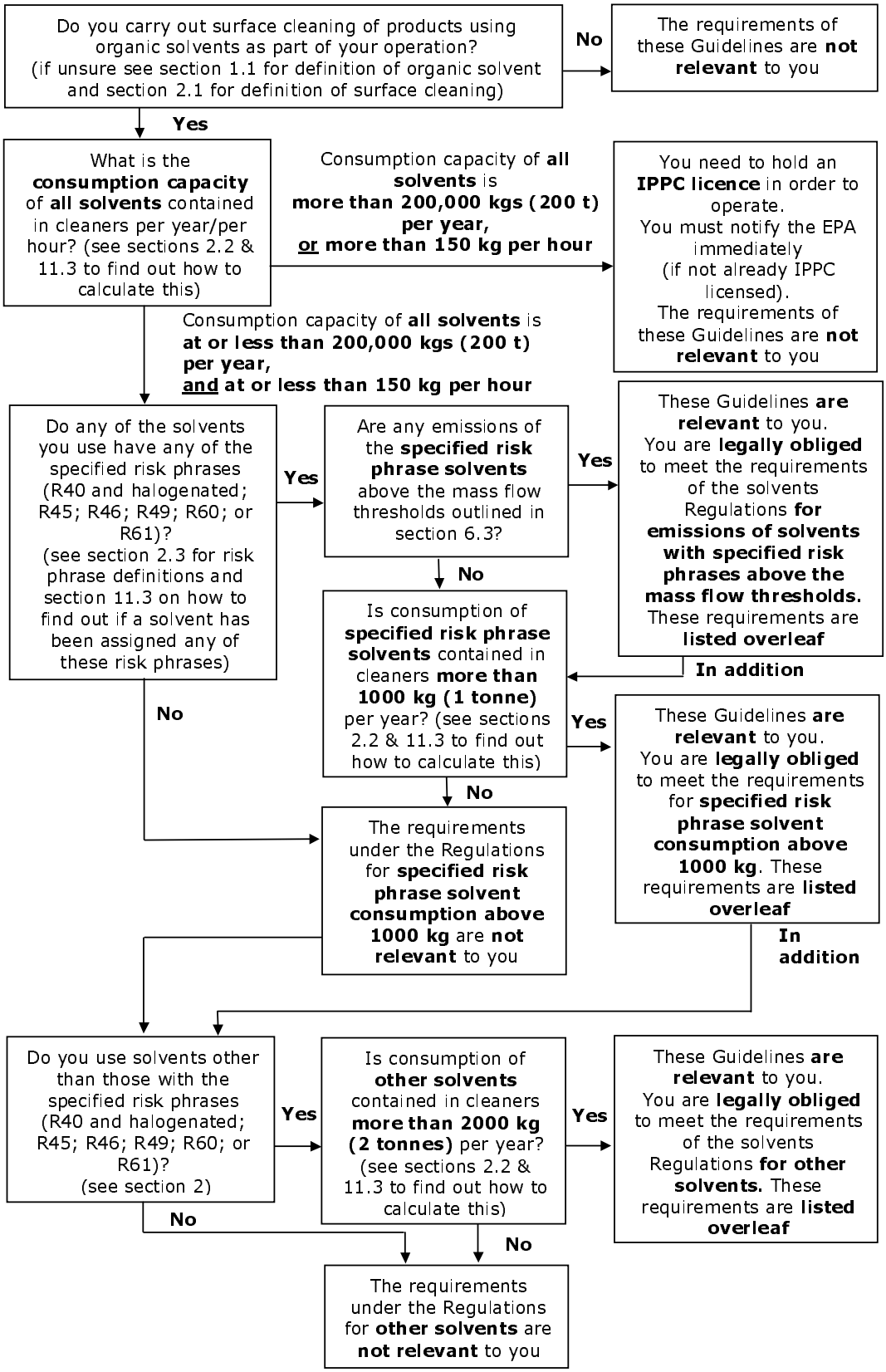
Best Practice Guidelines for Surface Cleaning Using Solvents

Overall Summary of the Requirements

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



Overall Summary of the Requirements (continued)

Requirements of the solvents Regulations for surface cleaning using solvents with the specified risk phrases with <u>either</u> a consumption of more than 1000 kg (1 tonne) per year of such solvents <u>or</u> emissions of such solvents above certain mass flow thresholds

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

Determine if you are a new or existing installation (see section 3)

Replace certain specified risk phrase solvents as far as possible within the shortest possible time (see section 6.1)

Comply with emission limit values for specified risk phrase solvents (see section 6.3 or 6.4)
- from date of first operating a new or substantially changed installation
- by 31 October 2007 for an existing installation

Register with your Local Authority: (see section 5)
- before operating a new or substantially changed installation
- no later than 31 October 2007 for an existing installation

Demonstrate compliance with the ELVs to your Local Authority by drawing up a solvent management plan including measurement of emissions (see sections 8 and 11); getting an Accredited Inspection Contractor (AIC) to inspect your operation (see section 5); and meet the mandatory requirements of section 13 as appropriate:
- before commencing operation and annually thereafter for a new or substantially changed installation
- by 31 October 2007 and annually thereafter for an existing installation

Obtain a certificate of compliance from your Local Authority (see section 5)
- before commencing operation of a new or substantially changed installation and annually thereafter
- no later than 31 October 2007 for an existing installation and annually thereafter

N.B.: Demonstration of compliance and certification must be repeated/initiated where a substantial change is made to either an existing or new installation.

Requirements of the solvents Regulations for surface cleaning using other solvents with a consumption of more than 2000 kg (2 tonnes) per year

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

Determine if you are a new or existing installation (see section 3)

Comply with emission limit values for other solvents (see section 7)
OR, comply with a 30% solvent content limit (see section 9)
OR, comply with a reduction scheme (see section 10)
- from date of first operating a new or substantially changed installation
- by 31 October 2007 for an existing installation

Register with your Local Authority: (see section 5)
- before commencing operation for a new or substantially changed installation
- no later than 31 October 2007 for an existing installation

Demonstrate compliance with the ELVs **OR** with the 30% solvent content limit **OR** with a reduction scheme to your Local Authority by drawing up a solvent management plan (including measurement of emissions if meeting ELVs) (see sections 8 and 11); getting an Accredited Inspection Contractor (AIC) to inspect your operation; and meet the mandatory requirements of section 13 as appropriate:
- before commencing operation and annually thereafter for a new or substantially changed installation
- by 31 October 2007 and annually thereafter for an existing installation

Obtain a certificate of compliance from your Local Authority (see section 5)
- before commencing operation of a new or substantially changed installation and annually thereafter
- no later than 31 October 2007 for an existing installation and annually thereafter

N.B.: Demonstration of compliance and certification must be repeated/initiated where a substantial change is made to either an existing or new installation.

Best Practice Guidelines for Surface Cleaning Using Solvents
CONTENTS

SECTION 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 use of organic solvents[1]. The Directive has been brought into effect in Ireland through Regulations published in November 2002[2].

The Directive was drawn up because solvent emissions can have harmful effects on human health and the environment. Surface cleaning using solvents is just one of the many types of activities to be affected by the legislation (activity numbers 4 and 5 in Annex IIA).

1.1 What are solvents and VOCs?

In terms of surface cleaning, solvents are organic compounds that are used to remove contaminants from the surfaces of products. This legislation is specifically concerned with volatile organic compounds (VOCs), i.e. those organic compounds that have a tendency to evaporate under ambient conditions (see table below for level of volatility that makes an organic compound a VOC). Typical volatile organic compounds used as surface cleaning solvents usually depend on the type of cleaning operation, but can include materials like methylene chloride, xylene, Stoddard solvent, and other hydrocarbon mixtures, among others.

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 surface cleaning using solvents, and:

- the amount of solvent with any of the risk phrases R40 and halogenated; R45; R46; R49; R60; or R61 (see section 2.3 for risk phrase definitions) contained in cleaners consumed in a year is more than 1,000 kg (1 tonne), or
- the amount of other solvent contained in cleaners consumed in a year is more than 2,000 kg (2 tonnes)

you are legally obliged to meet the relevant requirements of the solvents Regulations which are outlined in these Guidelines.

However, if you have a consumption capacity of **more than 200,000 kgs (200 tonnes) of solvent per year,** or **more than 150 kg (0.15 tonnes) solvent per hour**, you need to hold an IPPC licence in order to operate. If this is the case, and you are not already IPPC licensed, you must notify the EPA immediately. The requirements of these Guidelines are not relevant to you.

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[1] 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.

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

SECTION 2: SECTOR COVERED BY THE GUIDELINES

2.1 Surface Cleaning using Solvents

The activity covered by these Guidelines is surface cleaning above specified thresholds of solvent consumption.

Surface cleaning involves the removal of various contaminants from the surfaces of products. Surface cleaning takes place in operations as diverse as small metal working enterprises to large electronics firms. Solvent based cleaning processes in use are:

- vapour phase cleaning or degreasing where solvent vapours condense on the surfaces of the product
- liquid phase cleaning where parts are soaked/immersed in solvent
- manual cleaning using wipes, rags, brushes, etc. with liquid or aerosol solvents.

The degree of control of solvent emissions from the processes varies. Some equipment is completely enclosed, whereas others are open. Equipment can be batch operated or conveyorised.

The solvents that are used usually depend on the type of cleaning process, the nature of the contaminant being removed, and the products involved:

- vapour phase cleaning or degreasing: solvents used typically include n-propyl bromide, methylene chloride, perchloroethylene, and trichloroethylene.
- liquid phase or cold cleaning: solvents used typically include mineral spirits, hydrocarbons such as Stoddard solvent, and alcohols such as IPA and ethanol.
- manual cleaning: solvents used typically include alcohols such as IPA and ethanol and various other hydrocarbons.

Organic contaminants are mainly being removed through solvent cleaning, such as oils, grease, waxes, carbon deposits, etc. The surfaces being cleaned include metal, plastic, and composite surfaces such as those on printed circuit boards.

The cleaning of equipment or premises is not covered by the Regulations. Dry cleaning is not included under the definition of surface cleaning and is covered by separate guidelines.

The definition of surface cleaning under the Directive is as follows:

> ***Surface Cleaning*** *(Directive definition):*
>
> any activity except dry cleaning using organic solvents to remove contamination from the surface of material including degreasing. A cleaning activity consisting of more than one step before or after any other activity shall be considered as one surface cleaning activity. This activity does not refer to the cleaning of the equipment but to the cleaning of the surface of products.

See Section 12 for a list of VOC emissions to air, water, and waste from surface cleaning, and the sources of such emissions.

2.2 Solvent Consumption

The requirements of these Guidelines only apply to surface cleaning activities above specified levels of solvent consumption, viz:

- consumption of more than 1,000 kg (1 tonne) per year for solvents with any of the risk phrases R40 and halogenated; R45; R46; R49; R60; or R61 (see below).
- consumption of more than 2,000 kg (2 tonnes) per year for other solvents.
- if solvent consumption capacity is **more than 200,000 kgs (200 tonnes) of solvent per year,** or **more than 150 kg (0.15 tonnes) solvent per hour**, you need to hold an IPPC licence in order to operate. If this is the case, and you are not already IPPC licensed, you must notify the EPA immediately. These Guidelines are not relevant to you.

To find out how to calculate your solvent consumption go to section 11.3.

> ***Consumption*** *(Directive definition):*
>
> 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;
>
> ***Reuse*** *(Directive definition):*
>
> 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.

2.3 Solvents with Specific Risk Phrases

In the case of solvents with specific risk phrases (a risk phrase is a phrase that describes the hazards of a substance), the risk phrases have the following definitions:

Risk Phrase
R45 (may cause cancer)
R46 (may cause heritable genetic damage)
R49 (may cause cancer by inhalation)
R60 (may impair fertility)
R61 (may cause harm to the unborn child)
R40 (limited evidence of a carcinogenic effect)[3]

There are certain solvents used in surface cleaning which have been assigned one or more of the above risk phrases, including but not limited to methylene chloride and perchloroethylene. In the specific case of R40, the solvent must also be halogenated, i.e. contain a halogen such as chlorine (e.g. methylene chloride), fluorine, bromine, etc.

> ***Halogenated Organic Solvent*** *(Directive definition):*
>
> Halogenated organic solvent shall mean an organic solvent which contains at least one atom of bromine, chlorine, fluorine or iodine per molecule.

See section 11.3 for information on how to determine if a solvent that you use has been assigned any of the specified risk phrases.

2.4 Other Activities Under the Legislation

It may be the case that you carry out other activities which come under this legislation apart from surface cleaning using solvents (for example, metal coating, plastic coating, car refinishing, adhesive application, etc.).

If you exceed any of the relevant thresholds for such other activities in addition to exceeding the thresholds for surface cleaning, you will have to meet the requirements for both activities.

It should be noted that where you have more than one surface cleaning process or steps in your plant, it still only counts overall as one activity.

[3] Only R40 risk phrase solvents that are also halogenated are to be included in respect of solvents with specified risk phrases.

SECTION 3: NEW OR EXISTING INSTALLATIONS

There are different requirements under the legislation, depending on whether your installation is **new** or **existing**.

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.

In addition to this, if you are an existing installation and you make what is called a **substantial change** to your installation, the part of the installation which undergoes the change must either:

- be treated as a new installation, or
- be treated as an existing installation, provided that the total emissions of the whole installation do not exceed those that would have resulted had the substantially changed part been treated as a new installation.

A substantial change for installations covered by these guidelines depends on the solvent consumption see (Appendix 1 for definition of "consumption") and whether solvents with specified risk phrases or other solvents are in use:

	Solvent Consumption	**substantial change**
Solvents with specified risk phrases (R40 and halogenated; R45; R46; R49; R60; or R61)	1,000 – 5,000 kg	increase of >25% in emissions of VOCs
	> 5,000 kg	increase of > 10% in emissions of VOCs
Other solvents	2,000 – 10,000 kg	increase of > 25% in emissions of VOCs
	> 10,000 kg	increase of > 10% in emissions of VOCs

Also the local authority can decide a change is a substantial change if it considers it may have significant negative effects on human health or the environment.

SECTION 4: SUMMARY OF LEGAL REQUIREMENTS

This section of the Guidelines gives an overview of the requirements of the legislation for surface cleaning activities with:

- consumption of more than 1,000 kg (1 tonne) per year for solvents with any of the risk phrases R40 and halogenated; R45; R46; R49; R60; or R61.
- consumption of more than 2,000 kg (2 tonnes) per year for other solvents.

(see section 2 for more information on such activities).

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

Legal Requirements under the Directive and its implementing Irish Regulations

If you carry out surface cleaning using specified risk phrase solvents with ***either*** *a consumption of more than 1000 kg (1 tonne) per year,* ***or*** *emissions of such solvents above certain mass flow thresholds you are legally required to:*

Determine if you are a new or existing installation (see section 3)

Replace certain specified risk phrase solvents as far as possible within the shortest possible time (see section 6.1)

Comply with emission limit values for specified risk phrase solvents (see section 6.3 or 6.4)
- from date of first operating a new or substantially changed installation
- by 31 October 2007 for an existing installation

Register with your Local Authority: (see section 5)
- before operating a new or substantially changed installation
- no later than 31 October 2007 for an existing installation

Demonstrate compliance with the ELVs to your Local Authority by drawing up a solvent management plan including measurement of emissions (see sections 8 and 11); getting an Accredited Inspection Contractor (AIC) to inspect your operation (see section 5); and meet the mandatory requirements of section 13 as appropriate:
- before commencing operation and annually thereafter for a new or substantially changed installation
- by 31 October 2007 and annually thereafter for an existing installation

Obtain a certificate of compliance from your Local Authority (see section 5)
- before commencing operation of a new or substantially changed installation and annually thereafter
- no later than 31 October 2007 for an existing installation and annually thereafter

N.B.: Demonstration of compliance and certification must be repeated/initiated where a substantial change is made to either an existing or new installation.

Legal Requirements under the Directive and its implementing Irish Regulations

If you carry out surface cleaning using other solvents with a solvent consumption of more than 2000 kg (2 tonnes) per year, you are legally required to:

Determine if you are a new or existing installation (see section 3)

Comply with emission limit values for other solvents (see section 7)
OR, comply with a 30% solvent content limit (see section 9)
OR, comply with a reduction scheme (see section 10)
- from date of first operating a new or substantially changed installation
- by 31 October 2007 for an existing installation

Register with your Local Authority: (see section 5)
- before commencing operation for a new or substantially changed installation
- no later than 31 October 2007 for an existing installation

Demonstrate compliance with the ELVs **OR** with the 30% solvent content limit **OR** with a reduction scheme to your Local Authority by drawing up a solvent management plan (including measurement of emissions if meeting ELVs); getting an Accredited Inspection Contractor (AIC) to inspect your operation; and meet the mandatory requirements of section 13 as appropriate:
- before commencing operation and annually thereafter for a new or substantially changed installation
- by 31 October 2007 and annually thereafter for an existing installation

Obtain a certificate of compliance from your Local Authority (see section 5)
- before commencing operation of a new or substantially changed installation and annually thereafter
- no later than 31 October 2007 for an existing installation and annually thereafter

N.B.: Demonstration of compliance and certification must be repeated/initiated where a substantial change is made to either an existing or new installation.

If you carry out surface cleaning and if solvent consumption capacity is ***more than 200,000 kgs of solvent per year,*** *or* ***more than 150 kg solvent per hour,*** *you are legally required to:*

Hold an IPPC licence in order to operate. If this is the case, and you are not already IPPC licensed, you must notify the EPA immediately. The requirements of these Guidelines are not relevant to you.

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), and if relevant the Safety, Health and Welfare at Work (Carcinogens) Regulations 2001 (Statutory Instrument No. 78 of 2001).

SECTION 5: REGISTRATION WITH YOUR LOCAL AUTHORITY & CERTIFICATES OF COMPLIANCE

As an installation performing surface cleaning above the solvent consumption thresholds, you are legally required to register with your Local Authority.

5.1 Dates for registration and obtaining a certificate of compliance

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

EXISTING INSTALLATIONS:

- **complying with the requirements of a REDUCTION SCHEME must be registered and must obtain a certificate of compliance no later than 31st October 2005. *You will not be allowed to continue operation after this date without this certificate.***
- **complying with EMISSION LIMIT VALUES must be registered and must obtain a certificate of compliance no later than 31st October 2007. *You will not be allowed to continue operation after this date without this certificate.***

5.2 How do I register?

Registration involves submitting the following to your Local Authority:

- the registration details, as set out in Schedule 4 of the 2002 Regulations[4] and reproduced in Appendix 2 of these Guidelines.
- a report by an Accredited Inspection Contractor (AIC) on compliance or otherwise with the Regulations. This is called an AIC Report (see below).
- a fee of €50.

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

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 Accredited Inspection Contractor (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 Values (ELVs) (see section 7), the solvent content limit requirements (see section 9), or a Reduction Scheme (see section 10). This is done using the solvent management plan (see section 11).

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

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

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

The AIC report will state why/if compliance is not achieved (major non-compliances). The AIC report will also in any event list any minor non-compliances or any observations.

5.4 How often must an AIC Report be submitted?

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

A report by an Accredited Inspection Contractor must also be submitted if a substantial change is proposed (see section 3 for a definition of substantial change). A new certificate of compliance must be obtained before operating the substantially changed facility.

5.5 What must I do before getting an Accredited Inspection Contractor?

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 3.

For information on how to prepare the solvent management plan see section 10.

It is a good idea to carry out a solvent management plan now to see how you compare with the ELVs, the solvent content limit requirements, or reduction scheme requirements and if you will need to reduce your emissions before the dates shown in section 4.

Section 13 outlines other mandatory requirements which you must implement covering containment of solvent, handling of solvent waste, records of training, and records of any maintenance.

5.6 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 items listed in Appendix 3.
- carry out spot checks on the back up documentation for these figures (e.g. invoices, waste certificates of disposal, etc.).
- tour areas of the premises relevant to the surface cleaning operation – the surface cleaning equipment/area, fresh solvent storage areas, waste solvent storage areas, solvent recycling units (where used), location of equipment stack outlets (where relevant), etc.
- may interview employees – e.g. surface cleaning equipment operators, purchasing personnel, etc.
- review any other back-up documentation – e.g. surface cleaning equipment manuals, MSDSs for cleaning materials, etc.

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. NB: the National Protocol that the AIC inspector will use and which contains the AIC report template is available at www.epa.ie .

5.7 Where can I find an Accredited Inspection Contractor (AIC)?

The Irish National Accreditation Board (INAB) will have a list of such Accredited Inspection Contractors (AICs) (contact Irish National Accreditation Board, Wilton Park House, Wilton Place, Dublin 2 Phone 01 607 3003 http://www.inab.ie).

5.8 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 after the dates specified in the table in section 5.1 without such a certificate. Your Local Authority must

issue you with a certificate of compliance within 14 days of receiving the compliant AIC report from you, 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.

If the Local Authority considers that the Regulations are not being complied with, it will notify you of its refusal to issue a certificate. Enforcement of the Regulations is a matter for the Local Authority.

5.9 How long is the certificate of compliance valid?

The certificate is valid for ***one year only***. You must submit an AIC Report each year to obtain a new certificate. The cost of the inspection must be covered by you.

SECTION 6: REQUIREMENTS FOR SOLVENTS WITH SPECIFIC RISK PHRASES

If you carry out surface cleaning using specified risk phrase solvents with either a consumption of more than 1000 kg (1 tonne) per year of such solvents or emissions of such solvents above certain mass flow thresholds (see section 6.3 for these thresholds), you are legally required to:

- Replace as far as possible solvents with risk phrases R45, R46, R49, R60, or R61.
- meet emission limit values (ELVs) for emissions of solvents with risk phrases R45, R46, R49, R60, R61, or halogenated solvents with risk phrase R40. Section 6.3 specifies the mass flow thresholds for emissions of specified risk phrase solvents and the associated ELVs, while section 6.4 specifies the ELVs for consumption of more than 1000 kg (1 tonne) per year of specified risk phrase solvents. Where both sections 6.3 and section 6.4 apply, the more strict waste gas ELV must be taken.

NB: It should be noted that the 30% solvent content limit or a reduction scheme *cannot* be used in place of the emission limit values set out in this section if any of the specified risk phrase solvents are in use and are either emitted at or above the mass flows stated in section 6.3, or consumption of such solvents is more than 1000 kg (1 tonne) per year.

This section of the Guidelines outlines requirements for meeting ELVs where using solvents with specified risk phrases. See section 8 for requirements if you are using other solvents.

6.1 Requirement to replace solvents with specific risk phrases

If you do use solvent with one or more of the risk phrases R45, R46, R49, R60, or R61 you are legally obliged to replace as far as possible the materials that contain such solvent with less harmful materials within the shortest possible time. *Note:* there is no legal requirement for halogenated solvents with risk phrase R40 to be replaced but such solvents are subject to reduced emission limit values.

You can propose measures to replace such materials – suppliers, trade organisations, or consultants may be useful sources of information in this respect. Where it is not possible to replace these materials, satisfactory evidence to support this must be documented and provided to the inspector. This information will be included in the AIC Report.

6.2 Emission Limit Values – what are they?

An emission limit value (ELV) sets the maximum amount of VOCs that you are allowed emit from your installation.

There are different types of ELVs. The two that are relevant to surface cleaning are:

- An emission limit value for waste gases: this sets the maximum amount of VOCs that may be emitted per cubic metre of air released from stacks (for example a stack taking air from a cleaning line).

- A fugitive emission value: this sets the maximum percentage of solvent *input* that may be emitted from fugitive sources, i.e. not through main stacks, but from doors, windows, etc. "Solvent input" is different to solvent consumption in that any solvent that is recycled is counted every time it is used. As an example, suppose a company carrying out surface cleaning buys in 5000 kg of cleaning solvent per annum, but half of this is recovered and used again for cleaning operations. This results in the total solvent input being 7500 kg.

6.3 ELVs for Discharges of Specified Risk Phrase Solvents above Certain Emission Thresholds

In the particular case of solvents with risk phrases R45, R46, R49, R60, or R61, where the mass flow of emissions of the sum of such compounds exceeds the threshold set out below, a more stringent ELV must be met. This is as follows:

Risk Phrase	Threshold mass flow of the sum of such compounds	emission limit value (mass sum of the individual compounds)[5]
R45, R46, R49, R60, or R61	≥ 10 g/h	2 mg/Nm^3
R40 (halogenated only)	≥ 100 g/h	20 mg/Nm^3

If you do use solvents with one or more of the risk phrases R45, R46, R49, R60, or R61, you need to determine if any emissions from your facility (for example a stack taking air from a cleaning line) are above the specified mass flow of 10 grammes per hour or more. If this threshold is exceeded, you need to determine if the concentration of the solvent(s) in the waste gases meets the specified emission limit value of 2 mg/Nm^3. You must also meet the fugitive emission values outlined in section 6.4.

If emissions of solvents with these risk phrases are below the mass flow, the above emission limit values are not applicable to you. However, the ELVs in section 6.4 will apply where consumption of specified risk phrase solvents is more than 1000 kg (1 tonne) per year. In addition, section 6.1 also remains relevant.

For halogenated solvents with risk phrase R40 the ELV specified above is the same as the ELV set in section 6.4 for consumption of more than 1000 kg (1 tonne) per year of specified risk phrase solvents.

To determine if these emission limit values are applicable to you, (and if so, is it being met) you will need to carry out monitoring of your emissions. This will involve getting a competent/accredited, consulting company to come to your installation and measure the concentration of the relevant solvents with the specified risk phrases in the waste gases, as well as the flowrate at which gases are being released (see IS EN 13526:2002). These values are then combined to determine mass flow.

Where solvent consumption of such specified risk phrase solvents is low you may be able to infer by mass balance that it is unlikely that the mass flow of such compounds in waste gas emissions would exceed the threshold (based on max. solvent usage rates per hour and expected waste gas flowrates). In this case measurement may be unnecessary, but such assumptions should be fully documented and justified by a competent person.

6.4 ELVs for Surface Cleaning using Specified Risk Phrase Solvents with Consumption of > 1000 kg/year

For surface cleaning using solvents with risk phrases R45, R46, R49, R60, R61 or R40 (halogenated only), with a consumption of more than 1000 kg (1 tonne) per year, emission limit values are as follows (apart from discharges exceeding the threshold mass flow specified in section 6.3, when the ELV in waste gases in section 6.3 then applies):

Solvent Consumption	*Emission Limit Value in Waste Gases*[6]	*Fugitive Emission Values*
Solvent consumption 1000 – 5000 kg/year (1 – 5 tonnes/year)	20 mg/Nm^3	15 % of solvent input
Solvent consumption > 5000 kg/year (> 5 tonnes/year)	20 mg/Nm^3	10 % of solvent input

There is a different fugitive emission value depending on the level of solvent consumption.

[5] "mg" means milligrammes of the actual solvent or VOC compound(s).
"Nm^3" means *normal* cubic metre of air, i.e. the quantity of air that occupies a volume of 1 cubic metre at standard conditions. Standard conditions are a temperature of 273.15 K (0 °C) and a pressure of 101.3 kPa (1 atmosphere).

SECTION 7: EMISSION LIMIT VALUES (ELVS) FOR OTHER SOLVENTS

If you carry out surface cleaning using other solvents[6] with a solvent consumption of more than 2000 kg (2 tonnes) per year, you are legally required to either:

- meet emission limit values (ELVs),

  OR

- comply with a 30% solvent content limit as an exemption from meeting the ELVs,

  OR

- comply with a reduction scheme.

This section of the Guidelines outlines the requirements for meeting ELVs if you are using other solvents. See section 9 for the requirements of complying with a 30% solvent content limit as an exemption from meeting ELVs. See section 10 for the requirements where using a reduction scheme.

Note: meeting the 30% solvent content limit or meeting the reduction scheme *cannot* be used in place of ELVs for solvents with specified risk phrases (R45, R46, R49, R60, R61, or halogenated solvents with risk phrase R40). See section 6 for the requirements where using solvents with specified risk phrases (R45, R46, R49, R60, R61, or halogenated solvents with risk phrase R40).

7.1 Emission Limit Values – what are they?

An emission limit value (ELV) sets the maximum amount of VOCs that you are allowed emit from your installation.

There are different types of ELVs. The two that are relevant to surface cleaning are:

- An emission limit value for waste gases: this sets the maximum amount of VOCs that may be emitted per cubic metre of air released from stacks (for example a stack taking air from a cleaning line).

- A fugitive emission value: this sets the maximum percentage of solvent input that may be emitted from fugitive sources, i.e. not through main stacks, but from doors, windows, etc. N.B. "Solvent input" is different to solvent consumption in that any solvent that is recycled is counted every time it is used. As an example, suppose a company carrying out surface cleaning buys in 5000 kg of cleaning solvent per annum, but half of this is recovered and used again for cleaning operations. This results in the total solvent input being 7500 kg.

7.2 Emission Limit Values for Surface Cleaning

The emission limit values for surface cleaning using other solvents with a consumption of more than 2,000 (2 tonnes) kg per year are as follows:

Solvent Consumption	*Emission Limit Value in Waste Gases*[7]	*Fugitive Emission Value*[8]
Solvent consumption 2,000 – 10,000 kg/year	75 mg C/Nm^3	20 % of solvent input
Solvent consumption > 10,000 kg/year	75 mg C/Nm^3	15 % of solvent input

[6] i.e. solvents other than those with risk phrases R45, R46, R49, R60, or R61 or halogenated solvents with risk phrase R40.

[7] "mg C" means milligrammes of solvents or VOCs expressed in terms of their carbon content only.

"Nm^3" means *normal* cubic metre of air, i.e. the quantity of air that occupies a volume of 1 cubic metre at standard conditions. Standard conditions are a temperature of 273.15 K (0 °C) and a pressure of 101.3 kPa (1 atmosphere).

[8] Solvent 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.

There is a different fugitive emission value depending on the level of solvent consumption.

There is an exemption for existing installations operating *existing* abatement equipment (apart from incineration) from meeting the above *waste gas* ELVs until 1 April 2013. Under this exemption, the following limits apply for waste gases until the dates specified:

Type of abatement	**Emission Limit Values for *existing* abatement equipment until 1 April 2013[9]:**
abatement equipment (other than incineration)	150 mg C/Nm^3
incineration abatement equipment	50 mg C/Nm^3

It should be noted that the fugitive emission limit values still apply from the relevant dates.

[9] This exemption is valid only provided the total emissions of the whole installation do not exceed those that would have resulted had both the ELV and the fugitive emission value for new facilities been met.

8 DETERMINING COMPLIANCE WITH ELVS

8.1 How do I find out if I am meeting the Emission Limit Values?

If you carry out surface cleaning using solvents above the consumption thresholds of section 6 or 7, you are required to meet the ELVs in these sections from the date specified in section 4.

You need to find out if you are meeting the ELVs and you also must be able to prove to your Local Authority via the AIC Report that you are in compliance.

To do this for the emission limit value in waste gases will require monitoring of your emissions (see below). Whereas for the fugitive emission limit value one of the ways this can be done is by making a solvent management plan (see section 9).

8.2 Compliance monitoring for Emission Limit Values in Waste Gases

Monitoring of your emissions in waste gases will involve getting a competent/accredited, consulting company to come to your installation and measure the concentration of VOCs in the waste gases, as well as the flowrate of gases being released.

It is important that:

- The measurements take place on an operational day when surface cleaning is taking place and which is likely to encompass the maximum level of VOC emissions envisaged.
- All stacks coming out of your installation that contain waste gases from surface cleaning are monitored.
- the company makes the measurements in accordance with the monitoring requirements under the legislation (see below). Use a reputable company that is appropriately accredited by the Irish National Accreditation Board (INAB).
- Flowrates of the waste gases are measured in addition to the VOC concentration levels.
- You record appropriate operational information on the day the monitoring takes place to scale up emissions in waste gases for the 12 month period, to be able to differentiate between emissions in waste gases and fugitive emissions, and to demonstrate it was a normal operation in terms of the cleaning processes that occurred.
- You keep a copy of the results as received from the monitoring company.
- the recommended method for total organic carbon (TOC) measurement is used: Continuous Flame Ionisation Detector Method. The Standard for the method, IS EN 13526:2002 "Stationary Source Emissions - Determination of the Mass Concentration of Total Gaseous Organic Carbon in Flue gases from Solvent Using Processes - CFID Method", should be used.
- Specific measuring technology may be required when quantifying specified risk phrase solvent emissions.

Monitoring Requirements under the Legislation

Periodic measurements comprising of at least three measurements during each measurement exercise must be carried out, unless abatement is not needed to meet ELVs (you will need at least one set of measurements to prove this). Sampling should be carried out over a time period which will be representative of the operation.

Any additional air added to the waste gas for cooling or dilution purposes must not be considered when determining the concentration of VOCs in the waste gas.
Note, any waste gas stream which emits more than an average of 10 kg/h of total organic carbon is required to be monitored continuously.

Determining Compliance

In the case of periodic measurements, the emission limit values shall be considered to

comply if, in one monitoring exercise:

a) the average of all the readings does not exceed the emission limit values, and
b) none of the hourly averages exceeds the emission limit value by more than a factor of 1.5.

In the case of continuous measurements the emission limit values shall be considered to comply if:

a) none of the averages over 24 hours of normal operation exceeds the emission limit values, and
b) none of the hourly averages exceeds the emission limit values by more than a factor of 1.5.

When must I first carry out monitoring and how often?

Existing facilities must carry out monitoring demonstrating compliance before 31st October 2007.

New or substantially changed facilities must carry out monitoring once normal operations commence.

Where periodic monitoring is required, this must be done on an annual basis, and also if a substantial change has taken place.

Where monitoring has shown compliance with the emission limit values and there is no abatement equipment in place, subsequent monitoring is not required as long as operating conditions remain the same.

These monitoring results will be used by the Accredited Inspection Contractor in the compilation of the AIC Report.

Are there any cases where monitoring is not required?

Yes. If you are using the exemption of complying with a 30% solvent content limit, or if you are using a reduction scheme, monitoring of waste gases is not required. However, you will need to monitor initially to ensure that emissions are below 10 kg/h for normal solvents or use a desk top study to determine this. Specified risk phrase solvents will always require monitoring to be carried out if above the mass flows specified in section 6.4.

Also, if end of pipe abatement equipment is not needed to comply with the legislation, monitoring of waste gases is not required apart from an exercise to prove compliance subject to no changes being made on-site which would affect emissions.

8.3 What do I do if I am above the Emission Limit Values?

By comparing the emission limit values with current actual solvent emissions will show if reductions in emissions are needed, and by when.

If reductions are required see section 14 for the various management techniques and technologies that can be used to reduce emissions. The AIC report which will indicate minor non-compliances or observations may offer opportunities to reduce emissions.

If you are operating within the ELVs you may proceed to have an AIC inspection/report prepared by the due date.

SECTION 9: EXEMPTION FROM ELVS FOR OTHER SOLVENTS

If you carry out surface cleaning using other solvents[10] with a solvent consumption of more than 2,000 kg (2 tonnes) per year, you are legally required to either:

- meet emission limit values (ELVs),

  OR

- comply with a 30% solvent content limit as an exemption from meeting the ELVs,

  OR

- comply with a reduction scheme.

This section of the Guidelines outlines the requirements for meeting the 30% solvent content limit as an exemption from meeting the ELVs. See section 7 for the emission limit values for other solvents. See section 10 for the requirements where using a reduction scheme.

Note: meeting the 30% solvent content limit or meeting the reduction scheme *cannot* be used in place of ELVs for solvents with specified risk phrases (R45, R46, R49, R60, R61, or halogenated solvents with risk phrase R40). See section 6 for the requirements where using solvents with specified risk phrases (R45, R46, R49, R60, R61, or halogenated solvents with risk phrase R40).

9.1 30% solvent content limit – what is it?

For surface cleaning using other solvents, there is an exemption from meeting the emission limit values (ELVs) of section 7 if the operator can demonstrate that the average organic solvent content of all cleaning material used does not exceed 30% by weight.

Note: ELVs will still have to be met for solvents with specified risk phrases (R45, R46, R49, R60, R61, or halogenated solvents with risk phrase R40) where their consumption exceeds 1,000 kg (1 tonne) per year. The 30% solvent content limit ***cannot*** apply in this case.

9.2 30% solvent content limit – how it operates

In order to use the 30% solvent content limit exemption, you will have to be able to demonstrate to the local authority that all cleaning material used does not exceed 30% solvent content by weight. This means that you will have to have sufficient records in place for the Accredited Inspection Contractor to be satisfied that this is the case and verify this in the AIC report. Sample records to be used in order to check and demonstrate compliance with the 30% solvent content limit are shown in Appendix 4. In addition to these records, the AIC may look for information such as:

- back-up documentation to verify the stated solvent content (e.g. MSDSs, supplier correspondence, analysis records, etc.)
- back-up documentation (e.g. purchase invoices, production material issues) or a site inspection to ensure all surface cleaners in use are included in the records.

It is possible that a local authority could still require you to keep a solvent management plan in order to keep a track on solvent usage and disposal/emission routes. This condition, if required, would form part of the certificate of compliance.

If you are an existing facility you will not have to meet this 30% solvent content limit until 31st October 2007. However in the meantime it is recommended that you start keeping records, particularly to identify any solvents that are above this limit and will require replacement.

[10] i.e. solvents other than those with risk phrases R45, R46, R49, R60, or R61 or halogenated solvents with risk phrase R40.

SECTION 10: REDUCTION SCHEME

If you carry out surface cleaning using other solvents[11] with a solvent consumption of more than 2,000 kg (2 tonnes) per year, you are legally required to either:

- meet emission limit values (ELVs),

  OR

- comply with a 30% solvent content limit as an exemption from meeting the ELVs,

  OR

- comply with a reduction scheme.

This section of the Guidelines outlines the requirements for using a reduction scheme. See section 7 for the emission limit values for other solvents. See section 9 for the requirements of complying with a 30% solvent content limit as an exemption from meeting ELVs.

Note: meeting the 30% solvent content limit or meeting the reduction scheme *cannot* be used in place of ELVs for solvents with specified risk phrases (R45, R46, R49, R60, R61, or halogenated solvents with risk phrase R40). See section 6 for the requirements where using solvents with specified risk phrases (R45, R46, R49, R60, R61, or halogenated solvents with risk phrase R40).

10.1 The Reduction Scheme – what is it?

The reduction scheme simply involves a target for reduced emissions and a plan setting out the measures that you will take to achieve this target. The reduction scheme is given as an option instead of meeting the emission limit values (ELVs).

You are allowed use any alternative reduction scheme to the one outlined in the Directive/Regulations which is for coating activities, if it is more suited to your installation, but an equivalent emission reduction must be achieved and demonstrated. The reduction scheme outlined in the Directive/Regulations is unlikely to be suitable to an installation carrying out surface cleaning using solvents. Hence an alternative scheme would have to be drawn up, if this compliance route is chosen.

You should seek the approval of the Local Authority for using an alternative reduction scheme.

[11] i.e. solvents other than those with risk phrases R45, R46, R49, R60, or R61 or halogenated solvents with risk phrase R40.

Section 11: SOLVENT MANAGEMENT PLAN

11.1 Solvent Management Plan - What is it?

The solvent management plan basically works out where all of the solvent you use eventually ends up. This is called a 'mass balance'. The reasons for making a solvent management plan are:

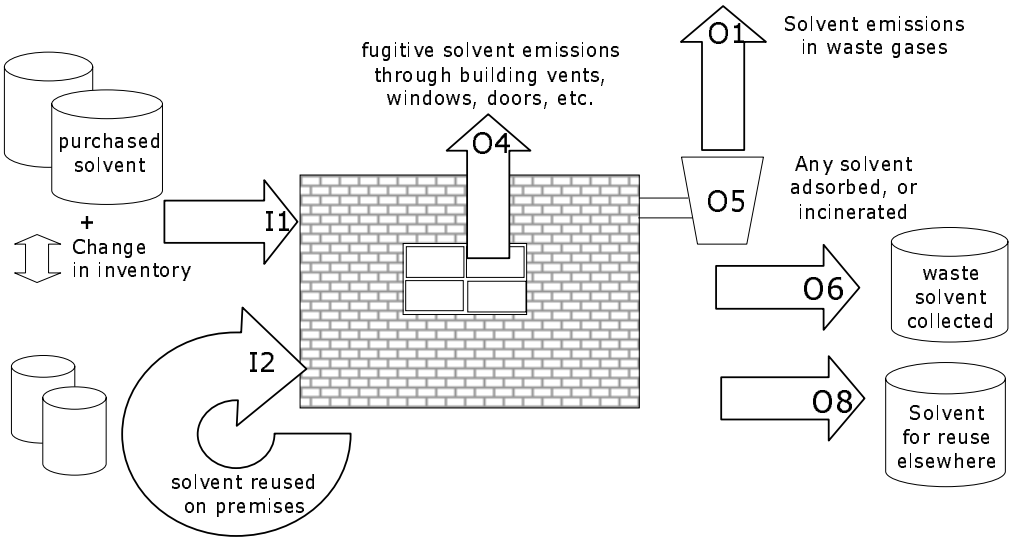
- to find out if you are complying with the fugitive emission value or with the reduction scheme
- to demonstrate to the Accredited Inspection Contractor and the Local Authority that you are in compliance with the fugitive emission value or reduction scheme.
- to help you identify future emission reduction 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.

Elements of the solvent management plan are also used to determine if an installation comes under the scope of this guidance document – i.e. if the solvent consumption thresholds set out in section 2.2 are exceeded.

11.2 Solvent Management Plan Terms for Surface Cleaning using Solvents

The following drawing and subsequent table list the solvents Directive terms used in the mass balance for surface cleaning using solvents.



The meaning of each mass balance term is shown in the following table. Those that are relevant to surface cleaning are highlighted in ***bold italics***. Where to obtain information for each term is also outlined (more information on this is given in Appendix 3).

Mass Balance Terms		Relevance to surface cleaning	Where to get information
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 purchased and used in a year.	Purchase records or supplier. Also include stock level change: stocks at start of year minus stocks at end of year.
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)***	Will be relevant to many but not all installations. Includes solvent that is reused directly (e.g. solvent in a vapour degreaser) or solvent recovered (e.g. through filtration, distillation) and used again on the premises.	Estimate based on process solvent capacity and no. of batches processed.
Outputs of organic solvents (O):			
O1	***Emissions in waste gases***	Relevant. The amount of solvent emitted from stacks (e.g. outlet from cleaning equipment air extraction system) that isn't treated (if treatment present, e.g. carbon adsorber, incinerator).	Obtain via monitoring of the waste gases.
O2	***Organic solvents lost in water, if appropriate taking into account waste water treatment when calculating O5***	May be relevant, but not in all cases.	Any flow monitoring of waste water discharged. Analysis or estimates in relation to solvent content. Waste water treatment plant efficiencies. Don't have to calculate it separately as it will be included in overall fugitive figure.
O3	The quantity of organic solvents which remains as contamination or residue in products output from the process	Unlikely to be relevant, since drying is usually an integral part of all surface cleaning operations.	Not relevant
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. Solvent emissions from areas which are not covered by extraction systems, e.g. cleaning material handling & storage area, waste storage area (containers, rags), spills, waste water treatment, etc.	Obtain via the mass balance by difference.
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)***	Will be relevant to some, but not every facility. Can be carbon adsorption (air or from waste water), catalytic incineration, or thermal incineration. Can also include degradation in a waste water treatment plant	Estimate based on operating hours; average flowrates; measured or estimated concentration entering incinerator/adsorber; & manufacturer information.

Continued overleaf.

Mass Balance Terms		Relevance to vehicle coating and refinishing	Where to get information
O6	***Organic solvents contained in collected waste***	Relevant. Includes waste solvent itself (e.g. spent cleaning solution) plus materials contaminated with solvent (rags, wipes, empty containers, etc.).	Records on number and volume of drums sent off-site for disposal.
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.	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***	May not be relevant to every facility. Any waste solvent collected and sent away for recovery/recycling rather than disposal.	Records on number and volume of drums sent off-site for recovery & reuse elsewhere.
O9	Organic solvents released in other ways	Not relevant.	Not relevant.

11.3 Solvent Consumption – How to Calculate it

Follow these steps to calculate your solvent consumption for your installation and see if it is above the thresholds.

Step 1: What materials are in use?

Draw up a list of all the materials you use in your surface cleaning operation(s). Remember surface cleaning may be carried out in more than one location, or at more than one stage in the process. Do not include materials used for the cleaning of equipment – the Regulations only cover materials used for the surface cleaning of *products*.

Step 2: Which of these materials contain solvents?

Check Technical Data Sheets or Material Safety Data Sheets (MSDSs) to find out if there are any solvents present in these materials. If you do not have a complete set of MSDSs, contact your material suppliers for these. Typical solvents present in these products include methylene chloride, xylene, Stoddard solvent, other hydrocarbon mixtures, isopropyl alcohol, methanol, etc.. Note that some aqueous cleaners still contain a small amount of solvent. Where solvent is present, note the solvent percentage in the product. If the percentage is not provided, if a range is given, or you are unsure if solvent is present or not, ask your supplier who is obliged to provide this information to you.

Step 3: Which of these materials contain solvents with specified risk phrases?

Also note whether the solvent(s) contained in the cleaner have been assigned any of the specified risk phrases: R40 and halogenated; R45; R46; R49; R60; or R61. See section 2.3 for more information about risk phrases.

Information on what risk phrases are assigned to the solvents in use at your facility can be obtained from Material Safety Data Sheets (MSDSs) or Technical Data Sheets. Make sure they are European in origin (or at least mention risk phrases). It is also important that the MSDS is up to date as this legislation changes regularly. Such information can also be found on product containers, but is usually more limited. Your supplier is obliged to provide you with this data.

Alternatively if you know the solvents in use, a free, searchable database of risk phrase classifications for approx. 2,500 substances is available at www.the-ncec.com (Note this database is limited to the 2,500 substances - a solvent not being on it does not automatically mean it has no risk phrases).

The European Solvents Industry Group (ESIG) may also be able to provide assistance with the supply of, or access to the data required, see http://www.esig.org .

Step 4: How much of these materials is used?

For the materials you have identified containing solvent, you need to determine how much

of the product you use in a given year. This consists of purchases and the change in stock level over the period.

Purchase information may be available from your own purchase records, but if you have difficulty, your supplier should be able to provide you with this data. The most recent 12 month period should be used – it does not have to be a calendar year.

It is important to be ***consistent*** in the ***units*** that you use. For example, the use of solvent 'mass percentage' (e.g. kg/kg %) and 'kilogrammes' of material consumed. Another example, the use of 'grammes/litre' for solvent content and 'litres' for material consumption.

Step 5: Take Reuse of Solvent (if any) into Account

As defined under the legislation, solvent consumption is the total input of organic solvents into an installation minus any solvent that is recovered for reuse elsewhere. Reuse covers any technical or commercial purpose, including use as a fuel, but not waste disposal. Reuse on-site is implicitly taken into account through reduced solvent input.

Step 6: Calculate the amount of solvent consumed

The final step is to fill in the following equation for consumption, using the values calculated to give the total solvent consumed per year:

Consumption: C = I1 – O8

= (quantity of solvents purchased & used as input into the process) less (solvents recovered for reuse but not as input into the process)

If consumption is above the threshold of 1000 kg (1 tonne) of specified risk phrase solvents per year, the requirements of the Regulations in relation to surface cleaning using specified risk phrase solvents are applicable.

If consumption is above the threshold of 2000 kg (2 tonnes) of other solvents per year, the requirements of the Regulations in relation to surface cleaning using other solvents are applicable.

An IPPC licence must be obtained where consumption capacity of all solvents is **more than 200,000 kgs (200 tonnes) of solvent per year,** or **more than 150 kg (0.15 tonnes) solvent per hour.** Note that it is "consumption capacity" rather than actual consumption that must be determined in this case.

11.4 Keeping Records

In order to generate the solvent management plan, you will have to start keeping records on ongoing basis to help you gather the information you require.

Appendix 3 gives a summary list of the information you will have to gather and keep on record.

A set of records for a 12 month period must be compiled before you have your first AIC inspection. This does not have to be a calendar year. Have regard to the relevant dates by which certificates of compliance must be obtained in Section 4 in order to commence timely record keeping, taking into account the time required to have an AIC inspection performed, an AIC report compiled, and for the Local Authority to process your registration/issue a certificate of compliance.

Appendix 4 gives an example of the type of records that must be kept. These sheets can be filled in by hand or on computer on an ongoing basis.

11.5 Getting Information for the Solvent Management Plan Terms

Appendix 3 gives a summary list of the information you will have to gather and keep on record. A summary of sources of information for each of the mass balance terms is provided in the table in Section 11.2.

11.6 Solvent Management Plan - Demonstrating Compliance with the Fugitive Emission Value

This section is only applicable if you are using the emission limit value compliance route. Section 11.7 is the applicable section if you are using the exemption from the emission limit values by demonstrating compliance with the 30% solvent content limit, while section 11.8 is the applicable section if you are using a reduction scheme.

In order to demonstrate compliance with the fugitive emission value, one of the following calculations should be made for fugitive emissions:

F = I1 – O1 – O5 – O6 - O7 - O8

or

F = O2 + O3 + O4 + O9

or

An equivalent calculation

F = I1 – O1 – O5 – O6 - O7 - O8

Fugitive emissions equals (organic solvents purchased and used as input into the process) less (organic solvents and/or organic compounds lost due to chemical or physical reactions) less (organic solvents contained in collected waste) less (organic solvents, or organic solvents contained in preparations, which are sold or are intended to be sold as a commercially valuable product) less (organic solvents contained in preparations recovered for reuse but not as input into the process)

F = O2 + O3 + O4 + O9

Fugitive emissions equals (organic solvents lost in water, if appropriate taking into account waste water treatment) plus (organic solvents which remains as contamination or residue in products output from the process) plus (uncaptured emissions of organic solvents to air.) plus (organic solvents released in other ways)

The fugitive emission value is expressed as a proportion of the input, which can be calculated according to:

Input: I = I1 + I2

fugitive emissions as a proportion of the input = F / I

11.7 Solvent Management Plan - Demonstrating Compliance with the 30% Solvent Content Limit Exemption for Other Solvents

This section is only applicable if you are using the exemption from the emission limit values by demonstrating compliance with the 30% solvent content limit. NB: It should be noted that the 30% solvent content limit *cannot* be used in place of the emission limit values set for specified risk phrase solvents where such solvents are either emitted at or above the mass flows stated in section 6.3, or consumption of such solvents is more than 1000 kg (1 tonne) per year.

Section 11.6 is the applicable section if you are using the emission limit value route, while section 11.8 is the applicable section if you are using a reduction scheme.

Use solvent management plan records (see Appendix 4) and back-up documentation to demonstrate compliance with the 30% solvent content limit for all solvent cleaners in use.

11.8 Solvent Management Plan - Demonstrating Compliance with a Reduction Scheme

This section is only applicable if you are using a reduction scheme. NB: It should be noted that a reduction scheme *cannot* be used in place of the emission limit values set for specified risk phrase solvents where such solvents are either emitted at or above the mass flows stated in section 6.3, or consumption of such solvents is more than 1000 kg (1 tonne) per year.

Section 11.6 is the applicable section if you are using the emission limit value route, while section 11.7 is the applicable section if you are using the exemption from the emission limit values by demonstrating compliance with the 30% solvent content limit.

Use the solvent management plan to calculate actual emissions and demonstrate if actual emissions comply with the target emission under your particular reduction scheme.

Actual emissions

Actual emissions E = I1 – O5 – O6 – O7 – O8

Actual emissions (waste gases & fugitive emissions) equals (organic solvents purchased and used as input into the process) less (organic solvents and/or organic compounds lost due to chemical or physical reactions) less (organic solvents contained in collected waste) less (organic solvents, or organic solvents contained in preparations, which are sold or are intended to be sold as a commercially valuable product) less (organic solvents contained in preparations recovered for reuse but not as input into the process)

SECTION 12: EMISSIONS AND SOURCES

12.1 Air

Emissions to air from surface cleaning:

Emissions	Source
volatile organic compounds	surface cleaning process equipment, cleaning material handling & storage areas, spills, fugitive emissions via doors, etc..
carbon dioxide	Thermal or catalytic incinerators (where present).
oxides of nitrogen	Thermal or catalytic incinerators (where present).

12.2 Water

There should be **NO** emissions to sewer or waters from surface cleaning processes using solvents under normal conditions.

Vapour degreasers: there will usually be some water generated from the water separator. Best practice is not to discharge separator water to sewer and instead collect it for off-site reclamation or disposal.

The use of waterborne cleaners may result in some emissions to sewer, but authorisation to discharge to sewer or waters must be obtained in advance from the local/sanitary authority.

Accidental Emissions

There are several areas with a potential to contaminate waters via accidental discharge to drains and sewers or onto ground. These include the vicinity of the equipment where solvent is used and storage of solvent-containing cleaners and of solvent waste. There should be no open drains or sinks in the vicinity of cleaning equipment using solvent or where solvent materials are being handled, used or stored.

12.3 Waste

Hazardous wastes generated from surface cleaning:

Waste	Source
Waste solvent	Spent cleaners, out of date material, obsolete material, etc.
Materials contaminated with solvent	rags, paper, disposable wipes, solvent laden activated carbon, used spill kits, empty containers, disposable protective clothing, etc.

SECTION 13: OTHER MANDATORY REQUIREMENTS

Apart from meeting either the emission limit values, the 30% solvent content limit, or the reduction scheme requirements, and keeping the necessary records to demonstrate compliance, there are other practices considered mandatory under the Regulations. This section of the Guidelines outlines these practices which must be implemented by surface cleaning installations. These issues will be checked by the AIC inspector.

13.1 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 which could be affected by an accidental spillage in the vicinity of areas where solvent is handled such as the solvent storage areas, the areas where the surface cleaning activity is carried out or surface cleaning equipment is located, and waste storage areas.
- Keep all VOC related containers closed when not in use and during safe/planned handling/transport around the premises. This includes containers holding or collecting waste and containers that are half full. The closed lid should be tight fitting. Transfer material out of containers that do not seal properly, e.g. are damaged or dented.
- Keep dedicated closed containers to hold dirty rags or disposable paper that has been used to wipe up solvent.
- Keep the number of solvent containing materials stored to a minimum.
- Keep solvent materials stored in a designated area(s) which:
  - is ventilated (but do not leave containers open with ventilation on)
  - is cool and is away from sources of heat or sparks
  - can be secured against vandals or unauthorised access
  - will avoid any damage from collisions, or spills from trips
  - is away from drains.

See section 14.2 for information on additional containment measures that would be considered best practice.

13.2 Safe Recovery/Disposal of Solvent Containing Waste

Collected hazardous solvent waste needs to be handled properly and recovered/disposed of safely as hazardous waste. Records of waste sent off-site must be maintained together with certificates of recovery or disposal. These will be open to inspection.

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

ALWAYS use a company who has the correct waste licence or waste permit and waste collection permit for the waste type. 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.

All such wastes should be stored in closed, labelled containers while awaiting recovery/disposal. All such wastes should be taken off the premises only by a licensed contractor.

You should keep a written record of the quantity and solvent content of all waste solvent sent off-site for recovery and/or disposal for inspection by the AIC.

Off-site Recovery for Reuse

Certain solvent wastes can be sent for recovery and reuse in another application. Use licensed companies only.

Certain solvent wastes which are unsuitable for reuse can be used as a fuel. At present there are no such facilities available in Ireland. Irish waste management companies utilise overseas facilities in several other EU countries and can provide a collection service for

these wastes. Use licensed companies only.

Off-site Hazardous Waste Incineration

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

- waste solvent
- solvent contaminated material (rags, paper, disposable wipes, etc.)

At present there are no such incineration facilities commercially available in Ireland. Irish waste management companies utilise overseas facilities in several other EU countries and can provide a collection service for these wastes. Use licensed companies only.

Landfill or Municipal Waste Incineration

Certain wastes can be landfilled or incinerated in a municipal waste incinerator (at present there are no such incineration facilities commercially available in Ireland), although it should be noted that it is ultimately up to the operator of the landfill or incinerator whether to accept a particular waste or not in line with their licence parameters.

Such wastes include:

- Process materials that are not contaminated with solvent or any other dangerous substances.
- General municipal type waste.

13.3 Training and Training Records

Training records must be maintained for all employees involved in carrying out the surface cleaning activities, handling solvent containing materials, and handling solvent containing waste. These records must be open to inspection. Training can be carried out by a competent person in-house – it does not have to be by a third party. Relevant new employees should also receive this training on arrival, be supervised during induction and periodically given refresher training.

The training record documents should include dates of training, what the training consisted of, and the employee names and signatures. 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:

- assessment of the most appropriate cleaning process or technique and the need to clean on every occasion (for relevant employees, e.g. production, supervision).
- instructions for the correct operation of cleaning equipment, and other relevant equipment such as solvent distillation units. Any training carried out by suppliers, for example when new equipment or materials are introduced should be included in this documentation process.
- the monitoring of operating temperatures, pressures, liquid flows, etc. as required.
- handling and storage methods for solvent-containing materials, including keeping all containers closed when not in use and during handling/transport around the premises.
- waste handling and storage methods, including using closed containers to hold dirty rags or disposable paper used to wipe up solvent.
- dealing with spills.
- why solvent emissions should be minimised as much as possible.
- maintaining appropriate records of solvent usage (for relevant employees)
- instructions for maintenance of cleaning equipment (for relevant employees, e.g. maintenance).

Remember regular training will also improve your operation as well as reduce solvent use.

13.4 Documented Maintenance Records

Documented maintenance records for the surface cleaning equipment and any other relevant ancillary equipment must be kept which records the dates and details of any

maintenance carried out. Maintenance should be carried out by competent persons in accordance with the manufacturers recommendations.

SECTION 14: REDUCING EMISSIONS

This section of the Guidelines outlines the various ways you can reduce your emissions of solvent.

These are described under the headings of load minimisation, containment, recovery, recycling, and abatement, while safe disposal or recovery is dealt with in Section 13. This follows the preferred hierarchy for dealing with emissions and waste.

These techniques are considered "Best Practice". They are not requirements of the Regulations, rather they act as a guide as to how the emissions limit values (ELVs), the 30% solvent content limit, or a Reduction Scheme might be met. This is particularly the case where an operator has determined that they will not meet the targets given by the emissions limit values (ELVs), the 30% solvent content limit, or a Reduction Scheme.

Additionally, minimising the consumption of solvent should reduce your costs.

It should be noted that the principal area for emissions reduction for surface cleaning is the use of substitute products/processes with lower or no solvent content.

14.1 LOAD MINIMISATION OR SOURCE REDUCTION

'Load minimisation' or 'source reduction' involves reducing the actual amount of solvent in use in the first place. For surface cleaning this includes:

- reduce need for cleaning by product/process redesign
- use alternative products and processes
  - cleaning materials with low solvent content
  - alternative solvents that are less volatile
  - alternative solvents which are less hazardous
  - water for cleaning
  - initial non-solvent pre-cleaning
  - mechanical cleaning
  - manual cleaning
  - water based solutions
  - biological degreasing system
  - ultrasonic cleaning
  - megasonic cleaning
  - unstable emulsion cleaners
  - enzyme cleaning solutions
  - plasma degreasing
  - laser cleaning
  - carbon dioxide cleaning
  - UV cleaning
- use an enclosed vapour degreaser
- use of spraying to enhance cold soaking and vapour degreasing
- implement modifications to vapour degreasers
- improve operational procedures for vapour degreasers
- use a water cover for cold solvent cleaning equipment
- use agitation to enhance cold soaking
- reduce drag-out from cold solvent cleaning equipment
- use of precleaners that can be diluted with water
- material inventory and management
- regular cleaning solution and equipment maintenance
- solvent cleaning equipment location
- improvements in rinsing for aqueous cleaning systems
- worker training/retraining

Reduce Need for Cleaning

The subsequent processes a work-piece is to be subjected to will have a bearing on whether it needs to be cleaned and what degree of cleaning is required. This question should always be asked - work-pieces should not always automatically be cleaned.

All cleaning applications should be assessed to see if they are absolutely necessary. If cleaning is deemed necessary the current method in use should be reviewed – it may be that it is only need for particular applications not all applications. The use of an alternative

cleaning process may be possible in some applications. In many cases a solvent degreaser or solvent cold soaking bath are used all the time just because they have "always" been there.

Some initial or basic (non-solvent) cleaning could be carried out before subjecting the components to the main solvent cleaning operation to reduce consumption.

The following techniques can eliminate/minimise the need for cleaning by identifying the root cause of the contamination which gives rise to the requirement for cleaning and eliminating or minimising it at source:

- Working in conjunction with the product manufacture (either in-house or suppliers) to:
  - reduce the amount of oil/grease on the product, for example through changing the amount, or the application methods being used.
  - allow the most environmentally friendly degreasing or cleaning system to be used, for example through changing the type of oil
  - Careful product storage and protection including a clean and dry environment; use of protective packaging, including reusable packaging, and sealed containers for small products and use of moisture absorbents.
- Limiting the amount of time, where possible, between cleaning and further processing to reduce the need for, or the extent of, cleaning.
- Eliminating or changing interim cleaning stages where possible through the consideration of subsequent production requirements against the level of cleaning carried out.
- Carrying out initial or basic cleaning before main cleaning operation.
- Removing excessive oil before cleaning, by heating and centrifuging smaller components, or using wiping or air knives for larger components.

Alternative Products and Processes

The principal area for emissions reduction for surface cleaning is the use of alternative products or processes with lower or no solvent content. What needs to be looked at is:

- What is the degree of cleaning required – i.e. what defines the surface as being "clean"? What subsequent production or use requirements are there?
- What is the nature of the contaminant?
- Is there anything related to the surface being cleaned to take into consideration (any possible adverse reactions etc.)?
- What economic and other considerations should be taken into account (investment, production time constraints, manpower requirements, need for discharge licence, etc.)?
- What are the possible cross media effects? It should be remembered that permission to discharge trade effluent to sewer or surface waters from any new waste water stream must be obtained in advance from the local/sanitary authority. The reduction in emissions to atmosphere should be weighed against any increase in emissions of waste water. Waste water treatment such as pH neutralisation may be required. Additional drying costs (if subsequent processing is not wet) may also be incurred.

Consider the following alternatives for cleaning:

- Use ***cleaning materials with low solvent content***. If solvent content is below 30% by weight, then exemption from the ELV requirements for other solvents is possible. This exemption cannot be used in place of ELVs for solvents with specified risk phrases (R45, R46, R49, R60, R61, or halogenated solvents with risk phrase R40).
- Use cleaning materials with ***alternative solvents that are less volatile***. This will result in a lower rate of evaporation of solvent.

- ***Alternative solvents which are less hazardous*** are available which should be used instead of solvents with the specified risk phrases. These include terpenes, aliphatic hydrocarbons, alcohols, esters, and glycol ethers.
- ***Use water for cleaning***. In certain applications, clean hot water at 80 – 90 ^{0}C without any chemicals can remove the majority of oil and grease that comes on work-pieces. Use of high pressure water jets increase the cleaning effect. Steam cleaning, assisted with detergents if necessary, can be another alternative.
- Carry out some ***initial or basic non-solvent pre-cleaning*** with dry rags or paper for larger parts prior to use of solvent cleaning. This will extend the solvent's working life and reduce solvent consumption (although it will generate waste soiled rags/paper).
- ***Mechanical cleaning*** such as power wire brushing or shot blasting may be applicable for some metal surfaces. These methods are suitable for the removal of particulates, rust, scale, and unwanted coatings. Wet and dry systems are available. Brushes should be maintained in a clean and serviceable condition. Can be used as initial pre-cleaning prior to solvent cleaning.
- ***Manual cleaning.*** Use of spray bottles, aerosols, together with rags, wipes, or swabs. Solvent or aqueous cleaners can be used. Can be used as initial pre-cleaning prior to degreasing. Solutions can be used in specific quantities as needed and can be applied directly to an area that is contaminated without covering the whole part. There are a wide variety of such products commercially available containing different solvents depending on the contaminant and the application. Pre-saturated wipes and swabs of various sizes are available which can control the amount of solvent being used. Aqueous based wipes are also available. Aerosol cleaners can be used for manual cleaning (ensure the propellant is not a global warming gas such as a HFC). Manpower requirements may be a factor. Appropriate prevention/minimisation of worker exposure to solvents should always be taken into consideration.
- Use ***water based solutions***. There are a wide variety of cleaners available for different types of soiling, different types of substrate and for the different types of follow on processes. Work-pieces are soaked in the solution. The solutions do require regular replenishment. Exhausted solutions will need to be either treated or properly disposed. Specialised equipment is available for using such solutions but is not always necessary. Some equipment is relatively simple and inexpensive. Some have integral brushes and heating to assist the cleaning process. The nature of the aqueous cleaning materials varies widely, and can include acids, alkalis, phosphates, silicates, and various additions such as surfactants/wetting agents, complexing agents, dispersants, and builders. Even aqueous cleaners sometimes contain small amounts of solvent, usually water soluble solvents such as glycol ethers and alcohols. If using the exemption of the 30% solvent content limit, all aqueous cleaners should be checked for their solvent content.
- Use a ***biological degreasing system*** which utilises specialised equipment. Surfactants are used to lift the oil from the surface of work-pieces and microorganisms then break down the oil and grease into carbon dioxide and water. These are closed systems so only very small amounts of sludge need occasional disposal. Only very small amounts of cleaning chemical need to be added. This has the advantage of there being no oil or solvent for disposal. May not be suitable for all types of oil. It has also been reported to eliminate the need for parts etching. Such systems are commercially available.
- ***Ultrasonic cleaning*** can be used to enhance cleaning systems, but specialised equipment is needed. An ultrasonic cleaning unit is a tank that has an attached transducer capable of generating particular sound waves. The transducer converts electricity to intense, high-frequency ultrasound vibrations. These sound waves are transmitted through the cleaning solution, causing formation and collapse of small vapour bubbles at the solid surface, called micro-cavitation. The energy created by these cavitations can effectively loosen and discharge many contaminants from the surface. This agitation assists in the removal of soiling, especially in hard to reach areas. Hence the efficiency of the cleaning process is enhanced. Tanks are usually operated with aqueous and other non-volatile media. It is possible to retrofit a tank, such as a cold cleaner or a vapour degreaser, with a transducer.

- ***Megasonic cleaning*** is a more gentle form of ultrasonic cleaning, using sound waves at a different frequency range. Megasonic cavitation occurs with significantly smaller bubbles than with ultrasonics, which results in a lower local energy release at implosion. This significantly reduces the risk for surface damage, making megasonics particularly desirable for cleaning delicate, sensitive parts. It is also more suitable where smaller amounts of contaminant need to be removed.
- Use ***unstable emulsion cleaners*** which dissolve oil and grease to form an emulsion which readily separates in a settling tank. Skimmers then remove the oil/grease, while the cleaning solution is returned to the process tank.
- Use ***enzyme cleaning solutions*** which break down oil/grease. Solutions cannot be regenerated but can usually be discharged to sewer (authorisation from the local/sanitary authority would be required in advance).
- ***Plasma degreasing.*** Suitable for removing thin-filmed organic contaminants in precision applications. Specialist equipment is needed. A chamber under vacuum is filled with a gas such as oxygen, argon, or helium. An applied electric field then ionises the gas cloud. Plasma can be defined as an ionised gas with a roughly equal number of positively and negatively charged particles. The properties of plasma are similar to both gas and liquid. The radicals cut hydrocarbon bonds and oxidise them to carbon dioxide and water. This is suitable for removing oil, grease and other organic contaminants. Plasma cleaning leaves no residue on the surface, so there is no need for a rinsing step. However, aqueous or semi-aqueous cleaning is often used as a precleaning step prior to plasma treatment, as plasma cleaning is not effective with any inorganic materials present.
- ***Laser cleaning*** is suitable for the removal of particulates, photoresist, adhesives, epoxy layers, urethane layers, or oxide layers. More suitable where smaller amounts of contaminant need to be removed. Specialist equipment is needed and could involve significant capital cost. The laser emits energy in the form of photons (light). This energy causes surface contaminant electrons to become excited, whereby the electrons are energized to higher energy levels. Relaxation of these electrons then occurs, and additional photons are released. Contaminant removal occurs as a result of the localized energy transferred to the surface from the relaxation process. Little heat is generated from the short, high intensity photon pulses. As a result, a cool and dry surface can result, showing no thermal or mechanical strain. A typical laser includes a light source (lamp), an optical train to direct the laser beam to the surface, a stage to hold the substrate in place, and a gas source. The laser system can be adapted to clean virtually any portion of a substrate.
- ***Carbon Dioxide Cleaning***. CO_2 is suitable as a solvent for removing oil, grease and other organic contaminants. Specialist equipment is needed. It is more suitable where smaller amounts of contaminant need to be removed. This method of cleaning is generally not applicable to rust, scale, and most inorganic compounds. A high degree of cleanliness is achievable. These systems are more usually suited to high tech applications. Three different types of CO_2 processes exist: 1) liquid form which consists of a pressure vessel into which parts are placed, and a recycling system; 2) as a gas, which is ejected as snow from specialized nozzles; and 3) super critical form (CO_2 above a particular temperature and pressure, at which it shows properties of both a liquid and a gas)with equipment consisting of a cleaning vessel, pump, an expansion valve, separator, and a condenser.
- ***UV Cleaning***. Ultraviolet (UV) light and ozone can be used to remove organic contamination on a substrate surface. Major applications of UV/ozone cleaning include removal of certain photoresists and carbonaceous removal from semiconductors. Cleaning occurs as a result of the free radical formation that accompanies ozone and hydrogen peroxide decomposition. Ozone (O_3) breaks down into oxygen gas (O_2) and a free oxygen molecule (O), while hydrogen peroxide (H_2O_2) breaks down into water (H_2O) and a free oxygen molecule (O). These free oxygen molecules are very reactive. The oxygen radical will react with organic compounds and cause them to cleave and break down. These reactions will continue in the presence of oxygen radicals until the organics can break down no further. A precleaning step may be needed in the case of thick layers of soils and may need to be coupled with other processes to remove inorganics and other ionics.

Use an Enclosed Vapour Degreaser

An enclosed vapour degreaser, by contrast to a conventional degreaser, is a completely sealed unit. It incorporates both refrigerated condensation and carbon adsorption/desorption to trap and regenerate solvent. It operates similar to a dry cleaning machine.

Use of spraying to enhance cold soaking and vapour degreasing

The use of spraying to enhance cold soaking and vapour degreasing can often improve the efficiency of cleaning. However emissions could increase if not carried out correctly. Low pressure spraying should be used. In degreasers, spraying should be carried out below the vapour level.

Implement Modifications to Degreasers

Certain minor modifications can be made to existing open top vapour degreasers to minimise solvent emissions. These include:

- Install support frames within the condensation zone to allow work that is mounted on jigs to be supported while degreasing is in progress. This enables the lifting device to be raised and the lid closed over the work during the degreasing process.
- The use of baskets having an area less than 50% of the degreaser opening will limit vapour dragout due to the piston effect.
- Increase freeboard height. A freeboard ratio (freeboard height divided by the width of the tank) of at least 0.75:1 and preferably 1:1 is recommended.
- Install fixed pipework, connected to the sump, for topping up with new solvent, rather than manually pouring new solvent into the degreaser from drums or buckets.
- Install refrigerated coils which will condense solvent from the air leaving the degreaser and return it to the unit.
- A rapid-response temperature sensor installed immediately below the condensation zone acts as an energy saving device. The sensor cuts the energy input to the sump in response to the vapour temperature. The cooling effect of the new load being placed in the unit reactivates the main heating system.

Improve Operational Procedures for Vapour Degreasers

There are a number of operational procedures that should be observed to minimise the loss of vapour from conventional vapour degreasers:

- When inserting or withdrawing components, speeds greater than 3 metres per minute (11 feet per minute) should be avoided to minimise the amount of solvent vapour lost. A power operated hoist is recommended for all degreasing plants to control the speed of entry and exit of the work-pieces.
- Avoid heavy loads which will result in the collapse of the vapour blanket and infiltration of air into the unit. This solvent saturated air will then be expelled when the vapour layer re-establishes.
- Ensure that the parts have reached the temperature of the vapour before removal so that condensation has ceased. Look to see that there is no liquid on the parts. Conversely do not leave parts in for longer than necessary.
- Rim ventilation should be high enough to protect operators, but excessive extraction results in unnecessary solvent consumption. An extraction rate of 640-915 m^3/hr per m^2 of bath surface is recommended. For any degreaser with a specific rim vent slot design, extract fan specification and ductwork configuration, there will be a specific rim vent slot velocity. Some users may find it easier to check this measurement rather than the total volume of air extracted. The degreaser supplier should be contacted for the appropriate figure.
- To ensure the degreaser functions efficiently, the solvent temperature should be maintained at a level adequate for vapour production.

Use a Water Cover for Cold Solvent Cleaning Equipment

Where the solvent is heavier than water, and not water soluble, a 5 – 10 cm layer of water acts to reduce solvent emissions from cold solvent cleaning equipment.

Use agitation to enhance cold soaking

The use of agitation to enhance cold soak cleaning can often improve the efficiency of cleaning. It is particularly recommended for aqueous cleaners. For solvent based systems, emissions could increase if not carried out correctly. The agitation should only be turned on when required. Lids should also be used to minimise emissions.

Reduce drag-out from Cold Solvent Cleaning Equipment

This is applicable to processes where parts are immersed in the cleaning solution. Applies to solvent and aqueous systems and to cold and heated solutions. Drag-out is a term which refers to the removal of cleaning solution from a bath as a result of its adherence to the work-pieces and the jig, basket or barrel. If the amount of drag-out formed in the first place is reduced, this will consequently reduce drying requirements and prolong the life of cleaning bath solutions. There are a number of ways that drag-out can be reduced:

- Better positioning of work-pieces on racks: parts should be placed on the rack so that the largest surface or plane is nearly vertical and the longer dimensions are horizontal. The lower edge should be inclined, so that run-off will occur at a corner rather than the entire edge. Avoid positioning parts directly over one another where possible.
- Better operation of racks and baskets: The rack should be positioned/inclined so that horizontal surfaces on the rack are minimised.
- Better operation of barrels: barrel holes should be kept clear to permit maximum drainage. Make sure barrel doors face upwards during withdrawal (usually less holes on doors). Intermittently rotate the barrel during draining and hold for 10 seconds in each position of rotation.
- Slower work-piece withdrawal from cleaning tanks. The faster the work-piece is withdrawn from the process bath, the thicker the film on the work-piece surface and the greater the drag-out volume. This is obviously easier to achieve with electrically operated systems than manual systems.
- Drainage time. Allow as much time as is feasible to drain above the cleaning tank. 15 seconds is recommended.
- choice of barrel: use barrels with as high a proportion of the surface covered in perforations as is possible. Use barrels with draining ledges within the barrels.
- Compressed air jets can be used to blow off drag-out from work-pieces.

Material Inventory and Management

In the case of solvents used in manual cleaning, keep tight control on the use of such solvents by limiting access to stores and issuing controlled amounts to operators. Similarly for cold cleaners and degreasers limit access to fresh replenishing solvent to a small number of suitably trained people.

Keep your stock of materials as low as is feasibly possible. This will reduce material going out of date and reduce the accumulation of materials you no longer use or that have been replaced.

Regular Cleaning Solution and Equipment Maintenance

Regular monitoring of the cleaning solution should be carried out such as pH, solution strength, etc (relevant parameters really depend on the process). Simple chemical test kits are often available from suppliers.

Regular monitoring of appropriate process parameters should be carried out, e.g. for degreasers, checks should be made on cooling water flow and temperature, solvent level, and sump temperature.

Routine removal of sludges, oils, particulates and other contaminants from cleaning baths should be carried out. This can be as simple as a perforated ladle, or intermittent/continuous filtering systems can be used. Self cleaning filters are preferable to disposal filters/filter cartridges. Oil can be removed by skimmers, gravity separators, centrifuges or membrane filtration.

Major cleaning of the process tanks should be carried out periodically. Condensing coils on

degreasers should be cleaned regularly, usually weekly. Ventilation systems should be included in maintenance programmes and inspected periodically for blockages.

Maintenance of racks, barrels and baskets should be carried out to prevent products of corrosion entering the cleaning baths:

- Check barrels regularly to see that holes are not being closed off through the tumbling action during processing. Any holes in polypropylene barrels that are starting to close off can be drilled back to normal size.
- Periodic checking of arms of jigs, baskets and barrels, including insulation (if present) for cracks which would trap cleaning solution.

Solvent Cleaning Equipment Location

Locate degreasers and cold soak cleaners away from draughts or use baffles to prevent upset of the solvent vapour (in vapour degreasers) or cause an increase in diffusion (in cold soak cleaners). Proper location is reported to reduce solvent loss by up to 30% for degreasers. Features that create air currents that can disturb the degreaser's vapours or increase evaporation from cold soak cleaners include doors, windows, heating and ventilation systems and busy passages.

Improvements in rinsing for Aqueous Cleaning Systems

Aqueous cleaning systems usually include a rinse step after the parts have been cleaned to remove the cleaning solution. Improvements that can be made to increase the efficiency of rinsing and reduce water use are:

- Use of a static rinse tank. These are rinse tanks without a flow of water. Water from the static rinse tank can be added back into the process tank to make up for evaporative losses. They should be used in conjunction with other rinsing systems. Combinations of multiple static rinse tanks can also be used.
- Counter-current rinsing. If there is room for more than one rinse tank set up a counter-current rinse system, i.e. have the fresh water entering the last tank that the work-pieces go through. Let the overflow from this last tank be the feed for the earlier rinse tank. A two stage counter-current rinse system will drastically reduce the amount of water needed to clean a part to the same degree of cleanliness – water reduction can be 90% or more.
  With a certain number of counter-current rinse tanks it may even be possible to reduce rinse water flow such that the rinse water can be used to make up for evaporative losses, even in ambient process tanks.
- Spray rinses. Spray rinses can be installed over rinse tanks. These act like a second rinse step. These rinses can be automated to only be in operation when the jig is being lifted, or for manual systems a switch with a timer could be used. Spray rinses can also be used on their own.
- An overall master control valve on the main water supply to the process with a switch convenient for the operator (e.g. beside door or on main control panel) for stopping water loss during breaks, overnights and weekends. Avoids having to change settings on individual valves on tanks.
- Controls on rinse water flows:
  - Flow restrictors on flow-through rinses. These simple mechanical flow control valves give constant flow independent of pressure and are very cheap. This eliminates variations in water flowrate arising from water line pressure changes or operators adjusting valves in error.
  - Control valves on rinse water flows with timers delivering a fixed amount of water triggered by programming or a switch.
  - Conductivity control in the flow-through rinse tank. This will deliver fresh rinsewater only when a preset level of conductivity, indicating contamination, has been exceeded.
- Air agitation. This keeps the rinse tank stirred and also has a scrubbing effect in removing process solution from parts.

- Use of a photosensor on an automated line. This can detect when dripping stops.
- Adjustments to existing rinse tanks to avoid short circuiting:
  - Put the water inlet at the bottom of the tank and run-off at the top.
  - Put a water distribution line (e.g. perforated plastic tubing) on the bottom of the tank rather than a single inlet.
  - Install baffles to maximise the use of the tank volume (if not restricted by work flow).
  - Dip twice in the same rinse tank rather than leaving parts submerged.
  - Use static rinse tank in both directions. If a static rinse tank is in place, use it just *before* parts go into the process bath as well as when they come out of the process bath. This will help stabilise the concentration of chemicals in the rinse tank at approximately 50% of the bath concentration. This is because it will drag in rinse water on parts into the static rinse tank, and it will drag in a more concentrated solution rather than rinse water into the process bath. Particularly suitable for ambient process tanks. This is sometimes referred to as an "eco-rinse".

Worker Training/Re-training

Worker training will help reduce emissions and waste. See section 13.3.

14.2 CONTAINMENT

Containment basically means measures that stop the solvent escaping to air, water or onto the ground, including:

- covers on solvent cleaning equipment
- closed containers
- dedicated closed containers for dirty rags
- spill kit
- adequate solvent storage

Use Covers on Solvent Cleaning Equipment

Install covers to eliminate draughts and reduce diffusion.

For immersion or soak cleaning equipment the use of covers when the parts are not being placed in or removed from the equipment will help reduce solvent emissions due to evaporation.

For degreasers these covers should be fitted below the rim ventilation slot, otherwise this can allow the extraction system to pump the system dry, and should be fitted at the top of the freeboard zone. A roller or a slide design should be used rather than lift-out panels as this is less likely to disturb the vapour. Double-door systems can be used, which are more expensive to install, but reductions in solvent consumption of up to 80% have been claimed. Such systems can have timed interlocks.

Closed Containers

See sections 13.1 and 13.3.

Keep Dedicated Closed Containers for Dirty Rags

See sections 13.1.

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 afterwards. There are various suitable kits available on the market. Train your workers in the use of this spill kit.

Bunded Solvent Storage

Best practice for solvent containing material 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.

14.3 RECOVERY AND RECYCLING

Recovery and recycling operations relevant to surface cleaning include:

- reuse of cleaning solvent
- collection of cleaning solvent for recycling
- use of recovered solvent
- container take back by supplier
- collect solvent containing rags for cleaning and reuse

Reuse Cleaning Solvent

Many types of solvent cleaning equipment facilitate the reuse of solvent, for example vapour degreasing. Filtration is often used to supplement reuse.

Equipment is also available which can recover spent solvent for reuse through distillation. You should keep a written record of the quantity of any solvent recovered and reused on-site (e.g. distillation).

Collect Cleaning Solvent for Recycling

Collect the used dirty solvent and send to specialist companies for recycling. Certain larger companies provide solvent supply contracts, where equipment is provided for recovery and the solvent is taken back for recycling.

Use Recovered Solvent

Ask your supplier for cleaning solvent that has already been recovered from other industries and purified/recycled.

Container take back by supplier

In some cases, coating suppliers may accept back their empty containers. The size of orders and distances involved are usually major factors in whether this is available or not.

Collect Solvent Containing Rags for Cleaning and Reuse

Rags contaminated with solvent can be collected and sent for treatment whereby the solvent is removed and the rags are cleaned for reuse. Only use an appropriately licensed/permitted company.

14.4 ABATEMENT

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

Abatement technologies that can be relevant to surface cleaning include:

- adsorption of VOC gases
- catalytic incineration of VOC gases
- thermal incineration of VOC gases
- biological treatment of VOC gases

It should be noted that in small scale operations, abatement can be technically and economically unfeasible.

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

Adsorption of VOC gases

This equipment contains an 'adsorbent', a material to which the solvent vapours become attached. The adsorbent is more often than not activated carbon, which is like charcoal.

After a period of time in operation the carbon becomes saturated, i.e. it cannot adsorb any more solvent. The canister containing the carbon has to be replaced with a new one or the carbon must be regenerated in-situ. It is essential that this is done before VOC emission levels rise. Where the solvent-containing carbon is replaced, it must be sent off-site for either recovery of the solvent from the carbon or for incineration of the carbon. Where the solvent-containing carbon is regenerated in-situ either heat or steam is used to remove the solvent, which must then be condensed and collected for either reuse, recycling or disposal.

Adsorption is particularly suited to intermittent cleaning operations. It also has lower installation costs than catalytic converters or incinerators.

Catalytic Incineration of VOC gases

A catalytic incinerator can be used to treat VOC gas emissions.

This technology is more suitable where there is a steady continuous load of VOCs in the waste gases. Catalytic incinerators are quicker at reaching the necessary operating temperature than thermal incinerators. Supplementary fuel such as natural gas or LPG may be needed to run the equipment.

Thermal Incineration of VOC gases

This technology uses a burner to destroy the solvent gases by combustion. It should be designed to operate at 750 ^{o}C and a residence time of 0.5 seconds.

More suitable where there is a steady continuous load of VOCs in the waste gases. Supplementary fuel may be needed. There is some opportunity for recovery of heat.

APPENDIX 1: GLOSSARY

adhesive: shall mean any preparation, including all the organic solvents or preparations containing organic solvents necessary for its proper application, which is used to adhere separate parts of a product.

average over 24 hours shall mean the arithmetic average of all valid readings taken during the 24-hour period of normal operation.

coating shall mean any preparation, including all the organic solvents or preparations containing organic solvents necessary for its proper application, which is used to provide a decorative, protective or other functional effect on a surface.

competent authority: for installations which fall under these Guidelines means the county council or city council in whose functional area the installation is located.

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.

contained conditions: shall mean conditions under which an installation is operated such that the VOCs released from the activity are collected and discharged in a controlled way either via a stack or abatement equipment and are therefore not entirely fugitive;

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.

halogenated organic solvent: shall mean an organic solvent which contains at least one atom of bromine, chlorine, fluorine or iodine per molecule.

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 one or more of the activities coming under the Directive/Regulations are 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.

mass flow: shall mean the quantity of VOCs released, in unit of mass/hour.

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 in 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.

preparation shall mean mixtures or solutions composed of two or more substances.

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 an installation involved in surface cleaning using specified risk phrase solvents, a small installation is one which has a solvent consumption of between 1 and 5 tonnes/year. For an installation involved in surface cleaning using other solvents, a small installation is one which has a solvent consumption of between 2 and 10 tonnes/year.

Specified risk phrase solvents: solvents with risk phrase R45, R46, R49, R60, or R61, or halogenated solvents with risk phrase R40.

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

start-up and shut-down 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 shut-downs.

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 installations covered by these guidelines, this means a change of the nominal capacity leading to an increase of emissions of volatile organic compounds of more than 25% for small installations and of more than 10% for all other installations. 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.

surface cleaning: any activity except dry cleaning using organic solvents to remove contamination from the surface of material including degreasing. A cleaning activity consisting of more than one step before or after any other activity shall be considered as one surface cleaning activity. This activity does not refer to the cleaning of the equipment but to the cleaning of the surface of products.

use: the total input of organic solvents into an installation per calendar year, or any other 12-month period.

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 2: REGISTRATION DETAILS

Schedule 4 to the Emissions of 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 under going 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 3:

SUMMARY LIST OF INFORMATION TO BE GATHERED

The following is a summary list of the information which must be gathered for a period of 12 months by installations involved in surface cleaning using solvents above the relevant thresholds. It is a summary only. You use this information to compile the solvent management plan (see section 11) 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. The sample record sheets in Appendix 4 can be used to summarise this information.

Information to be gathered by installations involved in surface cleaning using solvents above the relevant thresholds for a period of 12 months and kept on record prior to obtaining an Accredited Inspection Contractor:

1. Purchases of all solvent-containing cleaning materials in the 12 month period, including back-up invoices.
2. Average organic solvent content (in percentage by weight) of all such cleaning materials purchased in the 12 month period and the name of the solvent(s) present, including back-up documentation.
3. Identification of cleaning materials that contain solvents with specified risk phrases (see section 6), including the name of the risk phrase solvent, its concentration in the material, the risk phrase in question, and where this information was obtained.
4. Where such risk phrase solvents are in use, information on the amount of such materials purchased in the 12 month period.
5. Where it is not possible to replace the substances/preparations that have risk phrases R45, R46, R49, R60, or R61 as a result of solvent content with less harmful materials, document satisfactory evidence (note R40 halogenated risk phrase solvents do not legally require replacement).
6. The weight of every load of solvent containing waste sent off site in the 12 month period, where relevant, and the appropriate waste transfer documentation from the waste contractor.
7. Evidence as to whether solvent containing waste sent off site (where relevant) in the 12 month period is sent for recovery or for disposal.
8. An analysis of a representative sample of waste for VOC content, where such waste is sent off-site for disposal or for recovery. If there is more than one type of waste stream, separate analysis should be carried out. See Appendix 5 for accurate sampling methods. This analysis only has to be repeated when there is a major change in type of materials used, equipment used or operating practices employed.
9. If abatement is present (for example, carbon adsorption, thermal oxidation/incineration, waste water treatment, etc.), an estimate as to the amount of solvent treated by this abatement equipment during the 12 month period.
10. The stock levels on the <u>opening</u> day of the 12 month period of:
    a. all solvent-containing cleaning materials in storage in tanks, drums, etc..
    b. solvent levels in cleaning equipment, including ancillary equipment (for example a distillation unit, if present on-site).
    c. levels of solvent containing waste on the premises.
11. The stock levels on the <u>closing</u> day of the 12 month period of:
    a. all solvent-containing cleaning materials in storage in tanks, drums, etc..
    b. solvent levels in cleaning equipment, including ancillary equipment (for example a distillation unit, if present on-site).
    c. levels of solvent containing waste on the premises.
12. A log of the amount of solvent recovered on-site (if such equipment is present) during the 12 month period. Analysis for VOC content of this recovered material may be needed.

13. Analysis results for specified risk phrase solvents in emissions in waste gases (actual solvent concentration and gas flowrate) that is representative of the operation, including appropriate operational information to scale up emissions in waste gases for the 12 month period. [Note: this is only needed where consumption of specified risk phrase solvents is more than 1000 kg (1 tonne) per year or where the mass flow of emissions of the sum of such specified risk phrase compounds exceeds the threshold set out in section 6.3; it is applicable regardless as to whether you are meeting the Emission Limit Values, the 30% solvent content limit, or the Reduction Scheme for other solvents].

14. Analysis results for VOC emissions in waste gases (VOC concentration in terms of total organic carbon and gas flowrate) that is representative of the operation. [Note: this is only needed if meeting the Emission Limit Values - not needed if using the exemption of complying with a 30% solvent content limit, or if using a reduction scheme; see section 8.2 for other occasions when such monitoring is not needed.]

15. Where VOC emissions in waste gases have been analysed, document appropriate operational information on the day monitoring is carried out in order to scale up emissions in waste gases for the 12 month period, to be able to differentiate between emissions in waste gases and fugitive emissions, and to demonstrate it took place during an operational time which is likely to encompass the maximum level of VOC emissions envisaged. [Note: this is only needed if meeting the Emission Limit Values - not needed if using the exemption of complying with the 30% solvent content limit, or if using the Reduction Scheme.]

16. Where specified risk phrase solvents are in use, but consumption is 1000 kg (1 tonne) per year or less, and monitoring in waste gases has not been carried out, document and justify why it is considered unlikely that the mass flow of such compounds in waste gas emissions would exceed the thresholds in section 6.3. [Note: this is only needed if such risk phrase solvents are in use, and if consumption is 1000 kg (1 tonne) per year or less, and monitoring has not been carried out; it is applicable regardless as to whether you are meeting the Emission Limit Values, the 30% solvent content limit, or the Reduction Scheme for other solvents.]

17. A written record of any training carried out (see section 13.3).

18. A written record of any maintenance carried out (see section 13.4).

19. Be able to demonstrate that the mandatory requirements of section 13 have been implemented.

APPENDIX 4: SAMPLE RECORD SHEETS

SAMPLE RECORD SHEET 1 – Inputs and Consumption

Cleaning Material	Name of solvent constituent(s)	Solvent content (% w/w)	Has the solvent any specified Risk Phrases?	Source of solvent content information	Stock quantity of cleaning material at start of 12 month period	Quantity of cleaning material purchased during 12 month period*	Stock quantity of cleaning material at end of 12 month period	Solvent purchased and used during 12 month period (I1)	
								Specified risk phrase solvents	Other solvents
		D			A	B	C	= (A+B-C) x D	
Example:									
XYCleanerR B-204	IPA methanol	30% 25%	No No	Supplier MSDS Supplier MSDS	80 kg	3900 kg	50 kg		2161.5 kg
AB Degreaser	Methylene chloride	100%	R40 and halogenated	Supplier MSDS	400 kg	3000 kg	500 kg	2900 kg	
							Total I1	2900 kg	2161.5 kg

		Specified risk phrase solvents	Other solvents
Any solvent recovered and reused on premises during year (if relevant)	**I2**	1000 kg	0
Input: **I = I1 + I2**		3900 kg	2161.5 kg
Consumption: **C = I1 – O8**		2900 kg (assuming O8 = 0)	2161.5 kg (assuming O8 = 0)

* Back-up invoices will be needed to support these figures.

SAMPLE RECORD SHEET 2 – Solvent Sent for Disposal or Recovery

Stocks of Solvent for disposal					
Weight of solvent waste for disposal in stock at beginning of 12 month period (kg)				**E**	
Weight of solvent waste for disposal in stock at end of 12 month period (kg)				**G**	
Solvent sent for disposal during 12 month period					
Date:	Description	Collected by:	Weight of waste	Solvent content	Quantity of solvent
			H	**J**	**= H x J**
Total waste solvent sent off-site for disposal during 12 month period				**K**	
Total solvent collected for disposal during 12 month period				**O6 (= K + E - G)**	

Stocks of Solvent for Recovery for Reuse					
Weight of solvent waste for recovery for reuse in stock at beginning of 12 month period (kg)				**L**	
Weight of solvent waste for recovery for reuse in stock at end of 12 month period (kg)				**M**	
Solvent sent for recovery for reuse during 12 month period					
Date:	Description	Collected by:	Weight of waste	Solvent content	Quantity of solvent
			N	**O**	**= N x O**
Total waste solvent sent off-site for recovery for reuse during 12 month period				**P**	
Total solvent collected for recovery for reuse during 12 month period				**O6 (= P + L - M)**	

APPENDIX 5: ACCURATE WASTE SAMPLING

Sampling of waste and analysis for VOC content is required where waste solvent is being sent off-site for recovery or disposal. If there is more than one type of waste stream, separate analysis should be carried out.

Where taking a sample of solvent waste for analysis, it is important that this sample is an accurate reflection of the drum or tank contents. This is important as the waste drum may contain different layers and may also contain solids.

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.

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 the thumb or using a rubber stopper, and 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).

APPENDIX 6: REFERENCES & FURTHER READING

1.1. Draft Reference Document on Best Available Techniques for Surface Treatment using Organic Solvents (May 2004).

1.2. Draft Reference Document on Best Available Techniques for the Surface Treatment of Metals and Plastics (April 2004).