

Solvent cleaning: Europe vs the United States

Glenn Greenlees of Standard Industrial Systems highlights the differences in approach to VOC classification

With strict environmental legislation in Europe concerning emissions of Volatile Organic Compounds (VOCs), many companies are closely scrutinising what choices are available in order to achieve the repeatable levels of surface cleanliness previously enjoyed with "vapour degreasing", whilst ensuring that long term compliance with all health and safety and environmental legislation and standards is guaranteed.

The introduction of yet further restrictions in the form of European Standard EN12921 limits the working chamber of any solvent based system to a maximum residual concentration of 1gm/m³ prior to release of an interlocked door. This effectively renders obsolete any attempt to achieve compliance by "double lidding" traditional tank systems and relying upon activated carbon to "soak up" residual solvent molecules to abate emissions. EN12921 is based on German domestic legislation introduced as far back as 1990. Accordingly, double lidded systems were consigned to history by 1993 (German national statistics detail a reduction in solvent consumption by 98% between 1990 and a 2000 survey). Clearly the legislation achieved the desired effect.

Of course, many are quite rightly considering aqueous processes as an alternative to solvent degreasing. In many applications water along with an appropriate chemistry, is better suited to a particular task and this article is not designed to cloud any issues regarding the ongoing debate. So why is it that many organisations spend so much time and effort with technically qualified and commercially aware personnel exploring the relative merits of aqueous vs solvent, only to find that their ultimate choice of a solvent process is subsequently "rejected" by the Board or parent company in favour of an aqueous cleaning format?

Perhaps it was time to consider what was creating the overriding influence in the decision making process?

Unbelievably, even now many still consider that cleaning with water is always more "environmentally friendly". The use of biodegradable chemicals sounds just about as wholesome as can be – perhaps again an emotional decision taken without due regard to the whole cost of ownership including consumables and disposal costs.

Could the answer really be that simple? No, there had to be more to it than just an attempt to achieve PR bonus points. Close

examination revealed a pattern of opposition to any process which included the word "solvent" – especially if the word was prefixed with "chlorinated". It became clear that many of the companies with an anti-solvent stance were either American, of US parentage or with a predominance of US market sectors.

There is one principal reason why chlorinated solvents are avoided in the United States – this is specifically due to the US method of determining what actually constitutes a Volatile Organic Compound in the first place. American VOC classification is based upon a criteria known as Photochemical Ozone Creation Potential (POCP): the propensity of a product to contribute towards the creation of ground level ozone which ultimately leads to an increase in global warming. Basically, we want ozone up in the stratosphere to protect us from the sun's harmful radiation but we don't want it down here. However, in Europe, VOC classification is based upon the product's inherent vapour pressure: how readily the liquid will evaporate from a liquid into the vapour phase i.e. its volatility.

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For instance with a boiling point of only 41°C methylene chloride is exceptionally volatile – of course it is also organic and a most definitely a compound. (Incidentally it is also an excellent degreasing solvent with a high Kauri Butanol value of 136 and a risk phrase of R40 – the latter health and safety consideration, of course, being irrelevant when used within the confines of a vacuum based system).

In the United States, both methylene chloride and perchloroethylene (another important example in the field of surface cleaning) fell below their threshold for classification as VOCs and can be used freely without any control on emissions (from an environmental viewpoint). Simply put, the US believes that these products spilled to the atmosphere from open or 'enclosed' systems, do not contribute to the formation of ground level ozone and therefore do not pose a threat to the environment. So what is the problem? As we are all aware, health and safety is the 'issue of issues' in America and, in many cases, Occupational Exposure Standards (or, in the US, their equivalent Threshold Limit Values – TLVs) are 'tighter' than in European states.

The dreaded chlorine molecule!

For instance, the American Conference of Governmental and Industrial Hygienists (ACGIH) has just announced a new TLV of 10ppm for normal Propyl Bromide (n-PB). Compare this, for example, to the UK's Maximum Exposure Limit (MEL) of 100ppm for methylene chloride. In many cases the writer has experienced situations where US parentage has actually instructed UK subsidiaries to adopt a brominated solvent as a final resort in lieu of anything containing the dreaded chlorine molecule.

The renowned entrepreneurial spirit in the US seems to be based upon constantly inventing new solutions to old problems. In our industry this undoubtedly revolves around new products and processes, the long term future of which may not be assured – compare this with the rigorous testing, categorisation, classification and ultimately, the knowledge which has been gained over decades of experience with chlorinated solvents.

The whole scenario presents the US operator with a dichotomy he cannot possibly overcome. Less strict environmental limitations permit vast amounts of VOCs to be released into the atmosphere but he will disregard health and safety issues at his peril. His logical conclusion? – steer clear of the whole subject and strive to make an

aqueous process fit. (Interestingly, the US remains the world's largest polluter and whilst some individual cities have committed the Kyoto Agreement, the United States as a whole has re-confirmed its intentions to remain without).

On the other hand, in Europe both perchloroethylene and methylene chloride are, of course, classed as VOCs and therefore, are fully controlled in the relevant environmental legislation and standards.

The legislation in Europe governing industrial solvent use (including cleaning and degreasing applications) is the product of some 20 years intense research and debate. This legislation is regarded as the most comprehensive in force affecting both employee rights to an effective health and safety programme and the wider issues of the environment.

For example, substances giving rise to depletion of the stratospheric ozone layer such as 1,1,1 trichloroethane have been phased out. A list of many other environmental concerns (too numerous to detail here) such as the creation of ground level ozone and acid rain are similarly controlled in separate relevant legislation. In Europe both environmental legislation and health and safety concerns have grown together – in fact one very much influencing the interpretation of the other.

Lack of awareness

Hermetically sealed solvent cleaning systems with the essential vacuum drying technology to eliminate solvent residues have been commonplace in Europe for many years, whilst now growing steadily in the UK they remain almost unheard of in the United States. The American lack of awareness of machine development in Germany has seemingly led to a complete block of the technology which, in many cases, might be the only long term solution for ongoing high levels of component cleanliness in many fields.

In contrast, the control of aqueous processes in Europe is very much in its infancy. One of the most important points to consider here for the future will undoubtedly be the Climate Change Levy which will have a major impact on the future energy costing of cleaning processes particularly in large scale applications.

The EU is committed to a 20% reduction in CO₂ emissions by 2015. Many in the scientific fraternity believe that a 60% reduction is needed by 2050 in order to reverse global warming, so it is certain that energy costs will increase disproportionately, water, of course, is not volatile but drying of components takes time and energy.

The use of solvents, certainly within the UK and the USA, is still largely associated with the most basic of 'tank' type immersion/vapour technology. Understandably, this modus operandi has now been consigned to history but the inherent advan-

tages associated with the product should not be similarly discarded. After all, it is the solvent itself which does the cleaning – the hardware is designed to contain the solvent within a fully controlled process and separate, by distillation, the contamination from the solvent once removed from the component surface.

An uncanny resemblance

In the UK it is clear we are now experiencing an uncanny resemblance to developments in Germany in the early 1990s, i.e. install an aqueous cleaning process at all costs and worry about the actual practicalities and long term suitability later.

In many cases this did lead to a return to a solvent format due to the inability of the process to deliver the development of hydrocarbon cleaning technologies giving many the opportunity to reverse company policy in favour of a solvent solution without actually admitting failure (albeit at the cost of wasted investment).

The large return to chlorinated solvent technologies has now been completed, the utilisation of alternative solvent species such as modified alcohols and hydrocarbons being an option, specifically when demanded by the application requirements.

Within the European sector the use of hermetically sealed vacuum technology and ppm control conforming to EN12921 is absolutely standard. As with many other industrial processes the hazards associated with specific products are known and fully understood, and the appropriate systems and hardware installed to maximise product efficiency whilst fully addressing health and safety and environmental issues for the long term.

It remains the writer's view that some applications are best suited to an aqueous format whilst many will undoubtedly remain a task for cleaning with organic solvents. It is vital that the ultimate decision is based upon all the facts fully taking into account all of the legislation and standards relevant in the state of operation.

Unfortunately, for so many companies who are required to continue to utilise solvent processes for high precision cleaning due to customer demand, component geometry or high surface requirements, the decision to embrace such proven technology remains on hold and inefficient and non-compliant installations seem destined to struggle on until the fast approaching compliance deadline imposed by the EU – that promises to be a most interesting week!

The author of this article, Glenn Greenlees, is marketing director of Standard Industrial Systems, an independent distributor 'dedicated to offering the world's best in both aqueous and solvent cleaning technologies.' Tel: 0151 326 2314.

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