SAFE & SAFER

Note 1: This is a translated & reworked version of: Ad Stijnman, *Veilig en veiliger. Innovatie in de grafische techniekenV* in: *kM*, vol. 50 (2004, Summer), p. 41-43.

Note 2: Often the term "non-toxic" printmaking is used. A completely non-toxic way of working with the chemicals used in printmaking is not possible, as chemicals are needed in creating the image of cleaning the plate, which are reactive & possibly harmful. Terms, such as "healthier printmaking" or "less-toxic printmaking" better express that chemical procedures are less dangerous compared to those in traditional printmaking. Only such techniques as rubbing and Japanese-style woodcut printing with paste inks can be called non-toxic.

Note 3: Developments in safer printmaking procedures can be followed through the issues of Printmaking Today from 1995 onward.

Note 4: Sincere thanks to Willibrord van den Besselaar, Sytze Folkertsma, Willem Moezelaer & Gerard Post van der Molen for the advice & information they supplied.

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INTRODUCTION

Already in the 18th century we find references to harmful effects to the health of the etcher of the vapours rising from acids. New etching fluids, which were said to be safer, were developed in the 19th century. There was a profound awareness in the past that acids and other chemicals affected the printmaker's health. Acid booths, rubber gloves and face masks for personal protection entered the studio gradually, less aggressive substitites were suggested. However, it lasted until the end of the 1980s before the problems were handled at the sources, the chemicals themselves. Rigorous changes took place then by the introduction of alternatives which really sought to lessen the toxic burden. Now there are waterbased screenprinting ink, acrylic grounds, light-sensitive polymer films and plates, vegetable esters for clean up, while copper sulphate is used for etching.

Ad Stijnman and Anthea Boesenberg look back for an overview of the major development in safer printmaking techniques.

HEALTH & SAFETY

The health of the printmaker is burdened by the chemicals he uses. These can harm skin and eyes. They can enter the body through the skin, by swallowing and by inhalation. Damage to skin and eyes, and penetration through the skin can be easily prevented by wearing proper clothing, rubber gloves and face protecton. It is obvious that chemicals should not be swallowed. Do not drink, eat or smoke in the studio, wash your face and rinse your mouth when leaving. Preventing inhalation, however, is the most serious problem. Using masks and exhaust hoods helps, but is not fully effective, is expensive and limits your activities. Better is it to fight the problems at the source and change to alternatives for acids and solvents which produce aggressive gases and aerosols.

ETCHING

Corroding metal plates requires strong acids, or the electrolytic activity between salts and metals. Nitric acid has always been favoured for etching, but proabably has not available in distilled form before the 14th century. Mixtures of strong vinegar and various salts are capable of etching iron and were perhaps already used in the Iron-Age. The earliest mentioning of etching iron using a ground to control the corrosive action of the mordant is by Vitalis de Furno, writing around 1300, but citing an older source. He tells that if you cover iron with wax, scratch through the wax and lay the piece in vinegar, your lines will be etched into the iron. It is a reference from a bibliographer and not a real recipe, but nevertheless it shows the notion of control of the corroding process is present. From then on the etching of iron armour and tools developed.

Note: Edmund O. von Lippmann, *Beiträge zur Geschichte der Naturwissenschaften und der Technik*, Berlin 1923, repr. 1971, vol. 1, p. 181-182.

The Augsburg armourer Daniel Hopfer can be credited for the invention of etching iron printing plates as an alternative for engaving copperplates shortly after 1500. Iron, however, had two drawbacks: it was too hard for additional engraving and the plates rusted. Both were overcome by the Italian Marcantonio Raimondi and the Dutchman Lucas van Leyden who independently invented the etching of copperplates between 1515-1520. Their knowledge spread and became the standard intaglio printmaking technique after 1540.

Note: Ad Stijnman, *Lucas van Leyden and etching*, in: *Print Quarterly*, vol. 5 (1988), nr. 3 (Sep.), p. 256-257. David Landau, Peter Parshall, *The Renaissance Print* 1470-1550, New Haven, London 1994, p. 264-265.

NITRIC ACID

What mordants they used is not described, but copper was etched with either nitric acid or a mixture of salts in strong vinegar only until the mid-19th century. It was known that etching was unhealthy. François Tiquet published a treatise with all kinds of art recipes in Antwerp in 1741. He describes the making of an etching for ladies of higher classes and also considers about their health: "And because the smell of the strong water may incommodate the Ladies, who as a pastime would like to engrave something themselves, they could have the strong water poured on by a house servant, and furthermore have windows and doors opened so that fresh air can come in."

Note: Tiquet, F., *Korte onderrigting en leer, van zeer fraaye geheymen*, Antwerpen 1741, p. 89.

ALTERNATIVES

The search for alternatives for the unhealthy nitric acid started in the 19th century. Karl Urban Keller describes in 1815 that, because of "the unhealthy acid" he went looking for other techniques. He developed a mechanical way of roughening plates with gritty matter.
Note: Keller, K.U., *Neue bisher noch unbekannte Art, den Tusch in Kupfer nachzuahmen, ohne irgend ein Aezmittel*, Stuttgart 1815, p. 6.

Of course he was right that the best way of avoiding unhealthy vapours is changing to mechanical means of working the plate, and scratching or roughening a printing plate has been invented again and again through the ages. But etching is attractive to printmakers and a lot of alternatives have been recommended in the 19th century, such as Dutch mordant, ferric chloride, copper sulphate & electrolytic etching.

DUTCH MORDANT

The German chemists Schwarz and Böhme published an article about etching of copper with a mixture of hydrochloric acid and potassium chlorate in water in 1848. This etching liquid was developed to corrode copper more regularly than nitric acid did, but they also remark that "the weak chlorine smell is not as unpleasant as the vapours coming from nitric acid".

Note: Schwarz, H., Böhme, R., "Neues Verfahren in Kupfer und Stahl zu", in: *Polytechnisches Journal 29* (1848), Bd. 109, pp. 313-314.

The avant guarde of 19th-century British etchers adopted this mordant, starting with Seymour Haden, because it was "not so disagreeable in odour as the old one". Mistakenly thinking it was used in Holland before, they called it "Dutch mordant", while actually "Dutch" should be read as "Deutsch", or German. When Hamerton says that the vapours rising from Dutch Mordant are less disagreeable, then it is only as far as the smell he observed. In mixing and etching with it chlorine gas is produced which is highly toxic.

Note: P.G. Hamerton, *The etcher's handbook*, 3rd ed., London, Boston (USA) 1881, p. 31.

FERRIC CHLORIDE

English William Fox Talbot, pioneer of photography, worried about the fading of his earliest photographic impressions. It is now understood that this was due to incomplete fixation. Fox Talbot wanted to solve this problem by making printing plates with the help of his negatives and print them with ink, because black printing ink does not discolour. He developed "Photoglyphic engraving", the forerunner of helio-engraving, in 1852. Six years later he patented an improved version in which he etched copper plates with ferric chloride, being safer than nitric acid: "it quickly effects an etching, and does this without disengaging bubbles of gas, or causing any smell, for which reason it is much more convenient to use than aquafortis (nitric acid)".

Note: Improvements in the art of engraving. Patented in London, by William Henry Fox Talbot, April 21, 1858", in: *Journal of the Franklin Institute ...etc.* 57 (1859), pp. 193-197.

The latest development in etching with ferric is the addition of citric acid. This is the so called "Edinburgh etch", named like that by its inventor Friedhard Kiekeben in 1997 when working at Edinburgh Printmakers studio. Addition of citric acid prevents formation of a sediment in the grooves, a well-known disadvantage that was before overcome in the printing industry by the addition of hydrochloric acid. Washing the plate with a mixture of vinegar and kitchen salt in water after etching has the same effect.

Etching copper in ferric chloride is safer than in nitric acid, because no toxic gases are produced. However, you still need to be careful as the salt solution is also a strong acid (pH 1.5). Ferric should not be used for etching zinc or aluminium, this makes the bath bubble vehemently with drops of the mordant going airborne.

Note: Friedhard Kiekeben, New etching chemistry in: Keith Howard, *The contemporary printmaker: intagliotype & acrylic resist etching*, Rochester NY 2003, pp. 182-189.

COPPER SULPHATE

Zinc can be safely etched in a solution of copper sulphate in water. The reaction is calm and stable, pH 3.5, the temperature of the bath does not increase during etching as it does with nitric and no toxic gases are produced. A minute amount of hydrogen gas is given off, but this is not aggressive. According to Eva Figueras Ferrer it seems that Goya already etched zinc plates with copper sulphate, but it became obsolete again.

Note: Friedhard Kiekeben, "Perfect chemistry", in: *Printmaking Today*, Vol. 13 (2004), no. 2 (Summer), p. 22-23.

Etching with copper sulphate was (re)invented simultaneously by Nik Semenoff in Canada and Cedric Green in France. Both published about it in 1998. Green called the mordant "Bordeaux Etch", because "a copper sulphate solution is better known to vine growers, farmers and gardeners as Bordeaux mixture (Bouillie Bordelaise)", and also because he lives in the neighbourhood of Bordeaux. Semenoff and later Kiekeben also explain that aluminium and steel can be etched in a mixture of copper sulphate and kitchen salt, which the latter calls "Saline etch".

Note: Nik Semenoff, L.W. Bader, 'Intaglio etching on aluminum and zinc using an improved mordant', in: *Leonardo* 31 (1998), p. 133-138. Cedric Green, *Green prints: a handbook on some new methods for safe intaglio etching and metal plate printmaking*, Sheffield 1998. Ad Stijnman, 'Kopersulfaat voor zink: veilig, makkelijk en goedkoop etsen' in: *kM* 31 (1999), p. 30-32. Kiekeben, ibid. both.

ELECTROLYTIC ETCHING

In 1839, the same year that the Daguerreotype patent was published, also the technique of "galvanizing" was published, that is covering objects with metal by means of electricity. By turning the poles in the galvanizing bath metal can be removed and so plates can be etched with electricity. G. Osann (1842) recommended it to scientists as a simple way of producing themselves the images going with their articles. It is a clean technique, in the sense that only hydrogen gas is given off during the process, and used by 19th-century professional engravers for both intaglio and relief plates. Nik Semenoff, followed by the Americans Marion and Omri Behr and later Cedric Green revived electrolytic etching in the 1990s. Chattock (1886), p. 42: "Electro-etching has the advantage of being free from the exhalation of any deleterious gas, but the apparatus required ... is more cumbrous, and the process itself more complicated than is the case with the ordinary methods of biting, and it does not appear to have been adopted for artistic work to any considerable extent." Probably for the same reason also now it fails to become popular.
Note: G.W. Osann, *Die Anwendung des hydroelektrischen Stromes als Aetzmittel*, Würzburg 1842. Richard Samuel Chattock, *Practical notes on etching*, 3rd ed., London 1886. Nik Semenoff, Christine Christos, "Using dry-copier toners and electro-etching on intaglio plates", in: *Leonardo*, vol. 24 (1991), no. 4, p. 389-394. O.M. Behr, M.R. Behr, Etching and tone creation using low-voltage anodic electrolysis, in: Leonardo, vol. 26 (1993), no. 1, p. 51-55. "Intaglio without tears, Cedric Green reassesses old electrolytic plate-making processes", in: *Printmaking Today*, vol. 7 (1998), nr. 1 (Spring), p. 25-27.

OTHER MORDANTS

More alternative mordants have been invented in the 19th and the 20th century, but most of them turned out to be unhealty or too expensive. The main line in this development is always to be able to do the same - corroding metal without unhealthy gasses or vapours getting airborne. From the print you can hardly see what chemical was used to bite the plate.

COLLAGRAPH

More effective to keep one's health is not to use an acid. The above-mentioned Keller already tells so and well-known are engraving, drypoint and mezzotint, all techniques for mechanically working the plate.

Another, presently popular manner is the "collagraph" technique. Norwegian artist Rolf Nesch started soldering bits of metal to a metal plate in order to create a relief, which he printed in intaglio, in the 1930s. After 1950 American printmakers started experimenting with pasting all kinds of materials to a base plate, while Glen Alps was the first to apply the term "collagraph" to these printing plates. French printmakers Henri Goetz and later Maurice Rousseau-Leurent developed "carborundum engraving". It is a kind of collagraph by which you paint with a mixture of glue and carborundum on a base plate and print it in intaglio.

They saw it as a technique next to the already existing techniques and not as to replace them. Safety was also not their issue, that notion was first expressed by Betty Winkler stating that "carborundum collagraph ... is non-toxic" (p. 1). The "non-toxic" is not completely true as volatile solvents evaporate from the glue in drying.

Note: John Ross, Clare Romano, *The complete printmaker*, New York: The Free Press; London: Collier-Macmillan, cop. 1972. Henri Goetz, *Gravure au carborundum, nouvelle technique de l'estampe en taille douce*, Paris 1969. Maurice Rousseau-Leurent, *La Gravure au carborundum - carborundum engraving* Villefranche-sur-mer 1991. Betty Winkler, *Carborundum collagraph printmaking*, New York 1995.

More sophisticated ways for creating printing plates by building up layers on a base plate are invented in the 19th century. A copper plate was painted by some substance, covered with graphite and next electro-plated. The whole could be printed in intaglio and was known under such names as 'electrotint', 'galvanography', Herkomer-type' or 'spongotype'. One wonders if these techniques will also be picked up and revived now, as they allow the painter a free hand of work & are quite safe to use.

Note: T. Sampson, *Electrotint*, London 1842. Cedric Green, *Green prints: a handbook on some new methods for safe intaglio etching and metal plate printmaking*, 4th ed., Sheffield 1999, p. 46 referring to Charles V. Walker, *Electrotype manipulation part 2*, 19th ed., London 1855, paragraph 173. Hubert Herkomer, *Etching and mezzotint engraving*, London, New York 1892, p. 106.

ACRYLIC GROUNDS

The classical etching ground is a mixture of pine-resin, asphaltum and bees-wax. It is shaped into balls, cakes or rods, hence its name "ball ground". For use the printing plate is heated, a little ground is melted onto it and spread over the plate with a feather, a dabber or a roller. It is also possible to dissolve this ground in a volatile solvent, after evaporation the ground is solid. The vapours of the solvents released in drying are harmful to brains and nerve system, see the paragraph on VCA.

One of the forerunners in the development of acrylic etching grounds is the American Mark Zaffron around 1995. Others experimented with commercially available acrylic binders, floor varnishes and acrylic relief printing inks. The idea behind using acrylic grounds is not exactly clear. It is said that they replace liquid classical ground with their aggressive volatile solvents. Another argument is that the asphaltum in the classical gorund is carcinogenic. So it is, if you eat it or rub your skin with it regularly. But when rolling up ball ground onto a heated plate it should not smoke or burn, melting is enough and that is harmless. The other way around, liquid acrylic grounds contain a few percent of paint thinner and ammonia. These evaporate during drying and even more when the grounds are "baked" to harden them. Only few people comment on that, most people seem to take for granted that acrylics are "safe", which they are not.

Note: Mark Zaffron, Zacryl etching systems. New materials for safe intaglio printmaking, in: *Printmaking today* 5 (1996), No. 1 (Spring), pp. 27. For acrylics see the books in the list of reference literature.

PHOTOPOLYMER FILMS

Mark Zaffron began experimenting with light sensitive polymer films which were used in the production of computerchips in 1993. The films are stuck on a surface, such as a copper or zinc plate, exposed and thereafter the non-hardened parts are washed out. The film stays on the plate and can be printed in relief or intaglio.

Australian Keith Howard had been working on less toxic light sensitive films for printing plates. He and Zaffron contacted in 1994, and Zaffron explained about light-sensitive polymer films. Howard immediately began experimenting with them. The first type was called "ImageOn" and was still toxic, later thinner and more sensitive foils were developed ("ImageOn Ultra", "Photec", "Blue Shot"). Basically, impressions from these films are reproductions of the negatives or positives with which they are produced. However, it is also possible to work directly into the film, which gives typical effects. Further etching of the metal support is also possible.

Note: Mark Zaffron, 'Photopolymer films; a safer & more versatile photo-resist for intaglio', in: *California printmaker*, (1995) (April), p. (...). Keith Howard, *The contemporary printmaker: intaglio-type & acrylic resist etching*, Rochester NY 2003. Henrik Bøegh, *Handbook of non-toxic intaglio : acrylic resists, photopolymer film & solar plates, etching,* Copenhagen 2003.

PHOTOPOLYMER PLATES

Parallel to the photopolymer films is the development of the photo-polymer plates. Flexography plates covered with light-sensitive polymer layers which could be washed out with water were available from around 1980. American Dan Welden started experimenting with these kinds of plates for use in intaglio printing then. He introduced them in Australia in 1992 where they were coined "solarplates". Simultaneously Danish printmaker Eli Ponsaing started working with another type of photopolymer plate. Both types can be printed as an etching, but also as a lithograph. Planographic printing, but then without water, is possible because the silicons repel oil-based ink. See the paragraph on Lithography.

Photopolymers do not produce unhealthy vapours, but care should be taken not to touch the material with bare hands, as they contain reactive chemicals. Scratching or gouging lines into these plates allow for additional structures.

Note: Eli Ponsaig, 'Photopolymer printing plates', in: *Printmaking Today* 4 (1995), p. 33. Dianne Longley, Pauline Muir, 'Solarplate printmaking', in: *Printmaking Today*, vol. 5 (1996), No. 4 (Winter). Taneli Eskola, Kari Holopainen, *Gravure. Polymer photogravure, a new method for photographers and graphic artists*, Helsinki 1996. Dan Welden, Pauline Muir, *Printmaking in the Sun: an artist's guide to making professional-quality prints using the solarplate method*, New York 1997. Dianne Longley, *Printmaking with photopolymer plates: a new, safe, versatile printmaking technique for artists and students*, Adelaide 1998. Carla Neis, 'Chemical reactions [letter to the editor]', in: *Printmaking Today*, vol. 12 (2003), No. 4 (Winter), p. 4.

LITHOGRAPHY

Silicons repelling oil-based inks was also used to effect by Nik Semenoff when he invented "waterless lithography" in the early 1990s. He manually covers his plates with a layer of silicon polymer, inks and prints the images as a lithograph, but no water is needed. Semenoff uses an emulsion ink he produces himself, which dissolves in water. This allows for a clean-up of plates and tools with water only. Other planographic kinds of plate materials, such as Pronto plates are becoming available gradually.

Note: Nik Semenoff, 'Waterless lithography', in: *Printmaking Today*, vol. 4 (1995), nr. 1 (Spring), p. 22-24, nr. 2 (Summer), p. 26-27, nr. 3 (Autumn), p. 26-29, nr. 4 (Winter), p. 32-33. George F. Roberts, 'Non-toxic polyester plate lithography', in: *Printmaking Today*, vol. 7 (1998), nr. 3 (Autumn), p. 28-29.

Lithographic stones and plates are cleaned with a Vegetable Cleaning Agent in studios in the Netherlands, Germany, Canada and the USA. See the paragraph on VCA. VCA is an non-volatile alternative for lithothine and similar solvents. Cleaning lithographic stones and plates with VCA goes exactly the same as with traditional solvents. Advantages are that VCA is not volatile and fouling of the stone does not happen. This allows for classical lithography, but without volatile solvents.

Note: Sytze Folkertsma, Peter Sincovitz and Ad Stijnman, 'Cleaning printing plates and brushes with VCA', in: *Printmaking Today*, vol. 5 (1996), nr. 1 (Spring), p. 25-26.

SCREENPRINTING

Most screenprinting inks are waterbased now. Developed in the 1970s they have been commercially available since around 1980. Waterbased screenprinting inks contain a small percentage of volatile organic solvents, so exhaust hoods, strong ventilation and goggles are necessary during printing. The inks can be mixed with acrylic paint, or you can print with acrylic paint mixed with a retarder. "Solvent-inks" are still used for printing plastics or thin paper, which is not possible with water-based inks.

Printmakers also sometimes use UV-inks. Their advantages are that they do not contain volatile solvents and dry slower or not at all, allowing for printing sharp details in edition. Disadvantage is that for drying the impressions, strong ultra violet radiation is needed. The printing industry uses drying tunnels through which the printed material is moved. A small drying machine may be used in a studio. This, however, always leaks ionised air and UV radiation, both being rather unhealthy for the pirntmaker, while UV degrades paper and colours.

Cleaning of the screens can be done with mild lyes, low-volatile paint thinners, and there are esters which probably do not produce harmful vapours. The most artistic innovations are that waterbased inks can print sharper details and thinner layers than solvent inks. Because waterbased inks are more liquid and dry slower the mesh of the screen can be finer.

Note: Robert Adam, Carol Robertson, *Screenprinting, the complete water-based system*, London 2003.

PRINTING INKS

Some remarks have been made about printing inks in the above paragraphs, such as Semenoff's emulsion inks for lithography, the waterbased and UV inks for screenprinting. Waterbased relief printing inks are already used in the 8th century in China and oil-based printing inks for printing textile from woodblocks developed in Europe from the 12th century. Still, inks made with gelatine as a binder kept being used for printing woodblocks by dominotiers and water-based relief printing inks have always been in use. Story goes that the earliest engravings were printed with water-based inks, but details fail.

The base of relief, intaglio and lithographic printing inks has always been linseed oil varnish ground with pigment. Cleaning them off typeface was done with boiling lye, cleaning copper plates was done by rubbing the plates with olive oil and running them through the press once more to get the ink out of the grooves and rubbing them with bread crumbs. Alois Senefelder, inventor of lithography, used turpentine. This lasted until about the mid-19th century. Turpentine was produced in large quantities in North Carolina, USA, then, due to which it became cheap enough to be used for cleaning. The American Civil War (1861-1865) interupted the trade, prices increased and alternatives were found derived from mineral oils, which kept being in use since then.

Note: [Short editorial on Naphta from mineral oil], in: *Laurens Coster*, vol. 4 (1861), p. 371.

In industrial intaglio printing volatile solvents were introduced in the inks to increase drying time. For economic and health reasons alternatives for these "evil smelling inks" were sought by developing water-based inks by the German printing ink firm Hartmann, shortly before 1914. Results were poor and there was no continuation.

Note: *Druckfarben : ihre Erzeugung und Verwendung*, Ammendorf bei Halle-Saale 1914.

Eighty years later new attempts were made for manual intaglio printing ink ('Createx', 'Green Drop'), but results were not particularly convincing. Akua-Kolor, New York, producers of water-based monotype inks, supply their water-based intaglio inks since 2001. These are especially developed for the printing of polymer films and plates. The pigments in these inks are very fine grained and the binder is an oil emulsified with a gum in water. It prints the shallow structures of polymer films well, but gives a lot of plate tone with metal plates. After printing the plates can be cleaned with water and detergent.

Disadvantages are that after some months the originally paste-like ink in the can turns liquid. This is because the emulsion falls apart, the gum-water separating from the oil, a common phenomenon with

emulsions. At the bottom of the can there is a layer of thick matter while on top floats a semi-transparant liquid. This ink does not dry by oxidation, as do the inks made from linseed-oil varnish, but because the binder bleeds into the paper. With thicker ink layers this causes the formation of halos around the ink turning yellow-brown in days. Note: tests by Ad Stijnman.

VCA

The biggest problem in printmaking is the deterioration of brain and nerve system by the vapours of volatile organic solvents. These are present in liquid etching grounds, screenprinting inks, metal polish, lacquer paints, glues and, of course, clean up solvents. By chronic or long term exposure they can cause an array of illnesses called Organic Psycho Syndrome (OPS). It is commonly known as "Painter's Disease", because it often occurs with house painters, but also with employees in the printing industry. It is an accepted complaint in Scandinavia and the Netherlands, and measurements have been taken to improve working conditions. Simple precautions, such as taping the back of your printing plate in stead of varnishing it, limits the use of solvents. But, again, it is safer to tackle the problem at the source.

The Danish offset-printing industry began cleaning plates and machines with Vegetable Cleaning Agents (VCA) in 1989 in order to improve indoor air conditions. The use of VCA in the printmaking industry was further supported and propagated by the European Union in the 'Subsprint Project'. Every EU member, except France, partook in the project. VCA was picked up by Dutch printmakers in 1994 and thereafter its use spread over workshops throughout Europe, Canada, the USA, Japan and Australia.

VCA is a generic name of a group of esters, chemical compounds of a vegetable oil and an alcohol. Properties vary depending on the kinds of oil and alcohol, and the additives. Its virtue is that is is not volatile while it has the same cleaning properties as white spirit and the like. After cleaning with VCA the object needs a further cleaning with some water and soap. Though not volatile one needs to wear rubber gloves during cleaning as it is not kind to the skin.
Note: Sytze Folkertsma, Peter Sincovitz and Ad Stijnman, 'Cleaning printing plates and brushes with VCA', in: *Printmaking Today*, vol. 5 (1996), nr. 1 (Spring), p. 25-26.

1989 - PRESENT

The past fifteen years saw a giant leap ahead in the awareness of health aspects in printmaking and an enormous development of safer printmaking materials, while a lot of safer materials are easily available now. Printmaking studios have changed their equipment and offer educational programs aimed at working with safer procedures. Awareness is still growing, but can be hindered by the costs of certain products. Inexperienced students with limited funds may be tempted to fall back on the use of volatile solvents and nitric acid again, because these are cheaper. Another issue is that the availability of certain alternatives is at the will of producers and suppliers, if certain materials do not make enough money, production and supply will stop. On the whole the printmaking world in Europe, Northern America and Australia has seen a shift towards safer materials and techniques in printmaking since 1995. Studios in other parts of the world are following.

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Cedric Green's website - with his safer printmaking techniques.
Nik Semenoff's website - with his safer printmaking techniques.
www.verenigingops.nl - information about OPS.