Best Practice Guidelines for Dry Cleaning

PART 1: What you MUST do

Required practices for Dry Cleaners

Under the

Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002
(S.I. No. 543 of 2002)

PART 2: What you SHOULD consider doing

Excellent Practices for Dry Cleaning

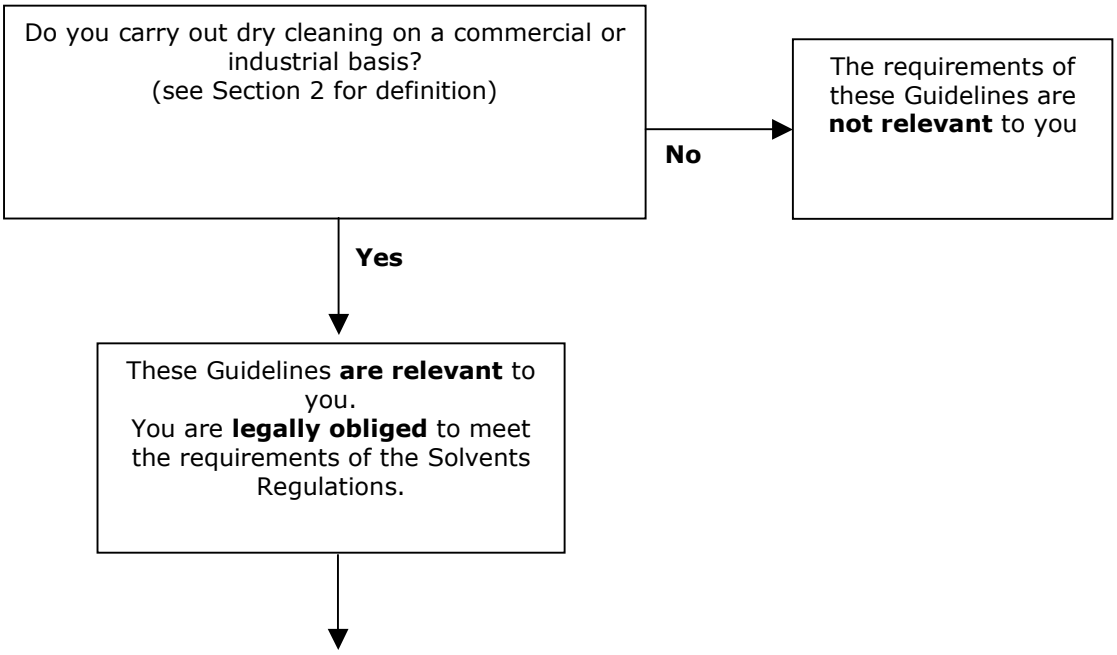
Note: These 2008 guidelines replace the earlier 2004 Best Practice Guidelines for Dry Cleaning with some minor amendments.

August 2008

Best Practice Guidelines for Dry Cleaning

Overall Summary of the Guidelines' Requirements

To find out if the guidelines are relevant to you, answer the following:



Here is a summary list of **what you must do**:

- Determine if you are a new or existing installation (see Section 1.3)
- Register with your Local Authority: (see Section 1.5)
  - annually for continued operation
  - before commencement of a new or substantially changed installation and annually thereafter
- Meet an Emission Limit Value (ELV) (see Section 1.6)
  - for continued operation
  - from date of commencement for a new or substantially changed installation
  - since 31 October 2007 for an existing installation
- Demonstrate compliance with the ELV to your Local Authority by drawing up a solvent management plan and getting an Accredited Inspection Contractor (AIC) to inspect your operation; and meet the requirements of section 1.9 as appropriate: (see Section 1.5)
  - before commencement and by the anniversary annually thereafter for a new or substantially changed installation
  - since 31 October 2007 and annually thereafter for an existing installation
- Obtain a Certificate of Compliance from your Local Authority: (see Section 1.5)
  - annually for continued operation
  - before commencement of a new or substantially changed installation and annually thereafter

CONTENTS

Guidelines:

These guidelines have been published by the Environmental Protection Agency under the National Waste Prevention Programme to support the enforcement of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002[1] henceforth referred to as the "2002 Regulations" or "Regulations" in this document. They provide a description of the mandatory requirements (Part 1) against which a Dry Cleaning installation will be assessed in the course of an AIC inspection.

The guidelines are technical in nature having regard to current Best Environmental Options. Legal compliance in any given instance of dispute can only be definitively determined by due legal processes.

[1] Statutory Instrument number 543 of 2002.

Best Practice Guidelines for Dry Cleaning

PART 1: What you MUST do

Under the 2002 Regulations

Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002
(S.I. No. 543 of 2002)

SECTION 1.1: INTRODUCTION

These Guidelines have been developed to help implement a European Directive on reducing emissions of volatile organic compounds (VOCs) to the air from the consumption of organic solvents[2]. The Directive has been brought into effect in Ireland through Regulations published in November 2002[3].

The Directive was drawn up because solvent emissions can have harmful effects on human health and the environment. Dry cleaning is just one of the many types of businesses to be affected by the Directive.

1.1 What are solvents and VOCs?

In dry cleaning a solvent called perchloroethylene is mainly used to clean textiles/clothing. Perchloroethylene, or perc as it is commonly called, is a solvent that is used to dissolve dirt and remove it from the clothes. Perc is a volatile organic compound (VOC), i.e. a chemical that has a tendency to evaporate under ambient conditions. The Directive definitions for each of these terms are outlined below.

Organic Compound
(Directive definition):

any compound containing at least the element carbon and one or more of hydrogen, halogens, oxygen, sulphur, phosphorus, silicon or nitrogen, with the exception of carbon oxides and inorganic carbonates and bicarbonates

Volatile Organic Compound (VOC) *(Directive definition):*

any organic compound having at 293.15 K a vapour pressure of 0.01 kPa or more, or having a corresponding volatility under the particular conditions of use.

Organic Solvent
(Directive definition):

any VOC which

is used alone or in combination with other agents, and without undergoing a chemical change, to dissolve raw materials, products or waste materials,

or is used as a cleaning agent to dissolve contaminants,

or as a dissolver,

or as a dispersion medium,

or as a viscosity adjuster,

or as a surface tension adjuster,

or a plasticiser,

or as a preservative.

1.2 What will the legislation mean for me?

If you are involved in dry cleaning you are legally obliged to meet the relevant requirements of the Solvents Regulations which are outlined in these Guidelines.

[2] European Council Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations, Official Journal L 85, 29.3.1999.
[3] Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002 (S.I. No. 543 of 2002).

SECTION 1.2: SECTOR COVERED BY THE GUIDELINES

The activity covered by these Guidelines is dry cleaning, which is the use of organic solvents, principally perc (perchloroethylene), to clean clothes, textiles, furnishings and other similar items. Other solvents might also be used such as hydrocarbons or siloxane-based solvents, but these are the exception rather than the norm in the Irish context.

There are generally two types of dry cleaning operation:

- Commercial premises providing a dry cleaning service to the consumer.
- Dry cleaning carried out as part of an industrial activity, usually companies offering textile rental to business and industry.

The first type accounts for the majority of dry cleaning operations, as many of the latter are changing to conventional laundry services. There is one application which is not covered by these Guidelines – using solvent to manually remove stains and spots in the textile and clothing industry. (However their use within dry cleaning installations is included in the legislation).

In general, the dry cleaning process can be divided into five steps:

1. cleaning the garments in the solvent
2. spinning to extract solvent
3. drying with hot air and recovery of solvent
4. deodorisation to remove last traces of solvent
5. regeneration of used solvent after the clothes have been cleaned.

The types of machine:

- closed-circuit machines - solvent is condensed from the drying air inside the machine and there is no general venting. Some closed-circuit machines have integral water-cooled or refrigerated condensers, while newer versions have integral activated carbon adsorption in addition to the refrigerated condensers.
- open-circuit machines - deodorisation of the clothes takes place with venting of drying air to atmosphere. Such machines are considered unlikely to meet the requirements under the Regulations. It is expected that most of these have been replaced;

The Directive definition for dry cleaning is given below.

> *Dry cleaning (Directive definition):*
>
> any industrial or commercial activity using VOCs in an installation to clean garments, furnishing and similar consumer goods with the exception of the manual removal of stains and spots in the textile and clothing industry

See Section 1.8 for a list of the emissions to air, water, and waste from the dry cleaning sector, and the sources of such emissions.

SECTION 1.3: TYPES OF INSTALLATION

Definitions for the different types of installation are as follows.

An **existing** installation is:

- an installation that is in operation on or before 30 June 2003.

A **new** installation is:

- an installation that is put into operation on or after 1 July 2003.

A **substantial change** for installations covered by these guidelines[4] is where:

- There is a change in the nominal capacity (i.e. additional machines or a new larger machine) leading to an increase of more than 25% in ***emissions*** of VOCs, or where
- The local authority decides a change is a substantial change if it considers it may have significant negative effects on human health or the environment.

Note that a replacement machine, or even an additional machine, may not result in a 25% emissions increase since, new machines emit less than older models.

[4] A different percentage increase in emissions applies if solvent consumption is more than 10 tonnes per annum. This level of solvent consumption is considered unlikely for Irish dry cleaning installations.

SECTION 1.4: SUMMARY OF LEGAL REQUIREMENTS

The following table summarises the legal requirements and refers to the relevant sections of the Guidelines for more information on each area.

Legal Requirements under the Directive and its implementing Irish Regulations

If you are a dry cleaning installation, you are legally required to:

- Register with your Local Authority:
  - annually for continued operation
  - before commencing operation of a new or substantially changed installation and Re-register annually thereafter:

    (see Section 1.5.2)

- - Meet an emission limit value (ELV):
  - for continued operation
  - from date of commencement for a new or substantially changed installation
  - since 31 October 2007 and annually thereafter for an existing installation

    (see Section 1.6)

- Demonstrate compliance with the ELV to your Local Authority by drawing up a solvent management plan and getting an Accredited Inspection Contractor (AIC) to inspect your operation; and meet the requirements of section 1.9 as appropriate:
  - before commencement of a new or substantially changed installation and by the anniversary annually thereafter
  - since 31 October 2007 and annually thereafter for an existing installation

    (see Section 1.5)

- Obtain a Certificate of Compliance from your Local Authority:
  - annually for continued operation
  - before commencing operation of a new or substantially changed installation and renew certificate annually thereafter

    (see Section 1.5)

Related Health and Safety Legislation

Note: while considering the implications of these guidelines for your operation you could also give consideration to relevant requirements under health and safety legislation such as the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 (Statutory Instrument No. 619 of 2001).

SECTION 1.5: AIC INSPECTION, REGISTRATION, & CERTIFICATES OF COMPLIANCE

As a dry cleaning installation you are legally required to register with your Local Authority and obtain a Certificate of Compliance. This is done by getting an Accredited Inspection Contractor (AIC) to inspect your premises and produce a report which you submit to the local authority as part of your registration.

1.5.1 Dates for registration and obtaining a Certificate of Compliance

EXISTING INSTALLATIONS must be registered and must obtain a Certificate of Compliance no later than 31st October 2007. *You are not allowed to continue dry cleaning after this date without this certificate.*

NEW (OR SUBSTANTIALLY CHANGED) INSTALLATIONS must be registered before commencement of operation and must obtain a Certificate of Compliance before commencement of operation. *You are not allowed to start dry cleaning until you obtain this certificate.*

If you are an existing installation (i.e. in operation on 30 June 2003), and you bought an additional machine since 1 July 2003 that caused an increase in emissions to air from your premises of more than 25%, you have undergone a substantial change. *You should have been compliant, i.e. registered and have obtained a Certificate of Compliance, before this increase occurred.*

1.5.2 How do I register?

Registration involves submitting the following to your Local Authority:

- the registration details in Appendix 1-2 of these Guidelines.
- A compliant AIC report (see below).
- a fee of €50.

Contact your Local Authority environment section to find out the procedure for registration**.**

1.5.3 What is the AIC report?

It is important to understand that this is a new approach – the onus is on you to get inspected annually by an accredited inspection contractor (AIC) - the Local Authority will not be carrying out the inspections themselves. However they are the competent authority to enforce these Regulations in the event of non-compliance.

You will need to get an AIC to review your operation and produce a report on your compliance (or otherwise) with the Regulations. This is called an AIC Report. The cost of having the AIC report prepared must be borne by you.

The AIC report demonstrates whether or not your facility complies with the requirements of these Regulations, i.e. if your installation is:

- Meeting the Emission Limit Value (ELV) (see section 1.6). This is done using the solvent management plan (see section 1.7).
- Meeting the other mandatory requirements in relation to handling of solvent waste, containment of solvent, training, and maintenance (see section 1.9). This is done by looking at written records.

The AIC report will state why/if compliance is not achieved (major non-compliances). The AIC report will also list any minor non-compliances or any observations. For compliant reports, such observations may relate to issues, which if they were not to be addressed, might result in a non-compliance arising with the requirements.

If you undergo an AIC audit and are found to be non-compliant, you must correct any non-compliances immediately and achieve a compliant audit result before submitting the report to the local authority.

1.5.4 Where can I find an accredited inspection contractor?

The AIC used to prepare the AIC Report must be accredited by the Irish National Accreditation Board (INAB) to ISO 17020 for the conduct of inspections to the 2002 Regulations.

INAB has a list of accredited AICs on their website www.inab.ie or contact the Irish National Accreditation Board, Wilton Park House, Wilton Place, Dublin 2; Phone 01 607 3003.

1.5.5 How often must an AIC report be submitted?

An AIC report must be submitted on registration, and ***annually*** thereafter. A fee of €50 must be paid to the Local Authority every time an AIC report is submitted.

An AIC report must also be submitted if a substantial change is proposed (see section 1.3 for a definition of substantial change). A new Certificate of Compliance must be obtained before operating the substantially changed facility.

If the local authority considers that the Regulations are not being complied with, it will notify you of its refusal to issue a certificate. The local authority can pursue prosecution for an offence under the Regulations if considered necessary.

The local authority can also look for further information if it is not satisfied with the AIC Report.

1.5.6 What is the Certificate of Compliance?

You cannot start up a new (or substantially changed) installation without a Certificate of Compliance, or you cannot continue operating an existing installation since 31st October 2007 without such a certificate. Your Local Authority must issue you with a Certificate of Compliance within 14 days of receiving your report by an accredited inspection contractor, once it is satisfied that you are in compliance with the Regulations.

After obtaining the certificate you must operate in accordance with the Directive and Regulations and any conditions attached to the certificate.

1.5.7 How long is the Certificate of Compliance valid?

The certificate is valid for ***one year only***. You must submit a compliant AIC report by an accredited inspection contractor to your local authority each year to obtain a new certificate.

1.5.8 Enforcement

The main onus to comply lies with the operator.

The local authorities are the competent bodies responsible for the enforcement of the Regulations within their functional area. The EPA Office of Environmental Enforcement will support the local authorities work in this regard through the Environmental Enforcement Network. AICs will be entitled to offer their services to relevant operators and may inform the authorities where they suspect non-registration is occurring. Those that do not obtain a Certificate of Compliance can expect escalating enforcement action including inspection, formal warning and legal action.

1.5.9 What must I do before getting an accredited inspection contractor on site?

You will need to do a certain amount of work before you bring an AIC in to inspect your premises. You will need to gather certain information and use this information to prepare a solvent management plan. For a list of the information you must gather see Appendix 1-3.

For information on how to prepare the solvent management plan see section 1.7. A spreadsheet has been developed (see www.epa.ie) with record sheets that can be maintained by you on computer or can be filled in on paper. The spreadsheet helps prepare the solvent management plan for you. These record sheets contain all the record keeping you will need to show compliance or otherwise with the emission limit value (ELV).

Section 1.9 outlines other mandatory requirements which you must implement covering handling of solvent waste, containment of solvent, records of training, and records of maintenance.

1.5.10 What will the AIC inspector look for on the day of inspection?

The accredited inspection contractor (AIC) inspector may ask for your solvent management plan documentation in advance of the day of the inspection.

On the day of the inspection, the AIC inspector will:

- Review the solvent management plan that you have compiled (as noted already, the AIC inspector may ask for this in advance).
- Look at each of the figures listed in Appendix 1-3.
- Carry out spot checks on the back up documentation for these figures (e.g. invoices, certificates of waste disposal, etc.).
- Tour areas of the premises relevant to the dry cleaning operation – the dry cleaning machine(s), fresh solvent storage areas, and waste solvent storage areas.
- Interview employees – e.g. dry cleaning machine operators.
- Review any other back-up documentation – e.g. dry cleaning machine manual.
- Review documentation for the other mandatory requirements, namely training records and maintenance records.

It may be the case that a follow up visit is required – this depends on the outcome of the inspection and the judgement of the AIC inspector. Refer to www.epa.ie for a copy of the AIC report template.

1.5.11 What if I am starting up a new installation?

If you are setting up a new dry cleaning installation, you will not have any records with which to demonstrate compliance with the Regulations. Inspections involving new installations will look at:

- Documentation in relation to the proposed machine(s): The make and model of the dry cleaning machine(s) including details on expected performance from the manufacturer in terms of Solvents Directive requirements, and information on whether refrigerated condensers and carbon adsorbers are to be fitted.
- Where the machine(s) will be located, the proposed fresh solvent storage areas, and proposed waste solvent storage areas.
- Procedures for training of employees.
- Procedures for the setting up of the solvent management plan including tracking purchases, tracking weights of garments cleaned, tracking waste, and taking opening and closing stocks.
- Arrangements planned in relation to waste.

Once you have obtained your Certificate of Compliance you will have to generate a solvent management plan and associated records as detailed above from the date of commencement of the operation. These will be checked at the next inspection.

SECTION 1.6: EMISSION LIMIT VALUE (ELV)

As a dry cleaning installation you are legally required to meet an emission limit value (ELV).

1.6.1 The Emission Limit Value – what is it?

The emission limit value (ELV) sets the maximum amount of solvent that you are allowed emit from your installation:

Total Emission Limit Value (ELV) for Dry Cleaning Installations
20 g solvent emitted per kg of product cleaned and dried

Where,

'product' means clothes, garments, furnishings or other similar items;

'emitted' means solvent that escapes to the air in vapour form. It does not include any solvent that is captured in liquid form and reused, or taken off the premises for recovery/recycling or disposal.

The emission limit value can also be expressed in an alternative way where perc is the solvent in use (based on every litre of perc weighing 1.6kg):

80 kg of product cleaned and dried per litre of solvent emitted

1.6.2 How do I find out if I am meeting the Emission Limit Value?

You are legally required to meet the emission limit value (ELV) from the date specified in section 1.4. You need to find out if you are meeting the ELV and you also must be able to prove to your Local Authority via a compliant AIC report that you are in compliance. The way to do this is to make a solvent management plan (see section 1.7). A spreadsheet has been developed (see www.epa.ie) with record sheets that can be maintained on computer or can be filled in on paper. The spreadsheet helps prepare the solvent management plan for you. These record sheets contain all the record keeping you will need to show compliance or otherwise with the emission limit value (ELV).

In order to compile the solvent management plan you will need to gather certain information - see Appendix 1-3.

It is a good idea to carry out a solvent management plan now to see how you compare with the ELV and if you will need to reduce your emissions before the required date. Actual measurement of emissions from dry cleaning has been shown to be less accurate than a solvent management plan and in many installations can be difficult to carry out.

Section 1.9 outlines other mandatory requirements which you must implement covering the handling of solvent waste, containment of solvent, staff training records, and maintenance records.

1.6.3 What do I do if I am above the Emission Limit Value?

By comparing the emission limit value with current actual solvent emissions (as calculated by the solvent management plan) you will see if a reduction in emissions is needed, and by when (see section 1.7.4).

If a reduction is required see Part 2 for the various techniques and technologies that can be used to reduce emissions. These include improving operating practices as well as add-on equipment.

1.6.4 Emissions to Sewer/Water

Best practice is not to discharge separator water to sewer or to waters and instead collect it for off-site licensed reclamation or disposal as hazardous waste, as appropriate (you should contact your sanitary authority before discharging sewer - your AIC may seek confirmation of this discharge permit). **A waste containing perchloroethylene would**

be hazardous by carcinogenic (H7) at ≥1% and by ecotoxic (H14) at ≥2.5%. (*Source: Environment Agency (UK) Hazardous Waste Interpretation of the definition and classification of hazardous waste (2nd edition v2.1)*).

SECTION 1.7: SOLVENT MANAGEMENT PLAN

1.7.1 Solvent Management Plan - What is it?

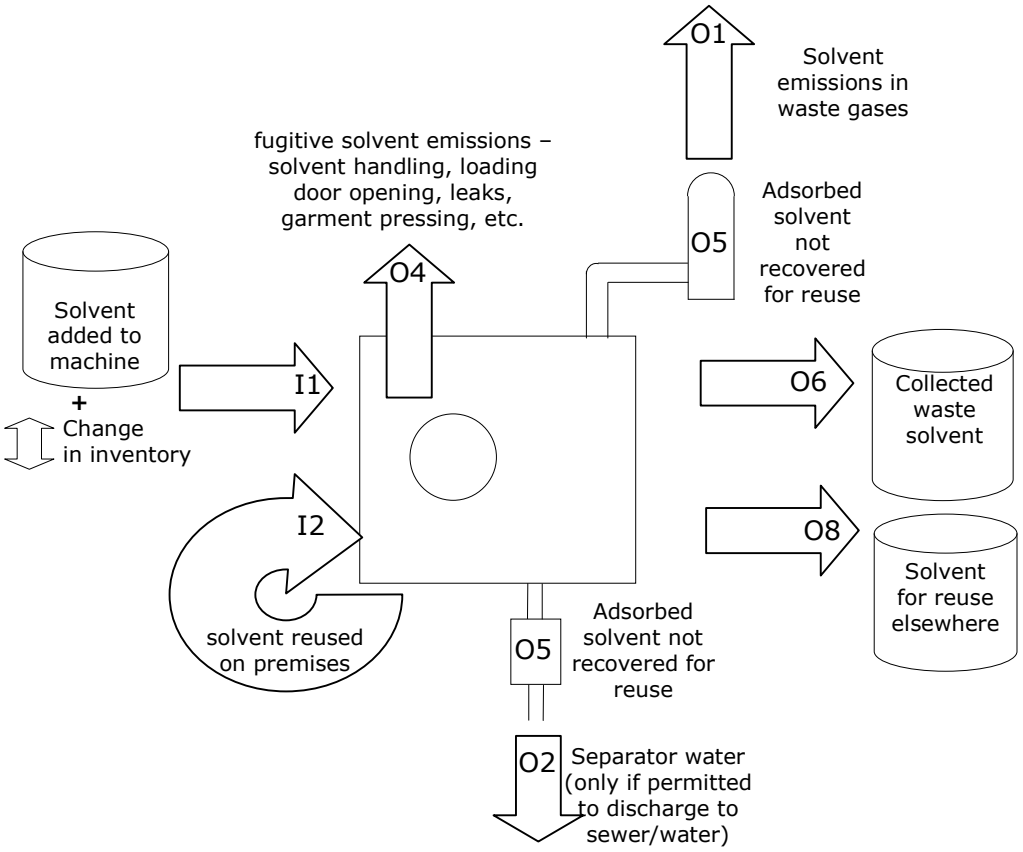
The solvent management plan basically works out where all of the solvent you use eventually ends up. The reasons for making a solvent management plan are:

- to find out if you are complying with the emission limit value.
- to demonstrate to the AIC and the Local Authority that you are/are not in compliance with the emission limit value.
- to help you identify future emission reduction options (and help reduce your costs).

The solvent management plan uses what is called a 'mass balance', basically identifying where solvent goes into a process and where it comes out. It can be done for an individual dry cleaning machine or for the entire dry cleaning premises.

1.7.2 Solvent Management Plan Terms for Dry Cleaning

The following drawing and subsequent table list the Solvents Directive terms used in the mass balance for dry cleaning installations.



The meaning of each mass balance term is as follows. Those that are relevant to the dry cleaning sector are highlighted in ***bold italics***:

Directive's Mass Balance Terms		Relevance to Dry Cleaning
Inputs of organic solvents (I):		
I1	***The quantity of organic solvents or their quantity in preparations purchased which are used as input into the process in the time frame over which the mass balance is being calculated***	Relevant. The amount of solvent put into the machine for the first time. Use of spotting chemicals is also added.
I2	***The quantity of organic solvents or their quantity in preparations recovered and reused as solvent input into the process. (The recycled solvent is counted every time it is used to carry out the activity)***	Relevant to the process of dry cleaning, although not used in the calculation, hence can be ignored. The amount of solvent used in a year, counting it every time it is recovered and reused within the machine.
Outputs of organic solvents (O):		
O1	***Emissions in waste gases***	Relevant. The amount of solvent emitted from the machine that isn't captured by the condensers or adsorbers.
O2	***Organic solvents lost in water, if appropriate taking into account waste water treatment when calculating O5***	May be relevant, but only if sanitary authority permits separator water discharge to sewer/water.
O3	The quantity of organic solvents which remains as contamination or residue in products output from the process	May be relevant, but the amounts involved will be very small due to pressing/ironing and in any case the solvent will inevitably be emitted to air.
O4	***Uncaptured emissions of organic solvents to air. This includes the general ventilation of rooms, where air is released to the outside environment via windows, doors, vents and similar openings.***	Relevant to dry cleaning. Includes leaks, emissions from opening doors, solvent handling, etc. (see Section 1.8).
O5	***Organic solvents and/or organic compounds lost due to chemical or physical reactions (including for example those which are destroyed, e.g. by incineration or other waste gas or waste water treatments, or captured, e.g. by adsorption, as long as they are not counted under O6, O7 or O8)***	Only adsorption is relevant. May not be relevant for every facility. Applicable to solvent removal from air or separator water. Does not include adsorbed solvent that is regenerated and reused within the dry cleaning machine.
O6	***Organic solvents contained in collected waste***	Relevant – waste solvent itself plus solvent in filters, etc. Also separator water if it is handled as hazardous waste.
O7	Organic solvents, or organic solvents contained in preparations, which are sold or are intended to be sold as a commercially valuable product	Not relevant.
O8	***Organic solvents contained in preparations recovered for reuse but not as input into the process, as long as not counted under O7***	Any waste sent away for recovery/recycling rather than disposal. May not be relevant to every dry cleaning facility.
O9	Organic solvents released in other ways	Not relevant.

1.7.3 Keeping Records – the Excel Spreadsheet

In order to carry out the solvent management plan, you must keep records on a regular basis to help you generate the information you require. An example of the type of records that can be kept are contained in the separately available Excel spreadsheet (see www.epa.ie). These record sheets can be maintained on computer or printed for filling in on paper. These record sheets contain all the record keeping you will need to show compliance or otherwise with the emission limit value (ELV). Appendix 1-3 gives a summary list of the information you will have to obtain and keep on record.

Within this set of records, there is a weekly record sheet which should be filled in on an ongoing basis by hand, regardless as to whether the overall records will be kept on computer or on paper. The best place to keep this weekly record sheet is attached to the machine itself (or one on each machine where there is more than one in operation).

The other summary record sheets can be filled in by hand or on computer on an ongoing basis. You can modify these sample record sheets to suit your own requirements.

A set of records for a 12-month period must be compiled before each inspection. However**,** for your first inspection only, a minimum of at least 3 consecutive months of records must be available. For subsequent inspections**,** 12 months of records must be available. This does not have to be a calendar year. When renewing Certificates take into account the time required to have an AIC inspection performed, an AIC report compiled, and for the Local Authority to process your registration.

1.7.4 Getting Information for the Solvent Management Plan Terms

Appendix 1-3 gives a summary list of the information you have to obtain and keep on record. The Excel spreadsheet provides more detail on how to obtain this information. A summary for each of the mass balance terms is as follows:

I1 The quantity of organic solvents or their quantity in preparations purchased which are used as input into the process in the time frame over which the mass balance is being calculated

This term is calculated based on the records of the volumes of solvent added to the dry cleaning machine. The start and end of year levels of solvent in the machine and in any fresh containers are also taken into account. The amount of solvent purchased during the period is used as a cross check.

Also added to this figure should be the usage in litres of VOCs from any spotting chemicals used over the time period. Spotting chemicals are solutions used to manually remove stains and spots from material prior to dry cleaning. Not all spotting chemicals contain VOCs. You can determine if a spotting chemical contains VOCs by looking at the material safety data sheet (MSDS) for that spotting agent or by contacting the supplier.

O1 Emissions in waste gases
and
O4 Uncaptured emissions of organic solvents to air. This includes the general ventilation of rooms, where air is released to the outside environment via windows, doors, vents and similar openings.

Air emissions are calculated by difference using the solvent management plan (see Section 1.7.5).

O2 Organic solvents lost in water, if appropriate taking into account waste water treatment when calculating O5

Relevant if the sanitary authority permits discharge of separator water. Analysis of solvent content of separator water is required (this may need to be repeated on a periodic basis) as wastes containing perchloroethylene at concentrations greater than 1% are carcinogenic. An estimate of the annual quantity of separator water generated is required (see Excel spreadsheet for method). Wastewater treatment equipment, if in use, should be taken into account. N.B. Machine operation and maintenance must be of good standard to ensure that only permitted quantities of solvent are lost in water.

O5 Organic solvents and/or organic compounds lost due to chemical or physical reactions (including for example those which are destroyed, e.g. by incineration or other waste gas or waste water treatments, or captured, e.g. by adsorption, as long as they are not counted under O6, O7 or O8)

This term is only relevant for carbon adsorption where the carbon is not regenerated in-situ. Calculated based on the weight of disposed carbon and an estimate of its solvent content. Covers adsorption of solvent from air and from separator water. Also may be relevant for any solvent remaining on disposed carbon from filters used to remove colour from the perc liquid.

O6 Organic solvents contained in collected waste
and
O8 Organic solvents contained in preparations recovered for reuse but not as input into the process, as long as not counted under O7

Records of the weight of solvent-containing waste sent off-site should be maintained. If there is no record of disposal of the solvent-containing waste by an authorised outlet, no credit will be allowed for the waste. It is important that the operator weighs and records the weights of solvent-containing waste sent off-site. These records should then be checked against weights quoted in returns from the authorised collector. **When weighing solvent-containing waste protective clothing, e.g. gloves, goggles, etc. must be worn.**

Analysis of solvent content of waste is required (this may need to be repeated on a periodic basis). This should ideally be obtained in mg/kg rather than mg/litre. Representative sampling methods should be used (see Appendix 1-4).

Servicing or repair of the machine may generate quantities of solvent waste. However these should not be recorded separately if they are added to the normal solvent waste drum since they will be weighed and recorded in any case.

If separator water is handled as hazardous waste, analysis for solvent content and quantification of volumes is also required.

Disposal is where such waste is sent for destruction, while recovery is where such waste is recovered off the premises for recycling or reuse in another application. For dry cleaners, the distinction between waste being sent for recovery or for disposal does not have an effect on the solvent management plan since there is no threshold for dry cleaning and so the "consumption" term is not critical.

Weight of product processed

The overall emission limit value is expressed in terms of emissions per unit product processed. Hence a total for product processed in the time period is required. This is based on records of the weight of each load of garments dry-cleaned. It is suggested that an appropriate digital and calibrated scales, capable of weighing the required volumes of clothing, be used for this purpose. Staff must be trained in the proper use of the scales. Record sheets for garment weights should be signed off by a senior manager. An appropriate check weight should be used to periodically check the scales and records kept of these checks. Where a weighing scales is found not to be weighing accurately, it should be removed from service and replaced by another suitable, calibrated unit.

1.7.5 The Solvent Management Plan Calculation

The solvent management plan calculates actual emissions for the year using the above terms in the following calculation:

Actual emissions: $O1 + O4 = I1 - (O5 + O6 + O8)$

Or using the meanings of these terms:
Actual emissions:
[(emissions from waste gases) + (fugitive emissions)] = (quantity of solvent purchased & used) – [(any solvent adsorbed & not recovered) + (solvent in collected waste for disposal) + (solvent collected for recovery/recycling/reuse elsewhere)]

The Excel spreadsheet performs this calculation automatically. If using the paper version of the records, instructions are provided.

1.7.6 Comparing Actual Emissions with the Emission Limit Value

Once actual emissions have been calculated, the amount of dry cleaning carried out in the period must be taken into account.

The ELV:	To get Actual Emissions use:
20 g solvent emitted per kg of product cleaned and dried	(*grammes* of actual emissions for the period) (kg of product processed during the period)

If the answer you get from the right hand column is bigger than the corresponding value on the left hand column, the emission limit value is being exceeded and emissions will need to be reduced (see Part 2). Otherwise, you are operating within the ELV and may proceed to have an AIC inspection/report prepared by the due date. However, further reductions in emissions may be attained by employing some of the measures outlined in Part 2.

The Excel spreadsheet performs this calculation automatically. If using the paper version of the records, instructions are provided.

SECTION 1.8: EMISSIONS AND SOURCES

1.8.1 Air

Emissions to air from dry cleaning and their sources:

Emissions	Sources
Solvent vapour	opening access doors – loading door, button trap, still, etc. unloading of clothes, emptying the still residue, filling the machine with solvent, emptying the filter, any leaks from certain parts of the machine & piping, any spills, ironing & steam pressing areas, fresh solvent storage and handling, solvent-containing waste storage and handling, finished goods storage area.

1.8.2 Water

Separator Water

Aqueous emissions from dry cleaning consist of water from the water separator. Separator water comes from various parts of the dry cleaning process (carbon adsorber regeneration, still cleaning, liquid detergents, clothes in the drum, etc.). Separator water contains a certain amount of dissolved perc (typically 150 mg/litre which is the saturation level) and can often contain small amounts of free phase perc which settles at the bottom of the separator water container, even where the water separator is automatically operated.

Other Emissions

Other sources of emissions not involving solvents may include cooling water (where used and operated on a once through basis rather than in a closed loop), and boiler blowdown (where steam is used).

Accidental Emissions

There are several areas with a potential to contaminate surface water and groundwater via accidental discharge of solvent to drains and sewers. These include the dry cleaning machine itself, the solvent storage area and solvent-containing waste storage area.

1.8.3 Waste

Hazardous wastes generated from dry cleaning:

Waste	Source
Materials contaminated with solvent	still residue, content of the filter, lint filter, & button trap, spent filter cartridges, spent activated carbon or carbon canisters (air or water treatment, or colour removal), empty containers, used spill kit material, etc.
Waste solvent	Any out of date, contaminated, etc. solvent

SECTION 1.9: OTHER MANDATORY REQUIREMENTS

Apart from meeting the emission limit value and keeping the necessary records in your solvent management plan to demonstrate compliance, there are other practices considered mandatory. This section of the Guidelines outlines these practices which must be implemented by dry cleaning installations. The AIC inspector will check records in relation to these issues.

1.9.1 Solvent Containment

The following containment measures should be implemented to prevent solvent escaping to air, water or onto the ground:

- There should be no drains in the vicinity of the dry cleaning machine, the solvent and waste storage areas or any area where solvent is handled which could be affected by an accidental spillage. Alternatively, if the machine is fitted with a spill tray that can contain 110% of the largest tank in the machine, this requirement in relation to drains is not necessary.
- Keep all containers closed when not in use and during handling/transport around the premises. This includes containers holding waste, containers holding separator water and containers that are partially filled. Spent cartridge filters (where used) should be stored in sealed bags or sealed containers.
- Do not use the dry cleaning solvent for any other application, except inside the dry cleaning machines.
- Use coloured (usually black) high density polythene drums rather than clear polythene drums.
- Keep solvent storage drums (and solvent waste) in an area which:
  - is adequately ventilated
  - is secured against vandalism or unauthorised access
  - arranged to avoid any damage from collisions or spills from trips as far as possible.
  - is away from drains which could be affected by an accidental spillage.

  (In Ireland, solvent is stored in drums and small containers - for tank storage requirements see ETBPP 1997.)
- If purchasing a new machine, a spill tray should be obtained.

1.9.2 Safe Disposal of Solvent Containing Waste

Records of the quantities of solvent waste sent off-site must be maintained (such as those in the Excel spreadsheet) together with certificates of recovery or disposal. These will be open to inspection.

NEVER allow waste solvent enter any drains, sewers or watercourses, or be discarded on the ground. NEVER dispose of solvent materials as part of domestic waste.

ALWAYS use a company who has the correct waste licence or waste permit and waste collection permit. Ask for and retain a copy of their waste licence/permit. Under law, you can still be held responsible for your waste, even after you hand it over to someone else.

Off-site hazardous waste incineration

For certain wastes incineration in a hazardous waste incinerator is the only appropriate method of disposal (where all reduction, reuse, recovery, and abatement options have been exhausted).

Such wastes include:

- still residue
- filter contents (lint, dirt, filter aid, etc.)
- lint filter & button trap contents (lint, dirt, etc.)
- waste from water separator cleaning
- spent filter cartridges (where used; equipment supplier may accept these back)

- separator water (where no valid discharge permit from the local authority is held by operator)
- any waste solvent (if not suitable for recovery)
- other solvent contaminated material (spent activated carbon, rags, etc.)

All such wastes should be stored in closed, appropriately labelled containers while awaiting disposal.

Water from Water Separator

Separator water contains solvent and should be considered as hazardous waste and handled and treated accordingly. Separator water from each machine used should be analysed periodically, preferably during the period under examination, and analysis records kept for inspection. Separator water should not be sent to drain unless permission to do so has been given in writing by the sanitary authority. The operator should contact the relevant sanitary authority regarding any discharges. It is important, even if permission is granted, that no free phase solvent is ever sent to drain, for example from any accumulations at the bottom of the container used to collect separator water.

(Best practice is not to discharge separator water to sewer and instead collect it for off-site licensed reclamation or disposal, as appropriate - see Part 2).

It is important that workers are made aware of what the correct practice is in relation to handling separator water. Correct operation of the machine and regular maintenance are vital to minimise solvent levels in water.

The waste generated from cleaning the water separator should be collected in a closed container and disposed of by a licensed contractor with other solvent containing waste.

1.9.3 Training

A written list should be made of the names of staff who are trained and deemed competent to operate the dry cleaning machine, handle solvent, or handle solvent-containing waste.

Maintain written training records for such staff. These records must be open to inspection. Training can be carried out by a competent person in-house – it does not have to be carried out by a third party. Relevant new employees should also receive this training on arrival, be supervised during induction and periodically given refresher training. Training may need to be repeated where employees perform duties only intermittently or where supervision shows that significant deviations are occurring from required behaviours or skill levels.

Records should include dates of training, brief description of what the training consisted of, trainer(s) name(s) and signature(s) and the employee name(s) and signature(s). These records should be retained on file while the employee remains at these duties and afterwards for at least two years.

The training should include:

- The correct way to operate the dry cleaning equipment, including start-up, shutdown.
- The correct way to carry out routine jobs on the machine, including:
    - operating the still & raking it out.
    - operating the water separator & handling the resulting separator water.
    - cleaning the button trap and lint filters.
    - regenerating the carbon adsorber (if present).
- Solvent handling, loading, unloading, and storage methods.
- Handling of waste containing solvents.
- What to do in the event of a solvent spill.
- The need to prevent any solvent discharge to sewer, waters, or ground.
- Actions to be taken if a vapour leak is detected.
- Correct use of spotting chemicals.
- Why solvent emissions should be minimised as much as possible.

Please note: the training described here is in addition to any health and safety training required.

The key points in machine operation should be displayed on or near the machine and the machine operating procedures should be readily available to workers.

1.9.4 Documented Maintenance Records

Documented maintenance records for each dry cleaning machine should be kept which records the dates of any service, or any component repair or replacement. Maintenance should be carried out by competent persons in accordance with the manufacturer's recommendations.

APPENDIX 1-1:

GLOSSARY

Consumption: the total input of organic solvents into an installation per calendar year, or any other 12-month period, less any VOCs that are recovered for reuse.

Dry Cleaning: any industrial or commercial activity using VOCs in an installation to clean garments, furnishing and similar consumer goods with the exception of the manual removal of stains and spots in the textile and clothing industry.

Emission: any discharge of volatile organic compounds from an installation into the environment.

Emission Limit Value: the mass of volatile organic compounds, expressed in terms of certain specific parameters, concentration, percentage and/or level of an emission, calculated at standard conditions, N, which may not be exceeded during one or more periods of time.

Existing Installation: in terms of the 2002 Regulations, means an installation that is in operation on or before 30 June 2003.

Fugitive Emissions: any emissions not in waste gases of volatile organic compounds into air, soil and water as well as solvents contained in any products. They include uncaptured emissions released to the outside environment via windows, doors, vents and similar openings.

Input: the quantity of organic solvents and their quantity in preparations used when carrying out an activity, including the solvents recycled inside and outside the installation, and which are counted every time they are used to carry out the activity;

Installation: a stationary technical unit where dry cleaning is carried out, and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions.

Normal Operation: all periods of operation of an installation or activity except start-up and shutdown operations and maintenance of equipment;

New Installation: in terms of the 2002 Regulations, means an installation that is put into operation on or after 1 July 2003.

Operator: any natural or legal person who operates or controls the installation or, where this is provided for in national legislation, to whom decisive economic power over the technical functioning of the installation has been delegated.

Organic Compound: any compound containing at least the element carbon and one or more of hydrogen, halogens, oxygen, sulphur, phosphorus, silicon or nitrogen, with the exception of carbon oxides and inorganic carbonates and bicarbonates.

Organic Solvent: any VOC which is used alone or in combination with other agents, and without undergoing a chemical change, to dissolve raw materials, products or waste materials, or is used as a cleaning agent to dissolve contaminants, or as a dissolver, or as a dispersion medium, or as a viscosity adjuster, or as a surface tension adjuster, or a plasticiser, or as a preservative.

Reuse of Organic Solvents: the use of organic solvents recovered from an installation for any technical or commercial purpose and including use as a fuel but excluding the final disposal of such recovered organic solvent as waste.

Small Installation: for dry cleaning an installation which has a solvent consumption of less than 10 tonnes/year.

Standard conditions: a temperature of 273.15 K and a pressure of 101.3 kPa.

Start-up and Shutdown operations: operations whilst bringing an activity, an equipment item or a tank into or out of service or into or out of an idling state. Regularly oscillating activity phases are not to be considered as start-ups and shutdowns.

Substances: any chemical element and its compounds, as they occur in the natural state or as produced by industry, whether in solid or liquid or gaseous form.

Substantial Change: for a small installation, means a change of the nominal capacity leading to an increase of emissions of volatile organic compounds of more than 25%. For other installations, means a change of the nominal capacity leading to an increase of emissions of volatile organic compounds of more than 10%. Any change that may have, in the opinion of the competent authority, significant negative effects on human health or the environment is also a substantial change,

Volatile Organic Compound (VOC): any organic compound having at 293.15 K a vapour pressure of 0.01 kPa or more, or having a corresponding volatility under the particular conditions of use. For the purpose of this Directive, the fraction of creosote which exceeds this value of vapour pressure at 293.15 K shall be considered as a VOC.

Waste Gases: the final gaseous discharge containing volatile organic compounds or other pollutants, from a stack or abatement equipment into air. The volumetric flow rates shall be expressed in m^3/hour at standard conditions.

APPENDIX 1-2:

REGISTRATION DETAILS

Schedule 4 to the Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002 (S.I. No. 543 of 2002)

Registration of an Installation

1. Name and address of the operator:

2. Address of the installation if different from 1 above:

3. Is the installation "new" or "existing" or undergoing a "substantial change" as defined in the Regulations?

4. State the activity or activities carried out or proposed to be carried out at the installation by reference to Schedules 1 and 2 of the Regulations:

5. Detail the type or types of organic solvent used or to be proposed to be used in the activity or activities:

6. State the estimated quantity of each type of organic solvent consumed or proposed to be consumed annually in each activity:

7. Will abatement equipment be used or is it used currently? If so, briefly describe:

8. Are you employing, or do you propose to employ, a solvent reduction scheme under article 7(1)(a)? If so, detail briefly any reduction targets to be achieved:

I am applying to register the above named installation under article 5/article 6 (delete as appropriate) of S.I. No. 543 of 2002.

Signature……

Date……

Checklist for Registration:

☐ Registration details (as above)

☐ Accredited inspection contractor (AIC) report

☐ Registration fee of €50

APPENDIX 1-3:

SUMMARY LIST OF INFORMATION TO BE GATHERED BY DRY CLEANERS

ALL INSPECTIONS OTHER THAN START UP OF A NEW INSTALLATION

The following is a summary list of the information which must be gathered by dry cleaners. A set of records is required for a 12-month period. However, for your first inspection only, a minimum of at least 3 consecutive months of records must be available. For subsequent inspections, 12 months of records must be available.

This list is a summary only - **for more detail see the Excel spreadsheet of sample records**. You use this information to compile the solvent management plan (see section 1.7) to see if you meet the requirements of the Regulations. The AIC inspector will then review the solvent management plan and carry out spot checks on the back up documentation.

Information to be gathered by dry cleaners for a period of 12 months (or a minimum of 3 months for first inspections only) and kept on record prior to obtaining an accredited inspection contractor is as follows:

1. Weight of every load of product dry-cleaned in the period.

2. Volume of solvent added to the machine(s) in the period.

3. Purchases of solvent in the period, including back-up invoices. Purchases of VOC-containing spotting chemicals in the period.

4. The weight of every load of solvent-containing waste sent off site in the period, and the appropriate waste transfer documentation from the waste contractor. It is important that the operator weighs and records the weights of solvent-containing waste sent off-site. These records should then be checked against weights quoted in returns from the authorised collector. **When weighing solvent-containing waste appropriate protective clothing, e.g. gloves, goggles, etc. must be worn.**

5. An analysis of a representative sample of waste for solvent content (preferably in mg/kg). See Appendix 1-4 for accurate sampling methods. This does not have to be repeated annually, only when there is a change in equipment or a major change in operating practices.

6. Analysis results of a representative sample of separator water from each machine used during the period for solvent content. This does not have to be repeated annually, only when there is a change in equipment or a major change in operating practices.

7. An estimate of the volume of separator water generated in the period.

8. The stock levels on the opening day of the period of:

- **a.** solvent volume in machine tanks.
- **b.** solvent volume in machine carbon adsorber (if present).
- **c.** solvent volume in fresh containers, if any.
- **d.** weight of solvent containing waste on the premises.

9. The stock levels on the closing day of the period of:

- **a.** solvent volume in machine tanks.
- **b.** solvent volume in machine carbon adsorber (if present).
- **c.** solvent volume in fresh containers, if any.
- **d.** weight of solvent-containing waste on the premises.

10. Information on the weight of any carbon from adsorbers disposed of in the period.

11. A written record of training carried out.

12. A written record of machine maintenance carried out.

13. Records of any incidents or spills

APPENDIX 1-4:

ACCURATE WASTE SAMPLING

When taking a sample of your solvent waste for analysis, it is important that this sample is an accurate reflection of the drum contents. This is important for the dry cleaning industry as a typical waste drum will have perc at the bottom, water on top and dirt and fibres interspersed between the two layers.

Representative samples can be taken by what is known as a drum thief sampler, which consists of a narrow, hollow, rigid, tube, 6 – 16 mm in diameter, which is open at both ends, and of a length somewhat longer than the waste drum depth.

When sampling, appropriate protective clothing, e.g. gloves, goggles, etc. must be worn.

A typical procedure which might be used to get a representative sample using a thief sampler is as follows:

- slowly insert the thief sampler into the drum, allowing it to fill up with sample material, until the sampler touches the bottom of the drum.
- Seal the open end at the top of the tube, by covering with a gloved thumb or using a rubber stopper, and slowly remove the thief sampler.
- Carefully discharge the sample into an appropriate sample container (glass or plastic bottle of about a quarter litre volume with a tight cover – these are usually supplied by the company who will perform the analysis).

If your solvent waste contains a lot of solids and is sludgy in nature a more appropriate sampling device may be a valved drum sampler or a syringe sampler (available commercially).

Alternatively your waste collector can arrange for sampling and analysis of the waste from your premises.

Best Practice Guidelines for Dry Cleaning

PART 2: What you SHOULD consider doing

Excellent Practices for Dry Cleaning

2.1 INTRODUCTION

Part 1 of this document deals with mandatory requirements for dry cleaners under the 2002 Regulations. This section of the Guidelines, Part 2, outlines what is considered "state-of-the-art" or "World Class" for dry cleaning particularly in relation to VOC-material use and emissions

These techniques are not current requirements under the 2002 Regulations, but may be practices which you could consider implementing at your premises. If you are not in compliance with the Emission Limit Value under the Regulations these techniques will assist you in reaching it. In many cases these will reduce your emissions of solvent, save you money in the long run by reducing the amount of solvent used, and improve work quality as well as protecting employee health and the environment.

These techniques are described under the headings of load minimisation, containment, recovery, recycling, and abatement, while safe disposal is mandatory and is dealt with in Section 1.9.2. This follows the preferred hierarchy of dealing with emissions and waste.

2.2 LOAD MINIMISATION OR SOURCE REDUCTION

'Load minimisation' or 'source reduction' involves reducing the actual amount of solvent in use in the first place. For dry cleaning, solvent usage can depend on:

- type of machine
- machine features that reduce emissions at source
- machine operation
- worker training
- regular machine maintenance

Type of Machine

These Guidelines *do not* oblige you to change to a newer machine. However, if you are considering changing your machine, you should take note of the following:

Alternatives to Perchloroethylene Dry Cleaning Machines

You could consider alternatives to dry cleaning machines using perc. These include:

- Professional wet cleaning systems (washer, dryer, specialty detergent & injection system, and finishing equipment). Some advantages: eliminates perc and its associated hazards; the legal obligations of these Guidelines would no longer apply; reported lower capital costs; lower energy costs; minimised water use; higher throughput; widens the range of services available. Some disadvantages: may not be applicable for all 'dry cleaning only' items; a certain level of garment mislabelling has been reported; may require increased training; may require more finishing work; some shrinkage possible without the use of tensioning finishing equipment; and lack of consumer awareness. The issue of care labels has been addressed by the issuing of a revised ISO 3758:2005 care label standard which now includes a professional wet cleaning symbol and standard.
- dry cleaning machines that use carbon dioxide (CO_2) as a solvent. Some advantages: eliminates perc and its associated hazards; the legal obligations of these Guidelines would no longer apply; the CO_2 used is that already generated in other industries, e.g. brewing. Some disadvantages: emissions of CO_2 which is a greenhouse gas; equipment is more expensive; detergents are reported as being more expensive.
- Machines that use a silicone-solvent based material (decamethylcyclopentasiloxane). Some advantages: eliminates perc and its associated hazards; reported similar operating costs. Some disadvantages: requires a licence from suppliers; the legal obligations of these Guidelines still apply since the material is still a VOC (has a vapour pressure above 0.01 kPa at 293.15K); has been reported as not being quite as effective at stain removal.

Change to Closed-circuit Machines with Carbon Adsorption

You should make sure any perc machine you purchase is a closed-circuit machine where the refrigerated condenser is supplemented by carbon adsorption. Older versions of closed circuit machines only have refrigerated condensers.

However, it is important to note that just installing a new machine is no good on its own. The various points on proper operation and maintenance and solvent management are also required. Record keeping is essential.

Professionally trained personnel should properly install any new equipment. Also any new machines should be CE marked to conform to the European standard EN ISO 8230 Safety Requirements for Dry-cleaning Machines using Perchloroethylene.

Machine Features that Reduce Emissions at Source

If you are considering changing your machine, you should take note of the following (for some of these items, you may be able to retrofit them to an existing machine):

- Use of a loading door interlock device so that the machine will not operate unless the door is closed properly and the door cannot be opened when operating in mid-cycle. On new machines, all doors are electrically and mechanically locked and cannot be opened during the automatic cycle; if they are interfered with, the machine shuts down.
- Use of automatic machine shutdown if any of the access doors are opened (lint filter, the still, button trap, etc.) (see note on previous point).
- Use of automatic shutdown after use for the still heat source.
- Use of automatic options for some of the more regular jobs, such as discharge of filter contents to the still, still waste pump out directly to the waste container, carbon adsorber regeneration, operation of water separator, washing of still wall using dirty solvent for redistillation, and water separator cleaning (all available on machines currently on the market).
- Temperature control of the still.
- Use of disc filters (often called eco-filters) rather than cartridge filters.
- Self-cleaning lint filters and button traps.
- Automatic drying sensors.
- Double water separators.
- Use of more than 2 tanks in the machine to cater for light and dark cleaning.
- Turbo fan on still to enhance amount of solvent removed.

Machine Operation

The operating manual provided by the manufacturer/supplier should always be followed. The following general guidance on machine operation will help reduce solvent emissions, regardless of machine type:

When machine is idle

- Keep the loading door and all other access doors to the machine closed at all times except when loading and unloading.
- Only add solvent to the machine when it is not running.

Before Start-up

- Turn on the general ventilation system.
- (If using) turn on compressed air and check it is at the right pressure.
- Check that the refrigeration cooling system is operating; or, if applicable, that the cooling water is circulating and is at the right temperature, pressure and flowrate.
- Check that the solvent level is correct in each tank in the machine.
- Check that the lint filter, dust bag and button trap are all clean.
- Check that the loading door and all other access doors are closed.
- Turn on steam partially, then fully. Check steam pressure is correct.
- Run the machine on deodorise for a few minutes, or run a "good morning programme" if available, to remove any solvent vapour generated overnight before the first loading each day.

Loading and Unloading

- Weigh every load of garments using an appropriate balance. This will help prevent overloading the machine. In any case this is mandatory for the solvent management plan.
- Do not underload the machine – a partial load will emit almost the same amount of solvent as a full load.
- The only exception to not underloading is bulky items (blankets, etc.); the machine should be underloaded for this type of bulky load, otherwise the load will not dry properly.
- Take the load to the machine before opening the door.
- Once running, do not open the loading door until the cycle is complete.

Operation

- Use automatic programmes in preference to manual operation.
- Avoid programmes that require opening in mid-cycle.
- If entering your own programmes, ensure it ends with a drying cycle of sufficient length.
- Ensure that the setting of the automatic drying control sensor (if present) is set at a level which ensures sufficient drying.

Shutting Down

- Check that the distillation has finished.
- Turn off the steam supply and leave the machine to cool with all doors closed.
- Only when completely cool, turn off electricity, refrigerating system (or cooling water if applicable), any air supply, and local ventilation. If your machine distils overnight, some of these items will have to remain on – check instructions.

Removing Waste Lint

- Waste lint from the lint screen and the button trap should be collected twice daily at the end of a cycle when this lint is in a fully dry state. Dispose of this lint along with other solvent-containing waste.

Frequency of Cleaning the Still

- The residues from the still should be cleaned out at least twice a week. This frequency is recommended in order that modern detergents, which are biodegradable, be removed after a short period. Otherwise they can decompose giving a bad smell to the garments.

Removing Still Residue

- Make sure the still is empty before opening;
- Dry the residue in the still for at least one hour;
- Leave the still to cool – it is recommended to wait until the still is at 38^{o}C or less, or leave overnight;
- Transfer the residue into a closed container;
- Make sure the door seal is clean and shut the door properly.

Changing Spent Filter Cartridges (not relevant to modern machines with disc filters)

- Change the filter cartridge once the pressure reaches that specified by the manufacturer (modern disc filters will usually discharge automatically to the still when the set pressure is reached).
- Remove the filter contents and put them in the still;
    - leave the filter in place to drain overnight;
    - in the morning remove the filter and put in a polythene bag;
    - put the bag into the machine drum and take the filter out of the bag;
    - put the filter through a drying cycle;

- remove the filter and store in a sealed, labelled polythene bag or container.

Worker Training

Ongoing worker training will help reduce emissions and waste. See section 1.9.

Regular Machine Maintenance

The dry cleaning machine should be maintained on a regular basis. A typical maintenance checklist is provided in Appendix 6. Follow the manufacturer's instructions on recommended frequencies for the various maintenance tasks. Suggested maintenance schedules are given in references ETBPP 1997 and USEPA 1994.
Some more recent machines have an automatic maintenance and servicing reminder inbuilt in the computer control system, or even fault diagnostic facilities - these should be utilised if available.

Others

Minimise use of Spotting Chemicals

Minimise as far as possible the amount of spotting chemicals you use prior to dry cleaning.

Solvent Inventory

Keep your stock levels of solvent as low as is feasibly possible. This will reduce the risk of spills.

2.3 CONTAINMENT

Containment basically means measures that stop the solvent escaping to air, water or onto the ground. Additional measures to those outlined in Section 1.9 include:

- enclosed solvent loading and unloading
- use of a spill tray
- use of closed containers
- use of appropriate solvent storage areas & methods
- use of a spill kit
- leak detection.

Enclosed solvent loading and unloading

When filling the machine with fresh solvent, and unloading spent solvent from the machine:

- transport fresh solvent in a *closed* container to the machine from the storage area.
- Hold small containers of fresh solvent (e.g. 5 litres) inside the drum before opening the cap.
- Use piped gravity feed or pumped feed from the machine to the solvent waste storage container.

Please Note: These measures are in addition to standard Health & Safety procedures for the safe handling of hazardous substances.

Use of a Spill Tray

A spill containment tray for the machine will provide local bunding. Such trays should be designed to hold 110% of the volume of the biggest tank in the machine. Machines available today have integral spill containment trays, either as standard or an optional extra. Refurbished machines can also have such trays fitted to them.

Closed Containers

See section 1.9. Train workers to keep all containers closed when not in use and during handling/transport around the premises. The closed lid should be tight fitting. Transfer material out of containers that do not seal properly, e.g. are damaged or dented.

Solvent Storage

Best practice for solvent storage and waste solvent storage is a 'bunded' area, i.e. any spills while they are stored are collected safely. Bunded pallets which facilitate this are available commercially in various sizes.

In addition limiting access to solvent storage areas to authorised personnel only would be desirable.

Keep a spill kit

Keep a spill kit nearby to wipe up any significant solvent spillages. These typically contain absorbent materials to wipe up the solvent, pads to cover drains, as well as a container in which to keep the used absorbent material afterwards (to await a drying cycle in the machine or to be disposed). There are various suitable kits available on the market.

Encourage your workers to place any used absorbent materials into the sealed containers. Try to use materials that can be dry-cleaned for wiping up spills, since the solvent can then be recovered. If you use other materials, they will have to be disposed of as hazardous waste.

Appropriate safety goggles, gloves, footwear, and respiratory protection equipment may also be needed for dealing with spills.

Train your workers in the use of this spill kit.

Alternatively if a spill is collected in a spill containment tray, it can be pumped back into the storage tank or the machine.

Leak Detection

One of the main sources of emissions from dry cleaning machines is through leaks that can develop in certain parts of the machine. These leaks start off very small but unchecked will eventually grow to become bigger leaks. A way to tackle this is to carry out a regular leak detection exercise, for example on a monthly basis.

To do this you will need something with which to detect any leaking solvent vapour. An air sampling pump and stain tubes (glass tubes which change colour when a particular solvent is detected), portable electronic gas analysers, or leak detection halogen lamps are suitable. Ask your equipment supplier.

Keep a written record of which components were tested and when, including if any leaks were detected.

Carry out the leak detection exercise during the *drying cycle* as this is when any leak will be at its greatest.

Follow the liquid circuit and then the vapour circuit from start to finish, checking for leaks anywhere there is a joint or seal. The parts of the machine that are most likely to develop leaks and which therefore should be included in a detection exercise are as follows:

- all solvent pipe valves and flanges
- all solvent pump seals
- all solvent tank sight glasses seals
- all machine access doors (loading; still; filter; button trap; air duct inspection)
- the condenser
- filter housing, seals, and dump valve
- carbon adsorber vent

Detected leaks should be repaired as soon as possible. If any large-scale leak is detected, the system should be shut down and operation recommenced only when the leak has been rectified.

2.4 RECOVERY AND RECYCLING

Recovery and recycling operations relevant to dry cleaning include:

- condensing the solvent
- filtering the solvent
- distilling the solvent
- adsorbing the solvent and recovering for reuse
- stabilising the solvent
- sending solvent for recycling rather than disposal
- container take back by supplier

Condensing the Solvent

The majority of machines have integral condensing units in place. Newer systems have water-cooled units followed by refrigerated units, while older models had water-cooled units only. These condense the solvent vapours mainly from drying, but also from washing, and collect them for reuse within the machine. It is possible to install add-on condensers for machines that have no condenser in place, or retrofit water-cooled condensers with refrigerated condensers. Condensers should be appropriately sized (see reference SCAQMD 1997 for more information). Water-cooled condensers can be operated in a closed loop which can save water usage and charges, although some additional electrical energy will be required.

Filtering the Solvent

Machines have integral filters in place. These are either disc filters (often referred to as "eco-filters") or cartridge filters, which are the older type of filter. Disc filters which do not need any filter aid and can be cleaned without opening are available on machines on the market today. Cartridge filters either use filter aid (diatomaceous earth or silica) or use paper and/or carbon (which can be reused for several hundred cycles). For preference use filters that can be regenerated rather than disposable filters.

The solvent is filtered, usually once a day, to eliminate lint, dirt and other solids that have been removed from the clothes. The collected solids in the filter are also usually removed once per day. They are usually heated in the still to remove as much solvent as possible. Some machines now have automatic filter maintenance.

Distilling the Solvent

The filtered used solvent is usually sent for distillation. The still is usually an integral part of the dry cleaning machine and can be steam or electrically heated. Vapour from the still is condensed and sent to a water separator from which solvent is taken for reuse and returned back to the machine tanks.

Adsorbing the Solvent and Recovering for Reuse

Some machines have integral carbon adsorption units in place. These contain an 'adsorbent', a material to which the solvent vapours become attached. The adsorbent is usually activated carbon, which is like charcoal. These adsorb the solvent vapours that get through the condenser and solvent vapours from the deodorisation stage.

Adsorbers can be regenerated in-situ or the carbon can be periodically replaced when saturated and disposed and replaced by fresh carbon. Adsorbers that are regenerated in-situ and the recovered solvent reused are considered recovery and recycling equipment while those adsorbers which are not regenerated in-situ are considered abatement equipment (see Part 2).

For adsorbers regenerated in-situ, the adsorbed solvent is periodically removed from the activated carbon by using a steam-fed heat exchanger or by hot air. The solvent is condensed and passed through a water separator. The collected solvent is returned to the storage tank within the machine for reuse.

Some machines regenerate adsorbers automatically, while other machines will not continue to operate until the regeneration programme is run when required. The time between regenerations is usually based on the number of loads that have been processed.

Periodically, even for adsorbers which regenerate in-situ, the carbon will become exhausted and have to be replaced. Such waste carbon should be regenerated before being removed from the machine, and should be disposed of with solvent waste.

It is possible to install add-on carbon adsorbers for machines that have no carbon adsorbers in place.

Stabilising the Solvent

Re-stabilise the solvent using a solvent stabilising kit to extend its useful life.

Send Solvent for Recycling rather than Disposal

Depending on quality, collectors of the waste solvent can, in certain cases, send it for solvent recovery rather than having to send it for destruction.

Container take back by supplier

In some cases, suppliers may accept back their empty solvent containers. The size of orders, size and type of containers, and distance involved are factors in whether this facility is available or not.

2.5 ABATEMENT

Abatement is any piece of equipment that is installed after the dry cleaning machine to treat the solvent emissions in the waste gases after they have been generated – so-called end-of-pipe technology.

Note: the 2002 Regulations require any abatement equipment that is installed since 1 July 2003 in a new installation, or since 1 November 2007 in an existing installation, to meet the Directive's requirements.

Adsorption of Solvent

Where a carbon adsorber is used, but there is no regeneration of the carbon in-situ and collection of the solvent for reuse, it is considered abatement equipment. Carbon adsorbers with in-situ regeneration and reuse of the collected solvent are considered recovery and recycling equipment (see Section 1.9.3).

After a period of time in operation the carbon becomes saturated, i.e. it cannot adsorb any more solvent. The canister or filter containing the carbon has to be replaced with a new one. It is essential that this is done before solvent emission levels rise. The solvent-containing carbon must be sent off-site for either recovery of the solvent from the carbon or for incineration of the carbon. Such carbon should be handled as solvent-containing waste.

It is possible to install add-on carbon adsorbers for machines that have no carbon adsorbers in place.

Water Separator & Carbon Filtration

Excess water is periodically removed from the dry cleaning machine using a water separator. Excess water from the water separator should ideally be drained on a daily basis when the machine is idle.

More modern machines have two water separators in place. Latest machines available in the United States also include a carbon filter (or double carbon filters) after these two separators.

There is commercially available equipment which can treat separator water and further reduce solvent content after the water separator. This is usually via phase separation and carbon filtration. Such units can be connected to the dry cleaning machine or can be operated separately.

APPENDIX 2-1: A TYPICAL MAINTENANCE CHECKLIST

This is a typical checklist only, and first reference should always be made to the machine manufacturer's manual. A maintenance record should be kept which records the dates any components are repaired or replaced.

DAILY

Wipe clean the:

- button trap door seal
- loading door seal
- lint filter door seal
- still door seal
- water separator door seal

Clean the button trap sieve.

Clean the lint filter.

Drain excess separator water.

WEEKLY

Check that the drum drains correctly and that there are no blockages.

Check the level control in the drum is operating and at the correct level.

Clean the still.

Clean the still thermostat.

Check the still thermostat is operating and set at the required temperature.

Check the level control in the still is operating and set at the correct level.

MONTHLY

If a carbon adsorber is in place, check the carbon is dry (if carbon is damp or wet – find source and repair)

If a carbon adsorber is in place, check for blockages or any channelling within the bed.

Check the dry cleaning machine is secured to the floor.

Clean the water separator, including a check of the vent for any blockages.

Check machine heating and condensing coils for lint build-up.

Clean condenser cooling fins.

WHEN INDICATED

Change filter cartridges when the pressure reaches the maximum specified.

If a condenser is in place, clean the condenser lint filter at the frequency specified by the manufacturer.

If a carbon adsorber is in place, replace the carbon once it is beyond regeneration (usually once a year).

EVERY SIX MONTHS

Carry out a detailed machine maintenance (see reference ETBPP 1997 for a list of six-monthly maintenance tasks).

Service the condenser cooling system (water or refrigerant).

FURTHER READING AND REFERENCES

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