ACADEMY

AIRBUS **C**ORPORATE **A**NSWER TO **D**ISSEMINATE **E**NVIRONMENTAL **M**ANAGEMENT S**Y**STEM

Environmental Analysis

Environmental aspects and impacts identification process

ECO-EFFICIENCY AND SUSTAINABILITY - G3 - ISSUE 1

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I. Introduction

The environmental analysis or environmental aspects and impacts identification process is one of the most important parts of any Environmental Management System (EMS), as it lays the foundation for how the management system will run in the future and the environmental improvements it should address. In basic terms, it will assess environmental risk.

It also has the ability to give information on the level and amount of environmental impact, and to give valuable information on other requirements of the system that might be required, including training needs, operational control requirements and the setting of objectives and targets within the system.

This guide will focus on the requirements of the ISO 14001 Standard and will aim to give an overview of what might be required to identify aspects and impacts within an organization's site-based operations.

II. Basic principles

There are some very key decisions to be made when planning to implement the organization's EMS. These are discussed in this section, and will save the organization time over the implementation period of the EMS and set the basis for the environmental analysis process.

Scope

The environmental analysis should reflect the scope of the organization's EMS, so that what is covered within the system can be measured; the scope needs to be determined at the outset.

So, will the scope cover the whole organization, or just part of it? For example, if you have a manufacturing unit and/or a design department, will the organization's EMS cover just the manufacturing element or include all other support functions within the business?

This scope will not only be needed at the outset, but also for as long as it may be audited, as the auditors will want to know what the organization's EMS covers and what they are going to audit.

Once the scope is defined and set for the system, this will then determine how the analysis is completed.

Level(s) of environmental analysis

It will then have to be decided at what level the organization will carry out the environmental analysis to determine the aspects and impacts. This can be done at a number of levels:

- Activity-based:
  Each element of each activity as it is carried out throughout the organization
- Department-based:
  For example, the goods in or goods dispatched
- Process-based:
  The whole process, for example machining

It is recommended that the process-based approach be used for the environmental analysis. If the aforementioned levels are investigated in more depth, it is possible to see why the process-based application is more favourable.

Activity-based

If an activity-based analysis is carried out, it is possible that repetition will occur within each activity compared to another. For example, if there are several machines producing components, it is entirely possible that the inputs and outputs are environmentally similar, so this could be covered by analysing the machining process overall.

Department-based. This is similar in outcome to the activity-based analysis, in that there may be repetition within the inputs and outputs. For example, if an analysis is performed for the Finance and Design Departments, although the function of these departments is very different, the inputs and outputs will be environmentally the same, so again it would be more appropriate to do an environmental analysis on the “office” based process.

Process-Based

The process-based analysis gives the assessor an overview of what is going on and avoids repetition within the analysis, as mentioned before. For example, all office-based activities can be analysed once, instead of individually analysing each office that has similar activities with therefore the same overall outcome.

When the method of carrying out the analysis has been chosen, it is also very important for sub-contractors to be included in the analysis. This will help identifying any environmental risk that the sub-contracted operations pose to the organization, and is now a requirement of the ISO 14001 standard.

Indeed, it is the organization's decision entirely as to the level at which the environmental analysis should be carried out, but again, this decision should be made early on in the implementation of the EMS organization process.

III. The ISO 14001 Requirements

As part of the planning section, the ISO 14001 Standard states that:

The organization shall establish, implement and maintain a procedure(s):

a) To identify the environmental aspects of its activities, products and services within the defined scope of the environmental management system that it can control and those that it can influence, taking into account planned or new developments, or new or modified activities, products and services,
b) To determine aspects that have or can have significant impact(s) on the environment (i.e. significant environmental aspects).

The organization shall document this information and keep it up to date, so all the results have to be recorded and periodically checked to ensure any changes or new processes are accounted for.

The organization shall ensure that the significant environmental aspects are taken into account in establishing, implementing and maintaining its environmental management system (Source ISO 14001:2004E).

The main areas of consideration for the analysis should be:

- Emissions to air
- Releases to water
- Releases to land
- Use of energy
- Energy emitted, for example: heat, radiation, vibration
- Noise (that can be heard off site)
- Waste in all forms, and by-products
- Physical attributes of the organization, for example: size, shape, colours, appearance, etc.

NB: There is further guidance from the Standard on what should be included within the environmental analysis and what areas of environmental impact should be considered and measured within the organization. However, this should only be considered where the organization has control and influence over environmental aspects and impacts.

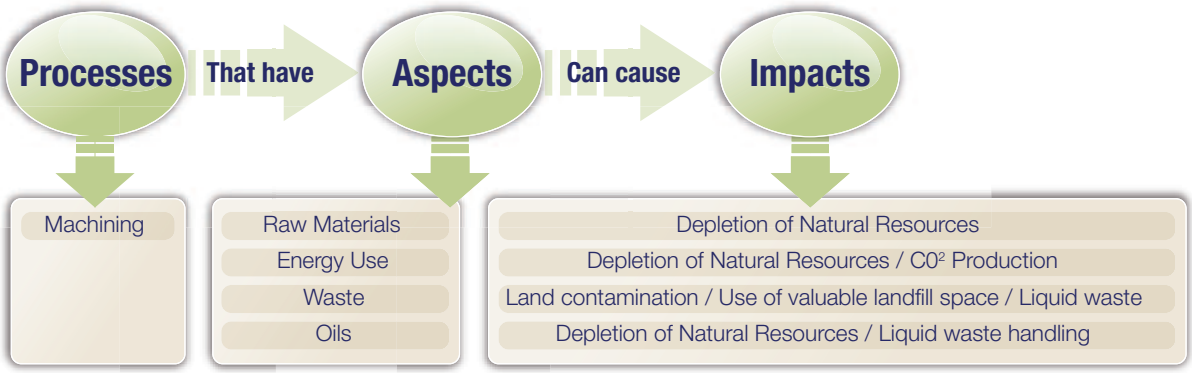
IV. Aspects and Impacts

Before investigating the environmental analysis process, it is important to understand the difference between an environmental aspect and an environmental impact and therefore what can ultimately be improved in time.

An Environmental Aspect is an element of an organization's activities, products or services that can interact with the environment.

An Environmental Impact refers to any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.

For example:



This is basically a cause and effect process.

A list of the environmentally sensitive areas that need to be measured, their potential aspects and impacts are shown in *Annexe 1.*

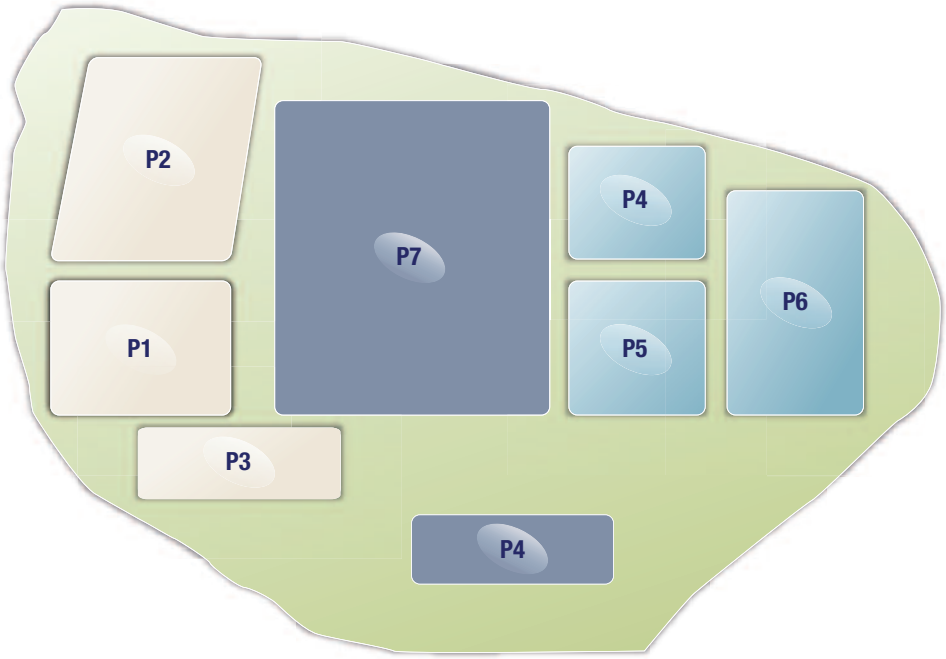
In addition to this, *Annexe 2* lists some potential processes that may be found in a manufacturing environment.

Neither of these lists is exhaustive, however they do help guide the assessor as to the potential aspects, impacts and processes that may be found.

V. The Analysis Process

The first thing to do in terms of fulfilling the analysis process is to map the site that the organization occupies. Does it share any buildings with another organization? If this is the case, these will also need to be considered. Once this has been established, a complete identification of the processes should be carried out.

Example:



P1 - unpacking and quality control
P2 - machining hall
P3 - goods in / out and waste collection area

Production Process

P4 - design office
P5 - customer services department
P6 - general administration support & site facilities
P7 - design office
P8 - the occupied site and boundary

Office Activities

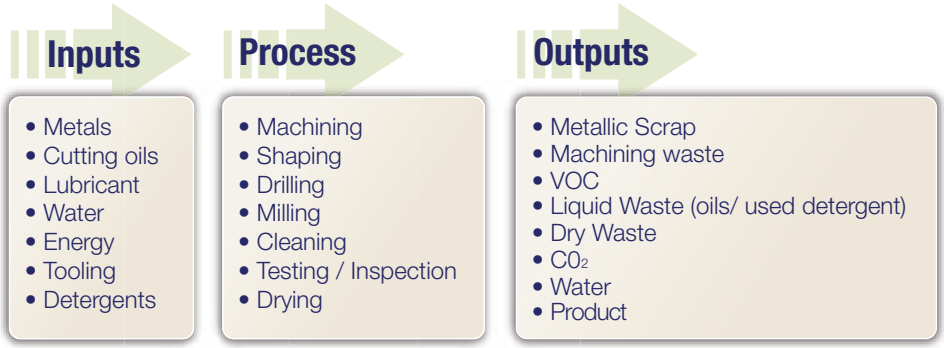
Now that the site has been mapped, the processes identified can be broken up into categories as shown above.

Once a full list of processes has been identified and categorised, each process should be scrutinised to see what the inputs and outputs are, and this starts the analysis process. This is dealt with in the next section.

VI. Inputs and Outputs

Now all the processes have been identified, the process should be viewed in terms of its inputs and outputs, or in other words what goes in, what happens and what comes out as a result or consequence of the process.

In terms of the machining example used earlier, the inputs and outputs for example could be as follows:



The inputs are an inventory or a consequence of the process requirement and the environmental aspects. The outputs are the result of completing those requirements and potential environmental impacts, so here again we have a cause and effect process. The above observations are not exhaustive and other items may be added or taken away as identified.

Using this method to identify inputs and outputs helps to ensure that nothing is missed and that a logical sequence is followed. Make sure that any periphery activity related to the process is also included. For example, delivery of metallic blanks to the machining area. What will happen to any waste packaging?

The same input will apply to different parts of the process. For example, energy will be used for all parts of the process, whereas detergents will only be used for the cleaning element. However, whatever part the input plays in the process, it will have a relative effect on the outputs.

The inputs and outputs will have to be completed for all the processes identified, to help determine how any aspects need to be identified in terms of their potential impact.

NB: When investigating the inputs and outputs, make sure that only aspects that can be managed locally at process level are included. With waste, for example, the segregation of waste is the responsibility of the local process and its contributors, whereas the organization's waste management process as a whole is the responsibility of the site services department, and can therefore be analysed as part of this process when it is analysed.

VII. Evaluation Process

Now as the list of processes and their environmental aspects have been identified, the next stage is to evaluate these aspects and determine whether or not they have an impact or pose a risk to the environment. The most appropriate way to do this is through a scoring mechanism, which helps ensure a consistent approach.

The ISO 14001 Standard requires this process to be carried out in "normal", "abnormal" and "emergency" situations. The reason for this is that the environmental impact will differ for each one. An example of these three situations can be illustrated using the example of a car. For example:

Normal condition:	normal everyday use of the car
Abnormal condition:	maintenance activities such as servicing
Emergency condition:	involvement of the car in an incident

Consider the environmental consequence of each situation and how they differ. Some examples below show the difference:

Normal condition - operation:

- Inputs: petrol/diesel, small amounts of oil and hydraulic fluid to top up
- Outputs: CO_2 emissions, small leaks

Abnormal condition - servicing:

- Inputs: replacement oil, hydraulic fluid, coolant, replacement parts
- Outputs: waste oils and hydraulic fluid, used parts

Emergency condition - accident:

- Inputs: from normal and abnormal conditions
- Outputs: spillage of petrol/diesel, leaking hydraulic and cooling systems

Given these different situations for each process, the environmental consequence or impact now has to be measured using an appropriate scoring system. There is no defined process for this within the ISO 14001 Standard, so it will be necessary to develop one for the organization. Any scoring system developed will have to be both meaningful and give consistent results as to what is being measured.

For normal and abnormal conditions, the scoring system should follow the same logic and should investigate: quantity of aspect, likelihood/frequency of occurrence and environmental consequences.

For emergency situations, basic risk management evaluation logic should be applied and should investigate the likelihood of occurrence versus the consequence for the environment.

What is measured and the outcome of that scoring process is up to the organization, but will also need to include a threshold that determines where an aspect becomes an impact after the scoring process has been completed. The next section deals with this issue.

VIII. The Scoring System

This is where the process becomes a bit more complex, as the processes that have been identified on the site now have to be measured to establish whether or not the identified aspects have an environmental impact or not via an "aspect rating (AR)".

A point that should be considered here, if a number of people are to carry out the analysis, is that regular co-ordination of the results should be reviewed to ensure consistency, particularly if you have similar processes in different parts of your business.

That leaves the scoring of "Normal" and "Abnormal" situations. When setting up the system, there are several environmental conditions to be considered. These could include:

- Consequence of the process aspect on the environment
- Likelihood that it will affect the environment
- Quantity of the aspect

Consequence, will the aspect be: Score

- Major and have a serious effect on the environment? 5
- Significant and have a noticeable effect on the environment? 4
- Moderate with a known effect on the environment? 3
- Limited effect on the environment? 2
- Minimal with very little effect on the environment? 1

Likelihood of occurrence, the aspect:

- Is certain to happen / always happens? 5
- Is very likely to happen / often happens? 4
- Is likely to happen / could happen? 3
- Is unlikely to happen / may not happen / never happens? 2
- Is very unlikely to happen / never happens? 1

Quantity of aspect, does the aspect produce:

- A major source of emissions or use major levels of resources? 5
- A high source of emissions or use high levels of resources? 4
- A moderate source of emissions or moderate levels of resources? 3
- A minimal source of emissions or minimal levels of resources? 2
- Or have no source of emissions or use of resources? 1

All these environmental conditions can be scored from 5 (high risk) to 1 (low risk) and multiplied by each other as each condition is given a score.

The next decision to be made is to determine a threshold within the scoring process for what would be considered an environmental impact or not. The basis for this should be the mid point of the scoring system, but it is ultimately the decision of the organization to set this threshold. With the sets of 3 conditions as described above the threshold score based on the mid-point suggestion is equal to or above 27. Any aspect that is equal to or above this score is considered to have a "significant environmental impact".

For example:

C **x** L **x** Q **=** AR e.g. 3 **x** 3 **x** 3 **=** 27
Significant impact

C **x** L **x** Q **=** AR e.g. 2 **x** 2 **x** 3 **=** 12
Non-significant impact

C **x** L **x** Q **=** AR e.g. 4 **x** 4 **x** 3 **=** 58
Significant impact

Where there are processes with similar inputs and outputs, it may be possible to use an analysis that has been carried out elsewhere in the organization. However, it is very important to check that the inputs and outputs do not vary.

Emergency Conditions

As mentioned before, the "Emergency" conditions should be treated in the same terms as a typical "Risk Management" assessment. This means that the measurement is taken from the notion of:

"Occurrence" versus "Gravity"

The following table shows how this principle works. For example, if a small amount of hazardous material were to be spilled into the local drainage system, what would be the outcome? The suggestion would be that this event would not happen very often, if at all, but if it does the consequence would be very high, so would probably score 7, making it a critical occurrence, even if it only happen once.

		Gravity			
		Very serious 4	Serious 3	Major 2	Minor 1
Likelihood of occurrence	VERY LIKELY 4	Very critical 10	Critical 7	Lightly critical 5	Lightly critical 3
	LIKELY 3	Critical 7	Lightly critical 5	Lightly critical 3	Non-critical 2
	UNLIKELY 2	Critical 7	Lightly critical 3	Non-critical 2	Non-critical 1
	VERY UNLIKELY 1	Lightly critical 5	Non-critical 2	Non-critical 1	Non-critical 0

IX. Other Inputs to the Analysis and General Notes

There are other considerations that may need to be factored in when completing the analysis.

For example:

- Does the process have any licence or legal requirements attached to it?
- Does the process use any hazardous materials?
- Etc.

In these cases, it may be appropriate to make the aspects automatically significant, giving them the highest possible scores. This will ensure the right level of focus is given to the reduction and subsequent management of any impacts, and will help ensure conformance with the licence agreement or the regulation involved.

Another consideration is Operational Control. Whilst carrying out the analysis, the levels of operational control can / could also be investigated. This will help to investigate whether or not existing controls are robust enough to lower or contain the environmental impact, or whether they should be introduced at a later date.

The sort of issues that can be questioned include:

- Is the level of employee awareness sufficient to enable them to control the environmental aspect?
- Are there technical solutions available that can reduce / control the environmental aspect?
- Are raw materials used in the most efficient way (within the process requirements and quality issues)?
- Are the work instructions being followed, can they be improved?
- Etc.

When considering land contamination, there are a few additional questions that should be asked:

- Has the organization been the only tenant on the land?
- Have processes used in the past and no longer implemented contaminated the land being used?
- Is the land used as part of a leasing agreement?
- Is a history available on the previous users of the land?
- Etc.

In the majority of cases, the organization will not produce its own energy, although it would be true to say that energy will be used! If the organization is not part of any emissions trading scheme (ETS), then it has no taxation or regulatory implication through energy use. However, there will be a cost implication and CO_2 output related to operations, so energy efficiency is the key measurement within the analysis.

X. What can be done with the Results?

Now that all of the processes have been measured, the consistency checked and the results recorded, there is a considerable amount of information available that can be used to move forward environmentally, and it is up to the organization as to how this information can best be used.

All the identified aspects that have a significant environmental impact fall into the category for potential “continuous improvement”. These can now be turned into environmental “Objectives and Targets” and become part of the organization's Environmental Management Programme (EMP) for the organization to lead, monitor, target and manage improvements in the future.

If the organization has additionally measured the operational control of each process (recommended), any improvements to this element can be part of the continuous improvement plan and be turned into objectives and targets towards the goal of reducing environmental impact.

The aspects and impacts may also highlight any training needs within the organization that will also lead to improvement and increase the awareness of all employees.

The results can help set indicators for reporting, for example: a 10% reduction in energy use will mean a 10% reduction in CO_2 output and reduce the organization's energy bill and increase energy efficiency.

Improvements can be made at both the input stage and the output stage depending on what is feasible.

For example:

- Are the raw materials consumed used in the most efficient way?
- Is it possible to re-use packaging?
- Can waste sent to landfill be reduced?

The environmental analysis should be continually updated and revisited to ensure that it is kept up to date. This could be done periodically for existing processes (recommended every 3 years, dependent on impact level), or for each new process as it is installed or even at the planning stage to remove or reduce potential environmental impacts at the earliest possible opportunity.

XI. Glossary

EMS - Environmental Management System.

Environmental aspect - an element of an organization's activities, products or services that can interact with the environment.

Environmental impact - any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.

Scope - description of the areas of business covered by the EMS.

ISO 14001 - International Organization of Standardization environmental management standard.

Operational Control - steps implemented to reduce/control an environmental impact.

ETS - Emissions Trading Scheme. An EU trading scheme allowing companies to emit CO_2 to an agreed level.

EMP - Environmental Management Programme. A central management process of an organization's objectives and targets.

Annexe 1 - Environmental Analysis Crib Sheet

Environmental Aspects (Normal, Abnormal and / or Emergency)		Environmental Impacts
Air Emissions	VOCs (Solvents e.g. from paint, sealant, degreasing, cleaning, etc.)	Formation of ground level ozone
	Chlorinated VOCs	Formation of ground level ozone and depletion of stratospheric ozone except VOC exempts compounds
	Dusts or particulates	Detrimental to local air quality Human respiratory problems and damage to flora
	NOx, SOx	Formation at ground level of ozone, acidification and effects on flora
	CO_2	Greenhouse gas - Impact on climate change
	Acid fumes / treatment bath extractions	Detrimental to local air quality
	Vehicle Exhaust fumes	Global warming Acid rain Detrimental to local air quality Formation of ground level ozone
Water Use	E.g. for cleaning, dilution of treatment chemicals or coolants, rinse tanks, etc.	Cost of incoming supply
Discharge to Water	Discharges to waste effluent facility	Use of treatment chemicals and/or filtration treatment process
	Accidental releases to Storm Water Drains Discharges to Foul Sewer	Contamination of local water courses
Noise Nuisance	Excessive noise or vibrations (outside building)	Off-site noise nuisance (above background level)
Solid Waste	Dry Hazardous waste (e.g. used containers, rags, brushes, etc.) Non-hazardous waste Paper or cardboard Packaging	Cost of disposal Contamination of landfill site
	Drummed liquid wastes (e.g. coolant, waste hydraulic fluid, oils, etc)	Cost of disposal Use of treatment chemicals
Energy Use	Electricity, gas, oil, consumption (including compressed air production)	Cost of supply Global warming Acid rain Depletion of non-renewable resources
Raw Materials	Fuel, metals, paints, solvents, chemicals, sealant, rags, cleaning equipment, wood, other (please state)	Cost of purchase, impacts of manufacturing processes
Ground Contamination	Spillages, discontinued processes	Contamination of area, cost of disposal, remediation costs

Annexe 2 - List of Processes

COMPOSITE WORKING
Lay up
Resin transfer moulding
Wet laminating (rework, maintenance)
Crushed core laminating
Half-shell laminating
Low pressure hose laminating
Non-destructive testing

SURFACE TREATMENT
Degreasing
De-scaling
De-oxidising
Anodising
Plating
Chemical milling
Passivating
Quenching
Etching
Pickling
Primer painting
Finish painting
Sanding
Shot blasting
Shot peening
Washing
Drying
Application of decor foils

INTEGRATED MACHINING
Machining
Penetrant Flaw Detection (PFD)
Chemical treatments
Heat treatments
Swarf handling
Laser cutting
Trimming
Press
Grinding
Pore filling
Punching
Stretch forming
Water jet cutting
Deep drawing

FACILITIES MANAGEMENT
Maintenance
Transport
Buildings and site infrastructure
Utilities management (Energy, Water… etc)
Waste management
Tool-room operations
Wood-mill operations
Project management of new facilities

WING SYSTEMS
Metal forming
Pickle line
Pipe & tube bending

ASSEMBLY
Sealing
Bonding
Cleaning
Touch up
Riveting
Welding
Composite assembly
General assembly

PLANNING & LOGISTICS
Packaging
Material storage
Material movement

MANUFACTURING ENGINEERING
Industrialisation of new Projects

DESIGN ENGINEERING
Design process
R & D Test activities
Wind tunnel

CUSTOMER SERVICES
Supply of spare parts

GENERAL PROCUREMENT
Procurement of site commodities
Procurement of site service contracts

AIRFRAME PROCUREMENT
Procurement of aircraft components
Procurement of manufacturing commodities