*
3. *Generation and Evaluation of GP options*
4. *Implementation of GP options*
5. *Monitor and Review*
6. *Sustaining GP*

TIP Success in Six can be made easy when you start with Eco-mapping (24.1). As most environmental problems are location-based, Eco-mapping can help even the smallest enterprise can see the value in GP quickly and inexpensively.

Why is Success in Six useful?

GP's Success in Six outlines a logical sequence for affecting change within your organization regardless of its size.

How will Success in Six help you?

It gives you a clear vision for change that is clearly laid out in simple steps. Success in Six will help you do better with less.

Where do you apply Success in Six?

Success in Six is applied to the Scope (71·1) of your GP initiative, as you have defined it.

When is Success in Six useful?

Success in Six is the framework for your GP program, and hence is most effective when initiated through a planning process. You need to obtain top management's commitment to support before proceeding, even if the idea for GP comes from a customer or from the shop floor.

Who benefits from Success in Six?

Success in Six is an excellent planning tool that will benefit the entire GP Team. As it is the foundation for GP, its benefits will be realized by the entire organization. It is also a useful tool for sharing your aims with external stakeholders. This can include customers interested from a supply chain perspective, or members in your community that have stated concerns about your environmental performance.

Ponder Point – User Notes

"Start with the end in mind" is a valuable premise to employ in project management. The Success in Six framework encourages you to do just that. It maps out a pathway to a greener, more productive future for your organization. GP is a long-term journey and the decisions will not always be easy. Take a moment at the beginning to envision this brighter future with both your organization and your GP Team. Constantly focusing on the endpoint will help you to maintain momentum and motivation as you embark on this exciting journey.

Team Tools

What are Team Tools?

What is a Team Tool? It is a process to help a group transform itself from a gathering of isolated individuals into an effective force for change. The goal is to optimize the efforts of the individuals working on the same objective, even if tasks are divided. Think of the cohesion required in a relay team; each person is responsible for a part of the race, but their ability to seamlessly coordinate the passing of the baton and cheer each other on makes the difference between a winning team and second place. It is important to note that the final result does not depend solely on any individual, and the only way for an individual to "win" is if the whole team "wins".

There are four basic steps.

TIP Lack of consensus or the absence of a teamed approach can be the reason that GP efforts fail. Truly successful organizations exist because the people make things happen. Spend time on building bridges between the individuals on your GP Team just as you would in training a relay team.

a) **Forming:** the group needs to be constituted; normally this is done artificially at first (i.e. the group members are selected by an authority, which may be the GP Team leader). On occasion it may include bringing other resource people considered necessary to achieve a goal. The team has to be both flexible and open to absorb other people as needed, even on a temporary basis.

b) **Storming:** this step refers to the period of time when the dynamics of the individuals are brought out. Typically, there is a range of personalities, knowledge, skills and attitude – the people have to learn about each other in order to move to being a cohesive GP Team. It will include debate and discovery of people's respective strengths and weakness, and can be a time of initial conflict, to which the name alludes.

c) **Norming:** this is where individuals start to understand the dynamics of the group and become comfortable with its way of operating. During this time, the group may establish policies and procedures for how it will manage itself. It can establish its objectives and the criteria for decision making, not on GP options but as to how the group will operate.

c) **Performing:** this is where the last vestiges of individualism disappear and people start to behave as a GP Team. It is not that the individuals cease to have their own opinion; rather they understand that their own success is dependent on the GP Team. When they believe the rest of the team is off on a wrong track, they will discuss this with the team as they realize they cannot stop working for the team without hurting themselves. They are ready for action.

TIP Tools such as the Affinity Diagram, Brainstorming and Nominal Group Technique (7.1, 11.1 and 53.1) can be used to accelerate the time it takes to move into operating as a GP Team. Don't try to hurry the process. The formation of an effective team is critical to the success of your GP program, and is worth the initial investment of time.

Why is a Team Tool useful?

It is useful because it provides the framework for developing consensus, to empower individuals to work as a team and thus create synergy through their individual capacities.

How will this Team Tool help you?

It will help you to accelerate the normal process of ironing out group dynamics. It can enhance the effectiveness of your GP program and enable you to manage your human resources in a way in which their individual and collective potential is maximized.

Where do you apply the Team Tool?

A GP Team needs to be established to handle a multi-disciplinary problem, or when the GP program is extensive. Team Tools should be used whenever a team is established. The most effective organizations operate like a relay team at all levels.

When is the Team Tool useful?

It is best used when a new team is formed. This process can be repeated when there are new members, whether they are involved on a temporary basis or due to turnover.

Who benefits from Using the Team Tool?

The GP Team leader benefits as well as the GP Team.
However, teams are formed to solve organizational problems. The benefit of Team Tools starts with the team itself, to improve its performance. As the team evolves to solve problems more efficiently, the whole organization benefits from the outcome.

Ponder Point – User Notes

What if you are the only member of your GP Team?

If your company is a micro-enterprise you may be the only internal member. However, the probability that you have to work with people external to your organization is very high. These same tools apply whether the individuals are internal or external or some combination of both.

Total Cost Assessment

What is Total Cost Assessment (TCA)?

Total Cost Assessment is a useful tool for integrating environmental and business considerations integrate environmental cost into capital budgeting.

When Total Cost Assessment is correctly practiced, all the environmentally related costs are assigned to the product cost, hence yielding the real cost of the product, not just the price. You need to consider costs such as:

- waste energy
- mandated pollution control equipment
- debt service on required environmental monitoring and control equipment
- wastewater treatment, air pollution control
- waste handling and tracking
- waste transportation
- disposal costs and
- environmental management (including tasks to comply with applicable laws and regulations)

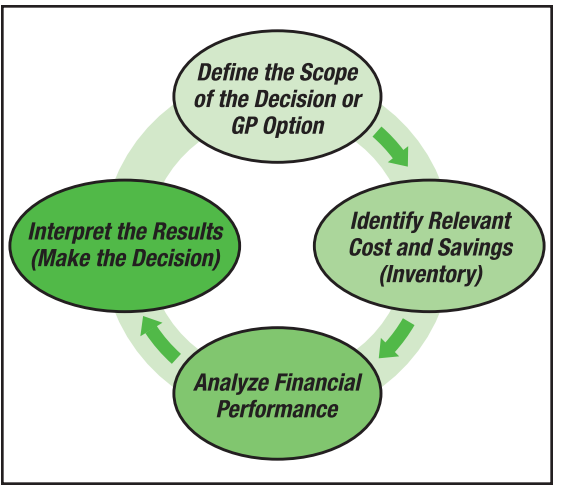
TIP Total Cost Assessment is a way to allow environmental investments, such as your GP projects, compete more successfully for limited capital funds.

Why is Total Cost Assessment useful?

It is very useful because it can provide information regarding subsidizations between products or between departments. Often the environmental financial cost is charged to one product and not to the cost of others creating an internal disadvantage, or is inappropriately considered as overhead. When it is not clearly seen, the costs are overlooked.

There are four steps in Total Cost Assessment (TCA).

1. Define the scope of the decision – understand what options will better define the type of cost information.
2. Identify and understand what the costs are – distinguish between direct costs (labour material and capital), indirect costs (often misallocated or lost in overhead categories), contingent costs (associated with potential liabilities) and less quantifiable costs (such as damage to employee morale or corporate image). Savings can come in the from of reduced inventory and avoided costs.
3. Analyze financial performance - TCA recognizes the fact that a dollar today is worth more than a dollar tomorrow - to recognize the time value of money. This is called discount cash flow.
4. Make the decision - integrating all the factors that are relevant to profitability of an investment opportunity.



How will Total Cost Assessment help you?

TCA will allow you to determine the true cost of a product or process and evaluate financial alternatives based on fact. It can also help to 'level the playing field' for investments in pollution prevention that might otherwise be dismissed in lieu of 'end-of-pipe' approaches where their price is lower, although the system cost is higher.

Where do you apply Total Cost Assessment?

It should be applied to financial decisions and strategies, such as equipment acquisition, process changes, training investments, etc.

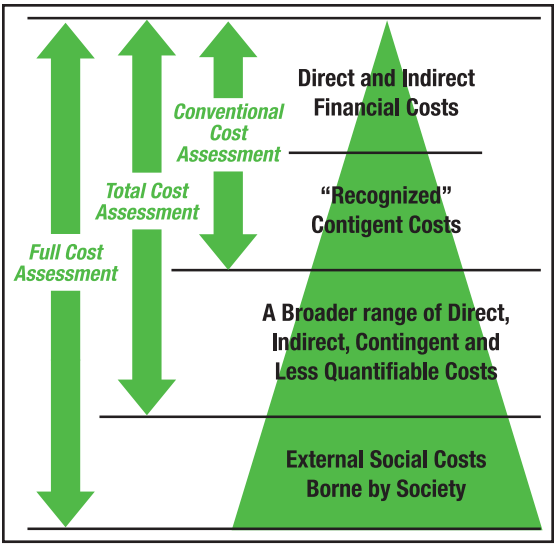
When is Total Cost Assessment useful?

Total Cost Assessment is necessary in any financial decision to avoid misleading information leading to inappropriate decisions. The price of a product with poor environmental qualities can initially look more attractive than a product with a higher price tag. However, this assessment tool can show that the higher priced product may have lower maintenance costs and reduced disposal costs, which makes its true cost much more attractive.

TIP One of the classic reasons that prevent companies from taking action is conflict between departments over budgets. If one division has to spend more to get a greener product but another division gets the financial credit for lower maintenance costs, typically the greener product is passed over. Here is where the need for a corporate strategy on Green Purchasing (39.1) can be of great value.

Who benefits from Total Cost Assessment?

Applying TCA benefits the financial health of the organization, as well as its environmental performance. The GP Team will benefit because it allows them to communicate and compare their environmental projects with other capital projects in the organization. Eventually, the organization will benefit from an overall improved bottom line.



Ponder Point – User Notes

This approach was developed by the Tellus Institute. It further differentiates Total Cost Assessment from Full Cost Assessment, where external social costs borne by society are included in addition to environmental considerations.

It is not uncommon for departments outside the GP program to fight a change. Sometimes GP improvements may result in a lower budget for their department, or the addition of higher costs, even though the total cost to the organization is reduced. Keeping top management informed of these opportunities is important. It may be useful to include someone from your purchasing and accounting department in your GP Team; or bring them into discussions as early as possible to give them a chance to inform others why changes in budgets will occur. Good data presented in a positive manner as early as possible is usually the best path forward.

Total Quality Environmental Management

What is Total Quality Environmental Management?

Total Quality Environmental Management (TQEM) is an evolution of Total Quality Management (80·1). It views Environmental Impacts (28·1) as a defect in your process, and includes strategies to implement measures to control and improve environmental quality. This includes management systems, control equipment, measuring and monitoring equipment, setting of performance indicators, etc.

As with Total Quality Management, it delivers an organization-wide approach. It establishes directives or protocols that govern the way in which all operations are carried out.

TIP When adopting a Total Quality Environmental Management approach remember that some issues differ between Quality and Environment. The two most critical differences are:

- the environment does not operate the same way as a client in quality management (you cannot interview or question Mother Nature to understand her requirements, nor can you negotiate changes to her contract),
- there is no practical end user verification of your environmental quality (e.g. there are no public environmental quality surveys). Others speak on behalf of Mother Nature whether it is the government through regulatory means, or concerns of special interest groups. Note that more customers are starting to demand environmental performance as part of their supply chain requirements.

Why is TQEM useful?

TQEM is useful because it provides a method for your company to evolve from viewing the environment as an afterthought or ignore issue to an opportunity. GP's Success in Six (76.1) enhances this by

connecting environmental improvements into productivity gains. This results in increased profit and prosperity. This is the essence of GP.

How will TQEM help you?

TQEM will enable you to work more productivly, to ensure that environmental factors are considered in day-to-day decisions. TQEM is a philosophy that you embrace. It fosters a different attitude, one that helps you do better with less.

Where do you apply TQEM?

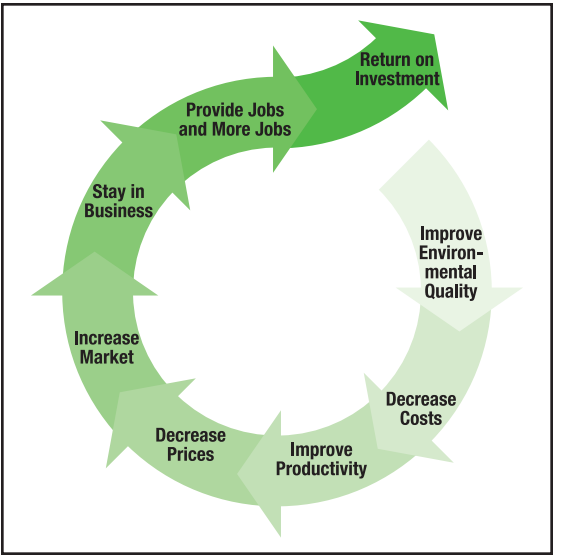
TQEM is applied throughout the whole organization. This allows you to achieve desired results and the potential for competitive advantage.

When is TQEM useful?

TQEM is most useful when the commitment to the environment is made a corporate priority. It is helpful when there is a Total Quality Management philosophy already embedded in the organization. Similarly the philosophy enables the organization to view the environment, as quality, not as something "extra" to be done as an afterthought, but as a way to improve core productivity.

Who benefits from TQEM?

The whole organization benefits. As well, those outside the initial system (customers, suppliers, shareholders, communities, etc.) benefit from the organization's adoption of TQEM. Nature also benefits as the positive effects of TQEM created synergy with natural flows. It does not stop at organizational or political boundaries. Applying the philosophy of total quality to environmental management can result in a chain reaction of benefits.



Ponder Point – User Notes

The application of quality principles to the environment started with statistical process control for biological labs in the 1970s. However, the term TQEM was coined in the late 1980s and made popular in the early 1990s by GEMI – the Global Environmental Management Initiative.

Total Quality Management

What is Total Quality Management?

Total Quality Management (TQM) is more than a concept; it is a philosophy unto itself. Its adoption by an organization means that the organization is committed to do things in accordance to the specifications it has set (or accepted) the first time. TQM is most often associated with Deming, a statistician who is considered as the 'godfather of quality'.

TQM encompasses the use of Quality Management tools in order to achieve and maintain the desired level of quality in everyday operations.

TIP Total Quality Management, does not mean that the quality specifications are unmovable. Quality specifications can and must change in order to provide continual improvement of the operations of the organization and meet changing customer expectations.

Why is Total Quality Management useful?

Total Quality Management is useful because it changes the way an organization works from seeing quality as something "extra" to be done as an afterthought, to being a means to improve core productivity.

How will Total Quality Management help you?

The philosophy and tools that support Total Quality Management will guide your organization and keep it focused on what quality levels it must achieve. This constancy of purpose directs programs and actions to achieve organization-wide improvement.

TIP The real value of TQM is that when adopted it gives you the power to control quality.

Where do you apply Total Quality Management?

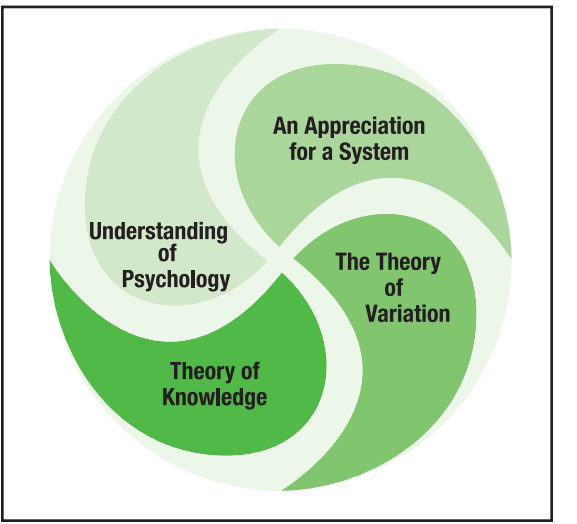
Total Quality Management is applied throughout the organization (that is part of the reason the word "Total" is used).

When is Total Quality Management useful?

Total Quality Management is useful when you have a customer to satisfy and you need to meet or exceed their quality requirements. Total Quality Management is a philosophy whereby every member of the organization commits to work in a better way.

Who benefits from Total Quality Management?

At a minimum, the whole organization benefits from the discipline of Total Quality Management. But its power goes beyond the organization's walls. Its benefits can extend to customers, suppliers, and the community in general through distribution channels.



Ponder Point – User Notes

Even before Deming's work in Japan that demonstrated the value to profitability, statistical process control, which was based on understanding natural variation in nature, proved the importance of a systems approach. The goal was not to rid yourself of variation but to emulate the way that nature copes with variance.

As a Brainstorming exercise (11·1) to initiate or enhance your GP program, outline how you would emulate a natural system to improve your Activities, Products or Services (5·1).

Training

What is Training?

Training is the act of transmitting information and data from one person (as coach or mentor) to another (student). The result is a change in knowledge, skill and attitude in the student from a lower level to a higher level.

NOTE: Training is a traditional approach to changing knowledge and skills, but it differs from Adult Learning. While Training is often used, its success will be greatly enhanced if the approach taken to training is founded in Adult Learning principles (6·1).

This process has the following three stages:

a) Exposure to the new information and data,

b) Analysis of the new information and data to produce new knowledge, and

c) Internalization of the new knowledge to link it with previous knowledge and take possession of the new knowledge as one's own.

A good training program must always bear in mind to whom it is directed to, what previous knowledge they have, and how the coach or mentor will help in the analyzing phase of the training program. Adults are more receptive to training when they are part of the program design.

TIP A training program must identify how students will internalize the new knowledge, since training is usually for a specific purpose, not just for general knowledge or for the love of learning. Establishing an opportunity for them to apply their new found knowledge shortly after the training program will help to achieve this.

Why is Training useful?

Training is useful in GP as it can help to change attitudes and behaviors necessary for adopting 'thinking outside the box',

conceiving new technologies or techniques in support of GP. It is important to break the tendency that people have to fall back on doing things as "the way it has always been done".

How will Training help you?

Training will help members of the GP Team or others within your organization understand the need for change and provide them with tools and knowledge to make these changes.

Training can provide the organization with access to many of the tools under GP's umbrella. It can make the difference between success and failure in your GP program.

Where do you apply Training?

Training is needed on an ongoing basis to ensure that members of the GP Team are always knowledgeable of:

a) what the organization needs to be doing differently

b) how to do it differently

c) why it should be done it in a particular way

d) why the old way no longer is appropriate

Training in some cases must also be used to build competencies.

TIP ISO 14001 (47.1) does require that people are competent in areas where they have the potential to cause significant Environment Impacts (28.1). Training people to understand how they can avoid spills, reducing pollution, or minimizing their own Ecological Footprint (22.1) can result in real savings to the company.

When is Training useful?

Rarely is Training not useful. The value of Training is to develop common knowledge regarding:

- an accident prevention technique
- an emergency response backup plan

- new procedures
- new handling techniques
- the introduction of new equipment
- better understanding of the need to improve environmental performance
- the promotion of GP methodology overall

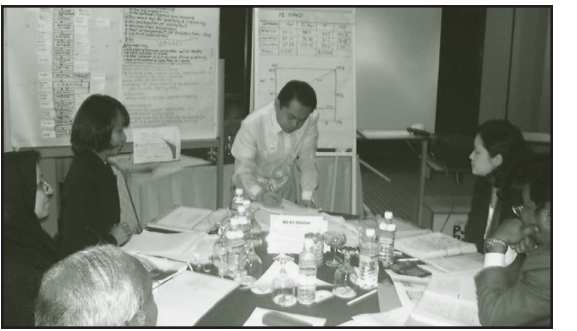
Training is an investment in your most valuable resource – your people. Having said that, ensure that your training program targets the right people, and teaches them skills relevant to their jobs to ensure that they are motivated learners. This will ensure that your programs achieve their desired goals.

Who benefits from Training?

Training directly benefits those receiving the training.
Additionally, the whole organization benefits from better informed, more skilled and more confident staff.

Ponder Point – User Notes

Training usually infers some kind of knowledge and skill transfer, and can be used to ensure the development of specific competencies. Training can be used to promote awareness of green issues inside the organization. This can lead to a motivated staff changing behaviors within the broader community.



Tree Diagram

What is a Tree Diagram?

A Tree Diagram is a graphic representation of the tasks needed to be achieved in order to attain a goal (e.g. the completion of a project, or a training program). It typically focuses on one goal that is further defined by sub-goal statements, and well-articulated activities.

Follow these simple steps to develop a Tree Diagram:

a) Choose your overall goal (the trunk).

b) Select the key headings (sub-goals) that need to be achieved in order to obtain the overall goal (limbs).

c) Add "generations" of sub-goals (branches), in the same way you build an organizational chart.

d) Identify activities to be the last level (like the leaves of the tree).

e) Review the whole diagram to check for consistency, logic flow and completeness.

TIP A Tree Diagram is most useful when used in combination with the results from an Arrow, Affinity or Interrelationship Diagram (9·1, 7·1 and 45·1).

Why is the Tree Diagram useful?

The Tree Diagram is a useful project management tool when you want to organize the activities needed to accomplish a project/program.

How will the Tree Diagram help you?

It will allow you to map your way through your options within your GP program. It will facilitate easier communication both in terms of the practical steps involved and your progress to members of your GP Team and others.

Where do you apply the Tree Diagram?

Tree Diagrams are an effective tool in the planning phase or where sharing information is advantageous to gain the support for your GP programs.

When is the Tree Diagram useful?

It is useful as a means to motivate your GP Team from a planning state into action.

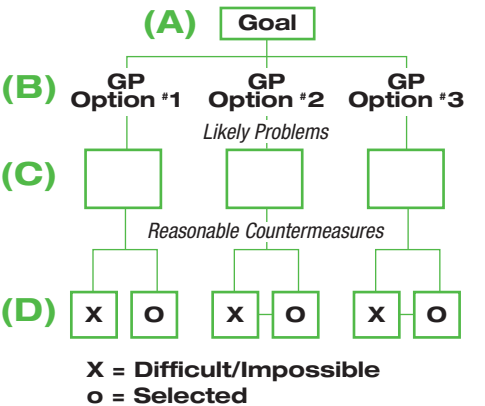
Who benefits from the Tree Diagram?

The Tree Diagram primarily benefits the GP leader and the team.

Ponder Point – User Notes

Managing the dynamics between four to six people is relatively easy. More than this number requires careful facilitation to get all views recorded, and people moving forward to take action.

Note again the nature-related terminology of the tool.



Walk Through Survey

What is a Walk Through Survey?

A Walk Through Survey is an inspection carried out by your GP team as a means of gathering information on the whole organization.

For a Walk Through Survey to be effective, it must be carefully planned. Team members should be briefed in advance. A record of the event should be kept. Check Sheets or Checklists should be prepared (14·1 and 13·1). A Plant Layout and a Process Flow Diagram are key in planning the Walk Through Survey effectively and efficiently (57·1 and 61·1).

The Walk Through Survey is not an audit; it is a data collection tool that will provide information on how the organization is performing against expectations on parameters that can be measured visually.

TIP The Walk Through Survey is particularly helpful when implementing behavior changing processes such as TQM or TQEM (80·1 and 79·1).

Why is a Walk Through Survey useful?

The Walk Through Survey is useful in acquainting the GP Team with all aspects of the organization. In some cases it can break the communications barrier between planning staff and implementation staff.

How will a Walk Through Survey help you?

The Walk Through Survey will help you:

- familiarize the team with the process you wish to improve
- allow the team to identify where opportunities for improvement exist
- validate existing information (Process Flow Diagrams, Eco-maps, Plant Layout, 61·1, 24·1 and 57·1),
- evaluate in a direct manner the physical changes that have been implemented in the organization since GP was started.

Where do you apply a Walk Through Survey?

The Walk Through Survey is applied to areas of the organization that have past, present or future GP initiatives.

When is a Walk Through Survey useful?

It is useful as part of the Planning Phase, as part of a training process for new members to GP, as part of monitoring progress against planned efforts, or as a demonstration tool for management.

Who benefits from a Walk Through Survey?

When done appropriately, it helps to educate staff, and allows top management the opportunity to see the success that GP brings.

The Walk Through should not disrupt production activities. If further discussion about what GP Team members saw during the Walk Through is useful, this can occur in another location so as not to disturb the normal work process.

Ponder Point – User Notes

The purpose of this activity is to help unfold your GP program in an efficient and effective way. It is not an exercise in criticism. If you see something during the Walk Through that requires corrective action, be as positive as possible. Seek first to understand the situation before you react. Do not exclude outlying buildings or satellite facilities that may impact your results.

Waste Management

What is Waste Management?

Waste Management is a group of techniques and strategies targeted at reducing the Environmental Impact (28.1) of waste generation and waste disposal.

Some Waste Management techniques and strategies include: waste classification, waste stream segregation, waste minimization, recycling, and reutilization.

A Solid Waste Management program looks into the issues of waste generation, waste management, and waste disposal, and tries to reduce the environmental burden caused by these activities.

TIP For a Waste Management Program to provide the best results it should be embedded within an Environmental Management program, such as ISO 14001 (29·1 and 47·1).

Why is Waste Management useful?

Waste Management is useful to control the resources spent on waste handling and control, as well as to limit resources being used in remediation of Environmental Impacts caused by bad waste control practices.

How will Waste Management help you?

Waste Management will put you in the control of the waste generated by your organization. With Waste Management programs in place you will understand your waste composition as well as why you are generating waste. This will facilitate the development of programs to reduce the Environmental Impacts caused by waste. Waste management facilities should be managed as efficiently as manufacturing processes. Inefficiency in this area can results in serious business risks, as well as wasting valuable resources.

Where do you apply Waste Management?

Waste Management should be applied throughout the organization, however processes that produce hazardous wastes or large amounts of non-hazardous solid waste might be targeted first.

When is Waste Management useful?

When an organization generates waste, it means that there is some inefficiency in their processes. There is a cost to the existence of waste that is often assumed to equate to the cost of treatment or disposal at the end-of-pipe. This is misleading, as it does not include the true costs or Total Costs of waste (78·1). The real cost of waste can be 7 times more than the disposal cost alone. The cost can be far higher when wastes are not controlled efficiently. Waste Management is useful to promote efficiency and reduce risk throughout the organization.

TIP The costs include:

- the purchase price of the material,
- storage,
- labour to handle and in production,
- administration,
- energy costs to process,
- equipment costs,

then if the material is not sold as a product, it trips waste management costs. If the material is toxic and is improperly stored or disposed of this may trip legal costs to say nothing of the frustration this brings in terms of emotional costs. Stress is costly in terms of productivity.

Who benefits from Waste Management?

Every department where Waste Management is applied will benefit from cost reduction, leaner production and an improved working environment.

Ponder Point – User Notes

Manufacturing processes do not have a 100% conversion efficiency. Consequently, some waste in the form of air emissions, effluents, solid wastes and heat releases is generated. GP techniques can improve on conversion efficiency and reduce generation of wastes.

Brainstorming (11·1) ways to eliminate waste can be a useful way to reduce the more obvious sources of waste. A re-design of a process may yield a more efficient approach that may position you to take advantage of an opportunity in a unique niche market, or simply make your existing process more productive.

Waste Prevention

What is Waste Prevention?

Waste Prevention implies the application of different tools and concepts such as Product Improvement or Process Modification (63·1 and 62·1) in order to prevent the creation of waste.

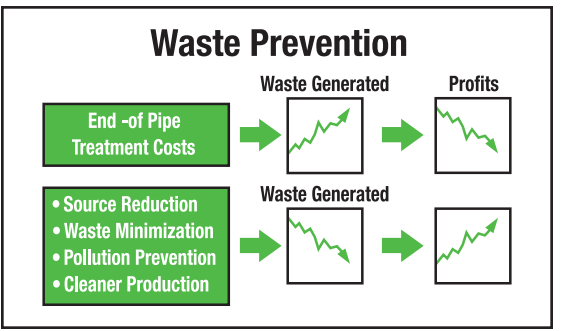
This is what is normally meant by "beginning-of-pipe" prevention strategies, which includes Source Reduction. You prevent the Environmental Impact (28·1) of waste by preventing it from being formed. It can be facilitated by the concept of DfE (20·1).

Normally, an organization starting with Waste Prevention strategies will find "low hanging fruit" in this area. These are opportunities that are easy to solve and can be found in a Walk Through Survey (83·1).

TIP Standardized Operating Procedures (74·1) are very helpful in Waste Prevention when requirements to reduce the generation of waste are included within the procedure.

Why is Waste Prevention useful?

Waste Prevention is useful because it fosters a proactive mindset to avoid the development of waste in the first place. Reduction of waste will result in better economic and environmental performance of your organization.



How will Waste Prevention help you?

Waste is expensive to generate, and expensive to treat. Waste Prevention will help you by reducing your costs and your environmental burden (both aspects and impacts) at the same time.

Where do you apply Waste Prevention?

Waste Prevention should be applied to all operations that generate waste; however large waste producers or producers of waste that carry higher costs (e.g. hazardous waste) should be targeted first, because they hold the greatest opportunity for improvement.

TIP Costs are determined by volume, weight and toxicity. A minute amount of highly toxic material can be extremely expensive to dispose of properly. A better solution is to eliminate the need for the toxic material through redesign. Design for Environment (20.1) and Life Cycle Assessment (50.1).

When is Waste Prevention useful?

It is useful for any kind of waste in all organizations. Coordinating with Green Purchasing (39.1) can be beneficial as up to 70% of the costs and affiliated environmental burden an organization faces are acquired through purchase. Designing problems out of your process is a sound solution. Your next option may be to find a market and sell your by-products to another organization as a raw material. Remember that the buyer is not looking for waste, they want a quality product for their process too. This means you have to have control over the quality of these so-called waste materials to achieve that goal.

Who benefits from Waste Prevention?

It benefits the whole organization be delivering financial payback. You and your community can gain from environmental and social improvements.

Ponder Point – User Notes

Consider involving someone from your purchasing department on your GP Team.

Waste Segregation

What is Waste Segregation?

Waste Segregation is a technique that outlines how to separate different material streams and as a result allow for a more efficient treatment of these waste streams. Ideally, you should begin with avoiding the mixing of wastes.

Waste can be segregated by their composition and by point of generations, composition, volume or media (air, water, etc.). They can also be segregated by their recycling potential.

TIP Waste Segregation will normally transform some waste streams into commercial by-products.

Why is Waste Segregation useful?

Waste Segregation is useful to facilitate the treatment of waste and to reduce the cost of this treatment. It can also avoid unpleasant and dangerous consequences – not all materials are compatible – in worst case scenarios explosions or toxic new materials can be formed.

TIP The problem that occurs when waste is just mixed not managed is that you end up with a chemical cocktail of unknown composition. The mix ratio is unknown. This makes it difficult even dangerous to handle.

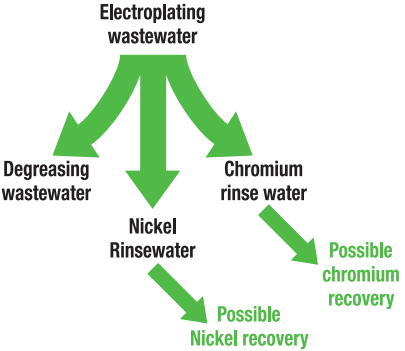
How will Waste Segregation help you?

Waste Segregation will help you if you are looking to reduce costs of waste handling and those that result from poor management. It will give you better control over your waste streams. It can provide you with more accurate information about the products you are considering as waste.

Waste Segregation can also reduce the quantity of material otherwise deemed hazardous, given that when combined, the total volume is generally classified as hazardous, even though the actual quantity of hazardous material is smaller.

Advantages of Waste Segregation

- Ease in end-of-pipe treatment of a non-compatible pollutant stream
- Increased possibility of recycling / reusing a waste stream



Where do you apply Waste Segregation?

Waste Segregation is an organization-wide strategy. It is applied wherever the volume of waste is significant or toxic, even in small amounts to reduce liability, cost and Environmental Impact (28.1).

When is Waste Segregation useful?

Designing the flow of the process to avoid waste materials being mixed is preferable. It may require additional space and carry higher capital and operating costs for waste transportation and storage. However, when materials are clearly separated without inter-material contamination, the benefits usually outweigh the initial investments incurred.

Who benefits from Waste Segregation?

Beneficiaries of Waste Segregation include the GP Team, as they can demonstrate a clear benefit in turn for the bottom line. The whole company can benefit from these cost savings. As well the recipient of the materials will benefit from the higher quality of material generated by your process. There are environmental and community benefits to this as well.

Ponder Point – User Notes

One of the challenges with Waste Segregation in some jurisdictions is the absence of management accountability. Additionally, the term waste can be a misnomer or poor visual image. Starting with the mindset established by GP, host a Brainstorming session (11·1) to refocus people to use positive productivity terminology instead of terms based on the concept of waste. Waste by definition has no value. In many jurisdictions waste actually has a negative value.

Annex A:

Cross Reference to

Handbook on Green Productivity

and

Greening on the Go

A Pocket Guide to Green Productivity

These two books were designed to be companion documents although each serve a different purpose and can be used in isolation.

Handbook on Green Productivity is a handbook that has been written by Lynn Johannson based on the materials in the Asian Productivity Organization's (APO) Training Manual on Green Productivity, the Manual for 5-Day Training Program.

This handbook is designed for people who have an evolving passion to enhance the quality of life by improving their environmental performance and productivity. By design, the handbook will challenge readers to study the broader issues driving the need to evolve towards sustainable development. While these two words are simple enough to say, "combined they represent the single largest challenge to the collective creativity and intellectual spirit that humans have ever faced."[1]

The handbook can be used for self-directed study. It can be used in conjunction with the training manual during a workshop or as a reference document after a course.

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[1]Green Productivity: An Approach to Sustainable Development (2002) Presented to the World Summit on Sustainable Development, September 2002 by the Asian Productivity Organization. Written by Lynn Johannson

There are six key chapters in the handbook:

Chapter 1 ***Green Productivity***

Chapter 2 ***Green Productivity Strategy***

Chapter 3 ***Green Productivity Tools and Techniques***

Chapter 4 ***Green Productivity Methodology***

Chapter 5 ***Management Systems and Programs***

Chapter 6 ***Sustaining Progress Towards Enhanced Productivity and Competitive Advantage to Meet your Green Productivity Strategy***

Greening on the Go: A Pocket Guide to Green Productivity has a much more narrow focus, and much of its content focus would fit into Chapters 3, 4 and 5. The material in the pocket guide is not presented in the same format as the handbook. There is merit in acquiring both books. For further explanation of the pocket guide see Explanation of Product (1·1) or How to Use *Greening on the Go* (3·1).

May you have Success in Six!

The Asian Productivity Organization (APO)

Enhancing the Quality of Life for All

Objective:

The Asian Productivity Organization (APO) is an inter-governmental regional organization established in 1961 to contribute to the socio-economic development of its member countries and improve the quality of life of their people through productivity enhancement in the spirit of mutual cooperation among its members. It is non-political, non-profit making, and non-discriminatory.

Membership:

APO members are: Bangladesh, Cambodia, Republic of China, Fiji, Hong Kong, India, Indonesia, Islamic Republic of Iran, Japan, Republic of Korea, Laos, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, and Vietnam.

Key Roles:

The APO seeks to realize its objective by playing the roles of think tank, catalyst, regional adviser, institution builder, and clearinghouse for information on productivity.

Organization:

The supreme organ of the APO is the Governing Body. It comprises one Director from each member country designated by their respective governments. The Governing Body decides on policies and strategies of APO programs and approves its budgets, finances, and matters relating to membership.

Each member country designates a national body to be its national productivity organization (NPO). NPOs are either agencies of the government or statutory bodies entrusted with the task of spear-

heading the productivity movement in their respective countries. They serve as the official bodies to liaise with the APO Secretariat and to implement APO projects hosted by their governments.

The Secretariat, based in Tokyo, Japan, is the executive arm of the APO. It is headed by the Secretary-General. The Secretariat carries out the decisions, policy directives, and annual programs approved by the Governing Body. It also facilitates cooperative relationships with other international organizations, governments, and private institutions.

The APO Secretariat has six functional departments: Administration and Finance; Research and Planning; Industry; Agriculture; Environment; and Information and Public Relations.

Thrust Areas:

The Governing Body has designated five thrust areas to be given emphasis when planning APO activities: Knowledge Management (KM); Green Productivity (GP); Strengthening Small and Medium Enterprises (SME); Integrated Community Development (ICD); and Development of NPOs (DON).

Programs and Activities:

APO programs cover the industry, service, and agriculture sectors, with special focus on: socio-economic progress; strengthening of SMEs; KM; total quality management; general management; technology, information technology, and innovation; GP; ICD; DON; agriculture development and agro-industry; resources and technology; and agricultural support systems.

The activities of the APO include basic research studies, surveys, symposia, study meetings, workshops, training courses, seminars, study missions, demonstration projects, technical expert services, information dissemination, and training videos.

Visit http://www.apo-tokyo.org for more information about the APO.

National Productivity Organizations (NPOs)

Contact Information:

BANGLADESH

NATIONAL PRODUCTIVITY ORGANISATION (NPO)

Established: 1983

Ministry of Industries,
Shilpa Bhaban (1st Floor),
91, Motijheel Commercial Area,
Dhaka-1000, Bangladesh

Phone: (880-2) 9562883
Fax: (880-2) 9563553 (Attn. NPO)
E-mail: npobd@gononet.com

CAMBODIA

NATIONAL PRODUCTIVITY UNIT (NPU)

Established: 2004

No. 45 Norodom Blvd.,
Phnom Penh, Cambodia

Phone: (855-12) 814150
Fax: (855-23) 428263
E-mail: bunnayea@yahoo.com

REPUBLIC OF CHINA

CHINA PRODUCTIVITY CENTER (CPC)

Established: 1955

2nd Fl., No. 79, Sec. 1,
Hsin-Tai-Wu Road,
Hsichih 221, Taipei Hsien
Taiwan, Republic of China

Phone: (886-2) 2698-2989
Fax: (886-2) 2698-2976
E-mail: 0092@cpc.org.tw

www.cpcnets.com.tw

FIJI

THE TRAINING AND PRODUCTIVITY AUTHORITY OF FIJI

Established: 1984

P.O. Box 6890,
Nasinu, Fiji

Phone: (679) 3392000
Fax: (679) 3340184
E-mail: info@govnet.fj

www.fntc.ac.fj

HONG KONG

HONG KONG PRODUCTIVITY COUNCIL (HKPC)

Established: 1967

TST P.O. Box 99027 Hong Kong,
HKPC Building,
78 Tat Chee Avenue,
Yau Yat Chuen
Kowloon, Hong Kong

Phone: (852) 2788-5678
Fax: (852) 2788-5090
E-mail: hkpcenq@hkpc.org

www.hkpc.org

INDIA

NATIONAL PRODUCTIVITY COUNCIL (NPC)

Established: 1958

Institutional Area,
Lodi Road,
New Delhi 110 003,
India

Phone: (91-11) 24690331
Fax: (91-11) 24615002
E-mail: npc@ren02.nic.in

www.npcindia.org

INDONESIA

INDONESIA DIRECTORATE GENERAL OF MANPOWER DOMESTIC PLACEMENT DEVELOPMENT, MINISTRY OF MANPOWER AND TRANSMIGRATION R.I.

Established: 1968

Jl. Jend. Gatot Subroto Kav. 51,
Floor VII/B, Jakarta Selatan 12950,
Indonesia

Phone: (62-21) 52963356 / 5255733
Fax: (62-21) 52963356 or (62-21) 5227588
E-mail: protek@centrin.net.id

ISLAMIC REPUBLIC OF IRAN

NATIONAL IRANIAN PRODUCTIVITY ORGANIZATION (NIPO)

Established: 1992

P.O. Box 15815-3693,
No. 43, 11th St.,
Golha Sq., Tehran 14316,
Islamic Republic of Iran

Phone: (98-21) 8959398
Fax: (98-21) 8955376
E-mail: nipo@nipo.ir

www.nipo.ir

JAPAN

JAPAN PRODUCTIVITY CENTER FOR SOCIO-ECONOMIC DEVELOPMENT (JPC-SED)

Established: 1955 (as Japan Productivity Center)
1994 (as Japan Productivity Center for Socio-Economic Development)

1-1, Shibuya 3-chome, Shibuya-ku, Tokyo 150-8307, Japan

Phone: (81-3) 3409-1135
Fax: (81-3) 3409-5880
Telex: J23296 JPCTOKYO
E-mail: Y.Osaki@jpc-sed.or.jp

www.jpc-sed.or.jp

REPUBLIC OF KOREA

KOREA PRODUCTIVITY CENTER (KPC)

Established: 1957

Saengsansung Building,
122-1, Jeokseon-dong,
Jongro-ku, Seoul 110-751,
Republic of Korea

Phone: (82-2) 724-1180/7
Fax: (82-2) 737-9140
E-mail: kbwoo@kpc.or.kr

www.kpc.or.kr

LAO PEOPLE'S DEMOCRATIC REPUBLIC

LAO NATIONAL PRODUCTIVITY ORGANIZATION (LNPO)

Ministry of Industry and Handicraft,
P.O. Box 4708 Nong Bone Road,
01005 Ban Fai Area,
Xaysetha District,
Vientiane Municipality,
Lao PDR

Phone: (856-21) 413001
Fax: (856-21) 414332
E-mail: mihlaoex@laotel.com

MALAYSIA

NATIONAL PRODUCTIVITY CORPORATION (NPC)

Established: 1962 (as Government Body)
1966 (as National Productivity Centre)
1991 (as National Productivity Corporation)

P.O. Box 64, Jalan Sultan,
46904 Petaling Jaya,
Selangor, Malaysia

Phone: (60-3) 79556323
Fax: (60-3) 79578068
E-mail: PRO@npc.org.my

www.npc.org.my

MONGOLIA

NATIONAL PRODUCTIVITY AND DEVELOPMENT CENTER (NPDC)

Established: 1992

Room 102 & 103, Central Cultural Palace,
Sukhbaatar Sq. 3,
Ulaanbaatar 11, Mongolia

Phone: (976-11) 326115
Fax: (976-11) 329799
E-mail: npdc-mon@mongol.net

NEPAL

NATIONAL PRODUCTIVITY AND ECONOMIC DEVELOPMENT CENTRE (NPEDC)

Established: 1974 (as Industrial Services Centre)
1988 (as Economic Services Centre)
1994 (as National Productivity and Economic Development Centre)

P.O. Box No. 1318,
Balaju Industrial District,
Balaju, Kathmandu, Nepal

Phone: (977-1) 4350293
Fax: (977-1) 4350530
E-mail: npedc@wlink.com.np

PAKISTAN

NATIONAL PRODUCTIVITY ORGANIZATION (NPO)

NPO Secretariat,

House No. 42-A,
Nazim-ud-Din Road
Sector F-7/4, Islamabad, Pakistan

Phone: (92-51) 9215981, 9251982, 9251983
Fax: (92-51) 9215984
E-mail: npopakistan@yahoo.com

www.npo.gov.pk

PHILIPPINES

DEVELOPMENT ACADEMY OF THE PHILIPPINES (DAP)

Established: 1967 (as part of the National Economic Council – later reorganized as the National Economic and Development Authority)
1973 (became part of the Development Academy of the Philippines)

DAP Building, San Miguel Avenue,
Pasig City, Metro Manila,
Philippines

Phone: (63-2) 631-2143, 631-2137, 631-2138
Fax: (63-2) 631-2123
E-mail: apolu@dap.edu.ph

www.dap.edu.ph

SINGAPORE

STANDARDS, STANDARDS, PRODUCTIVITY AND INNOVATION BOARD (SPRING)

Established: 1967 (as National Productivity Centre)
1972 (as National Productivity Board)
1996 (as Singapore Productivity and Standards Board)
2002 (as Standards, Productivity and Innovation Board)

2 Bukit Merah Central,
Singapore 159835, Republic of Singapore

Phone: (65) 62786666
Fax: (65) 62786665
E-mail: ird@spring.gov.sg

www.spring.gov.sg

SRI LANKA

SRI LANKA NATIONAL PRODUCTIVITY SECRETARIAT (NPS)

134, 4th Floor, CIL Tower, High Level Road,
Colombo 06, Sri Lanka

Phone: (94-11) 2513156
Fax: (94-11) 2513296
E-mail: nposl@sltnet.lk

THAILAND

THAILAND PRODUCTIVITY INSTITUTE (FTPI)

Established: 1994 (replacing Thailand Management Development and Productivity Centre as the national productivity organization for Thailand in 1995)

12th - 15th Floor, Yakult Building,
1025 Phahonyothin Road, Samsennai, Phayathai,
Bangkok 10400, Thailand

Phone: (66-2) 619-5500, 619-8087
Fax: (66-2) 619-8099
E-mail: apo_liaison @ftpi.or.th

www.ftpi.or.th

SOCIALIST REPUBLIC OF VIETNAM

DIRECTORATE FOR STANDARDS AND QUALITY (NATIONAL PRODUCTIVITY ORGANIZATION)

Established: 1962

8, Hoang Quoc Viet Street,
Cau Giay District,
Hanoi,
Socialist Republic of Vietnam

Phone: (84-4) 7911633
Fax: (84-4) 7911595
E-mail: thien@netnam.org.vn
vpc@fpt.vn

www.vpc.org.vn/english

GP Resources On-line

The following are some of the on-line resources available on Green Productivity. There are others that can be found by visiting the APO site, or one of the National Productivity sites, identified in the GP Resources On-line.

I. International GP Association (IGPA)

www.igpa.ema.org.tw

The IGPA has a mission is to enhance information flow, support human resources development, and strengthen public/private partnerships to stimulate the implementation of GP strategies and technologies in the Asian/Pacific region. It publishes a quarterly newsletter electronically.

II. American Council for an Energy-Efficient Economy

www.aceee.org

The American Council for an Energy-Efficient Economy (ACEEE) is a nonprofit organization dedicated to advancing energy efficiency as a means of promoting both economic prosperity and environmental protection.

Based in Washington, D.C., ACEEE works closely with the U.S. Department of Energy, U.S. Environmental Protection Agency, and other federal agencies. We also work with a wide range of states, utilities, and international organizations.

ACEEE is a leading source for energy efficiency analysis, policy and program advice, and information. The contents of the site are divided into following sections.

- Consumer Information
- Press releases
- Energy efficiency related web sites
- Mini reports
- Business case for energy efficiency and pollution prevention

The section on "Business case for energy efficiency and pollution prevention" includes 18 case studies. These case studies show how a range of industries have implemented projects or overall corporate strategies that profit from the synergies of energy efficiency, pollution prevention, process efficiency, and increased productivity.

ACEEE site also contains a list of other web sites that concern energy efficiency under the section "Energy Efficiency-Related Web Sites".

III. Environmental Integration Initiative

www.turi.org

Better, Faster, Cheaper, and Cleaner Manufacturing in Massachusetts is a collaborative project involving the Massachusetts Manufacturing Partnership, the Massachusetts Office of Technical Assistance, the Toxics Use Reduction Institute, and the Department of Environmental Protection. Conceived in 1995 as a means of streamlining available services to small and medium-sized businesses, this project is focused particularly on assisting manufacturers in the metal products and electronics. A major goal of the project is to demonstrate for companies how reducing environmental impacts of operations has direct links to increases in cost savings, productivity, and competitiveness.

This site contains a manual for manufacturers aiming to provide demonstrations and resources for manufacturers who are interested in increasing cost savings, productivity, and competitiveness by reducing environmental burden.

This manual was prepared during a collaborative project involving the Massachusetts Manufacturing Partnership, the Massachusetts Office of Technical Assistance, the Toxics Use Reduction Institute, and the Department of Environmental Protection. Conceived in 1995 as a means of streamlining available services to small and medium-sized businesses, this project is focused particularly on assisting manufacturers in the metal products and electronics. A major goal of the project is to demonstrate for companies how reducing environmental impacts of operations has direct links to increases in cost savings, productivity, and competitiveness.

The manual focuses on implementation cleaner production aspects such as incentives and barriers, laws and regulations, information sources and management tools such as, Toxics Use Reduction, Design for the Environment, Total Cost Accounting, and Environmental Management Systems. The case studies included in the manual focuses on Toxic waste reduction.

The links and contacts have been listed to complement and build on the information provided in this manual.

Cleaner production clearinghouses are special libraries that focus on alternative industrial process and alternative technical information:

A. Technology Transfer Center (TTC) located at the Toxics Use Reduction Institute at the University of Massachusetts Lowell; call - Anne Berlin Blackman at 508/934-3124.

B. Northeast Waste Management Officials Association (NEWMOA) in Boston; contact Lisa Regenstein 617/367-8558.

C. EPA Research Library for Solid and Hazardous Waste in Boston; contact Fred Friedman at 617/571-9687.

D. EPA Region 1 Main Library in Boston; call 617/565-3300.

The manual also provides list and brief description of various Internet sites, which provide information on various aspects of cleaner production and toxic waste reduction.

A. P2Gems Internet search tool for facility planners, engineers and managers who are looking for technical and process or materials management information on the Web. Over 300 sites with information valuable to TUR planning have been selected and catalogued for easy use. P2Gems are accessed by keywords that are organized into product, process, chemical, or management technique categories.

B. P2 Experts: Designed to help companies overcome P2 informational barriers, P2 Experts provides a quick and

easy way to locate individuals with specific P2 expertise, industrial experience, or process knowledge. P2 Experts also provides an opportunity for members to promote their P2 skills, cultivate business connections, and establish government contacts.

C. EPA Envirosense: Envirosense is an integral part of the U.S. Environmental Protection Agency's web site. It attempts to provide a single repository for pollution prevention, compliance assurance, and enforcement information and databases. Included are pollution prevention case studies, technologies, points of contact, environmental statues, executive orders, regulations, and compliance and enforcement policies and guidelines.

D. Pollution Prevention Resources: from the Great Lakes Information Network, includes archives of the P2TECH Email List.

E. FEDWORLD: Gateway to US Government sites and information.

F. EcoWeb: University of Virginia hub for ecological sites.

G. NBEN Online: () Northeast Business Environmental Network, private sector resource for companies of all sizes and sectors who seek to improve their environmental performance and profitability.

IV. The Eco Efficiency and Cleaner Production Home Page

www.deh.gov.au/industry/corporate/eecp

EnviroNET Australia is maintained by the Environment Protection Group.

Environment Protection Group
Environment Australia, PO Box E305
KINGSTON ACT 2604
AUSTRALIA

The site provides information on the following aspects.

A. What are cleaner production and eco-efficiency?

B. Examples and case studies

   The case studies could be searched by industry sector, or location. Also the search engine facilitates search based on any keyword typed by user.

C. Application to particular industries

   In this part of the Home page, Environment Australia provides an information forum for developments in eco-efficiency and cleaner production in particular industries. Suggestions can be posted on this page.

D. Tools, resources and links contains following topics:

   - Life cycle assessment
   - Public environmental reporting
   - Environmental Indicators
   - Industrial ecology
   - Codes of practice
   - Cleaner production
   - Environmental audits
   - Environmental management systems
   - Environmental accounting
   - Design for environment
   - Environmental labeling
   - Performance based contracting
   - Eco-efficiency
   - Environmental Taxes

E. Publications and research papers

F. Cleaner production handbook for local government

   - Cleaner Production Handbook for Local Government Fact Sheet - April 1997
   - Getting Ahead of the Game: an Anticipatory Approach to Environmental Management - July 1996

G. Fact sheets
- The EcoRedesign Project
- The EPG and Cleaner Production
- Industry Education Project
- National Materials Accounting Strategy
- Environment Health and Hospitals

V. Internet Resources on Cleaner Production in Industry

www.marietta.edu/~spilatrs/cln_prod.html

Web sites have been divided into four divisions.

A. Cleaner production These are sites that provide a wide range of information of cleaner production activities, programs sponsored by the EPA and private organization. Many have links to case studies, technologies, and corporate home pages.

B. Corporate Home Pages This section has links to corporations with histories of strong environmental programs. Some of the pages have features that allow searching of key words --one good way to track down relevant environmental information

C. Environmental technology This section has links to information about cleaner production technologies.

D. Other Useful Sites Here you will find links to cleaner production case studies, more information about corporations and cleaner production technologies, the EPA and its resources, databases of environmental information, and other general environmental resources. These sites can provide information about environmental legislation and policy, risk and life-cycle analysis, emissions databases (including TRI), professional organizations, etc.

VI. Envirosense

www.es.epa.gov/envirosense

This site is a part of the U.S. EPA's web site, which provides as a repository for pollution prevention, compliance assurance, and enforcement information and databases.

VII. World Business Council for Sustainable Development

www.wbcsd.ch

The site contains details of the "Eco-efficiency - European Eco-Efficiency Initiative (EEEI)" program. The site is divided into following sections.

- Concept Background
- Eco-Efficiency Metrics and Reporting
- European Eco-Efficiency Initiative
- Eco-Efficiency Case Study Collection
- By-Product Synergy

"Eco-Efficiency Case Study Collection" links to the success stories of various companies for improved environmental performance, significant cost savings, risk management, and business expansion. Each case study, though specific to a particular industry, contains lessons valuable to most of the industrial sectors. The case studies convey both ecological and economic benefits that can be achieved through eco-efficiency. The guidelines developed and applied are also given. The site facilitates submission of new case studies. Additionally the case studies can be searched by key words.

VIII. EMAS Tool kit for SMEs

www.inem.org/new_toolkit/

The EMAS Tool Kit for SMEs brings together a set of tools proven effective in helping small companies introduce an environmental management system and attain EMAS registration.

It is the result of co-operation among 14 European organizations, which have experience in working with small and medium-sized enterprises (SMEs) and in implementing environmental management.

The site contains freely downloadable pdf files.

Site developed by Ecotopia

The site contains information, which may be useful to the small and medium enterprises for implementing cleaner production program. The site is structured in following sections.

Introduction

Section 1: Introduction to EMAS

Section 2: What are the benefits and costs of EMAS?

Section 3: How to get started?

Plan

Section 4: How to develop an environmental policy

Section 5: How to carry out an initial environmental review

Section 6: How to develop an environmental programme

Do

Section 7: How to structure an environmental management system

Check

Section 8: How to control and monitor environmental performance and management systems

Act

Section 9: How to review an environmental management system

Section 10: How to communicate and report on environmental performance

Section 11: How to get official recognition

IX. Environmental Sites on the Internet

www.lib.kth.se/kthbeng/kthb.html

This site provides links to various aspects of environmental management. The links include general information such as conferences, journals and newsletters, directories etc. Specific information is arranged in a alphabetically arranged subject index. Some of the subjects include:

Alternative Technology;
Benchmarking;
Eco Products;
Eco Rating;
Environmental Labeling;
Environmentally Friendly Products;
LCA;
Recycling;
Solvent Alternatives.

X. United Nations Environment Programme (UNEP)

www.unep.org

The web site contains profile of UNEP, State of global environment, Information on Environmental Issues, Products and Services provided by UNEP, Environmental Conventions, various Environmental links.

UNEP's activities include promotion of,

- Safer production programme (APELL) aimed at improved accident prevention, community awareness and emergency preparedness.
- Cleaner Production as a strategy for preventing pollution, applied to processes, products and services.
- Industrial Pollution Management in Mining, fertilizer production, oil and gas, industrial estates, contam inated land, hazardous waste management.

- Assessing technologies from an environmental perspective (under Environmental Technology Assessment Program).
- Stimulating dialogue between stakeholders and promoting the use of environmental management tools.
- Policies and tools for environmentally sound tourism.
- Sharing information to design or improve energy-efficient systems.
- Need-based clearinghouse services to assist developing countries phase out their use of ozone depleting substances under the Multilateral Fund (OzonAction).

XI. Product Oriented Environmental Management Links

www.bbt.utwente.nl/en/index.html

The site is maintained by:

Frank de Bakker
Ph.D. candidate
Department of Legal Aspects of Business Administration
Faculty of Technology and Management
University of Twente
P.O. Box 217, 7500 AE Enschede, The Netherlands

This site contains over 175 links on eco-design, business and the environment and related issues. Most links concern product-oriented environmental management (POEM). Various related links (greening business, concurrent engineering, environmental links) are included.

XII. Tellus Institute

www.tellus.org

Tellus Institute is a non-profit research and consulting organization that promotes equitable and sustainable resource management. Tellus projects address policy and planning issues in such areas as energy, water, waste, and land use.

Using state-of-the-art methods, Tellus analyzes evolving problems and evaluates options for technological and institutional change. The Institute develops and disseminatesdecision-support tools to strengthen capacity to develop effective resource and environmental strategies.

The site is organized into four groups. The Energy, Solid Waste, and Risk Analysis groups work primarily in North America. Tellus also hosts the Boston Center of the Stockholm Environment Institute (SEI).

U.S. Agency for International Development (US AID) Environmental Pollution Prevention Project (EP3)

XIII. U.S. Agency for International Development (US AID) Environmental Pollution Prevention Project (EP3)

www.epa.gov

U.S. Agency for International Development (US AID) Environmental Pollution Prevention Project (EP3)

EP3 is sponsored by the United States Agency for International Development

Can be freely viewed and saved in to local machine.

The Environmental Pollution Prevention Project (EP3) is a five-year program sponsored by the United States Agency for International Development (USAID) to address urban and industrial pollution and environmental quality in developing countries. The objectives of the program are:

- to establish sustainable pollution prevention programs in developing countries
- to transfer urban and industrial pollution prevention expertise and information, and
- to support efforts to improve environmental quality.

The site contains miscellaneous documents (reports, newsletters, etc.), EP3 News, Case Studies, and International Resources.

XIV. Waste Prevention Association "3R"
www.rec.hu/e_index.html

Waste Prevention Association was founded in March 1993. This independent (not umbrella) association was created as a result of the demand of members of many NGOs, such as the Club "Gaja", Green Federation, Polish Ecological Club, Greenpeace International and local activists to establish a professional organization to service the information needs of these groups.

WPA is non-governmental and non-profit environmental organization. WPA's mission is to promote clean production methodology, waste reduction at source, and environmentally friendly waste management: segregation and recycling, as well as rational utilization of "historical" waste. Internet Resources included are divided in to following section:

- Pollution Prevention and Clean Production
- Municipal Solid Waste
- Hazardous Waste and Toxic Substances
- Waste Incineration

XV. World Cleaner Production Society (WCPS)
www.nif.no/index3.asp

World Cleaner Production Society (WCPS)
TI, P.O. box 2608 St. Hanshaugen, 0131 Oslo, Norway

The goal of the organization is to build capacity for self-sustaining Cleaner Production activities in countries with no or low capacity for transition to cleaner production.

The site contains information about ongoing cleaner production dissemination programs in 8 countries in Central and Eastern Europe, Asia and Africa. Programs are under final preparation in additional four countries in Asia and Europe.

XVI. World Resources Institute

www.wri.org

WRI is classified by the Internal Revenue Service as a tax-exempt, publicly supported,
educational organization.

World Resources Institute
10 G Street, NE
Suite 800
Washington, DC 20002
Phone: 202/729-7600
Fax: 202/729-7610
general email: lauralee@wri.org

World Resources Institute started in 1982. It believes a healthy environment and healthy economy can coexist. The organization conducts policy research, publicize policy options, encourage adoption of innovative approaches and provide strong technical support to governments, corporations, international institutions, and environmental NGOs.

The site also provides links to various other sites categorized in following areas:

Links Related to Thematic Areas

Biodiversity and Ecosystems Links;

Business and Environment Links;

Climate Protection;

Environmental Education Links;

Forest Resources Links;

Forest Frontiers Initiative: Internet Resources;

Sustainable Agriculture

Business and the Environment

XVII. Environmentally and Socially Sustainable Development

www-esd.worldbank.org

The Environment Department at the World Bank
1818 H Street, N.W.
Washington, D.C. 20433
Voice: 1 (202) 522-ESSD
E-mail: EADVISOR@WORLDBANK.ORG

The site includes following environmental and social themes,

- natural habitat and terrestrial ecosystem
- freshwater, marine and coastal resources
- pollution management
- environmental economics and indicators
- social policy and resettlement
- portfolio monitoring and environmental assessment
- global overlays

Remember to do...
Better with Less!