



Fluorosolvent Cleaning Solutions vs. Traditional Metal Cleaning Solvents

Your Dreams, Our Challenge

Many metal parts and components need to be cleaned and degreased before they are assembled or shipped. All contaminants need to be removed, including dirt, oil, fingerprints, solder paste residue and electronics flux.

When these parts are used for high-value electronics or other intricate or critical components, it becomes challenging to clean them effectively without using aggressive chemicals. Harsh solvents like n-propyl bromide (nPB or 1-BP) and trichloroethylene (TCE) clean metals effectively, but they have a pungent smell, are too aggressive for many plastics, and are harsh to workers and the environment.

Because of this, nPB and TCE are being phased out. Regulatory authorities around the world are sunseting these materials. The European Union has already sunset TCE in vapor degreasing and nPB is scheduled to be sunset in 2020. The American EPA requires use reporting paperwork signed by senior management in order to use these chemicals. Because of this scrutiny, it now costs more to work with and dispose of chemicals like nPB and TCE.

Fluorosolvent cleaners were developed to provide safer precision cleaners. They are ideal cleaners for high-value electronics and critical metal components because they have a favorable toxicity profile and less environmental impact than other types of solvents. They can effectively replace nPB and chlorinated solvents used in vapor degreasers or immersion systems.

nPB Safety Regulations

- European Union sunset: 2020
- OSHA/NIOSH Hazard Alert
- EPA top 10 chemicals to undergo risk evaluation
- EPA requires use reporting
- Department of Defense Emerging Risk Alert
- American Conference of Governmental Industrial Hygienists (ACGIH) lowered nPB exposure guideline to 0.1 ppm
- ACGIH reclassified nPB as A3: Confirmed Animal Carcinogen with Unknown Relevance to Humans

This ebook answers some common questions about fluorosolvent cleaning solutions.

What materials are compatible with fluorosolvent cleaners?

Fluorosolvents clean effectively without harming most substrates including metals, plastics, polyurethanes and fluoroelastomers. They also exhibit very low surface tension, which contributes to good surface wetting and superior cleaning of intricate and delicate parts. For example, testing shows virtually no deterioration of PVC, PTFE, ABS and HDPE after a 2-week submersion. They are compatible with aluminum, stainless steel, cold rolled steel, copper and galvanized steel.

	Fluorosolvents	nPB	TCE	Aqueous
Metal	●	●	●	●
PVC	●	●	●	●
LDPE	●	●	○	●
HDPE	●	●	●	●
PPO	●	●	○	●
ABS	●	○	○	●
Nylon	●	●	●	●
PET	●	●	●	●
Polysulfide Rubber	●	●	●	●
Natural Rubber	●	●	●	●
Urethane Rubber	●	●	●	●
Isoprene	●	●	●	●
Silicone Rubber	●	●	●	●
Nitrile Rubber	●	●	●	●
EPDM	●	●	●	●

Performance Key: ● Good ● Fair ● Poor ● Worse ○ Dissolved

How do fluorosolvents perform in the vapor degreasing process compared with TCE and nPB?

Fluorosolvents are very stable when used in a vapor degreaser. By contrast, TCE becomes acidic when it comes in contact with water and contaminants. This can lead to rework and expensive repairs. In addition, when using TCE, personnel have to monitor the pH and use pH control additives. Lastly, more energy is required for heating when using nPB and TCE because the boiling point for fluorosolvents is around 50 °C versus 70 °C for nPB and 87 °C for TCE.

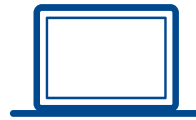
Which industries are ideal for fluorosolvent cleaners?



Aerospace



Medical



Electronics



Optics

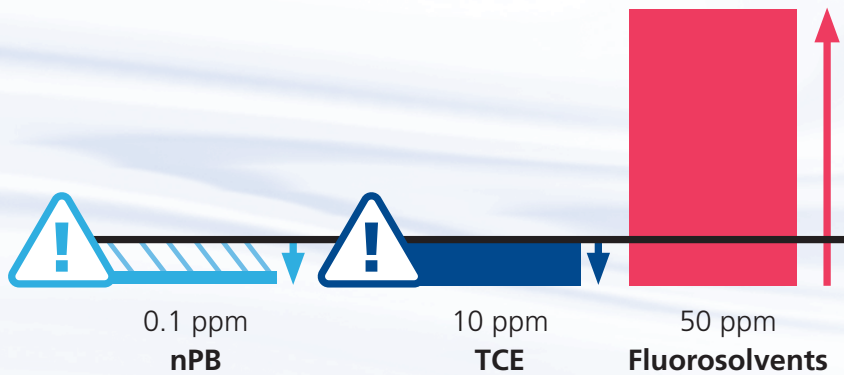


High-end consumer goods



Military

Exposure Guideline for Solvent Cleaners



Molar weighted average of the component 8-hour threshold limit values

What makes fluorosolvents safer to workers than other conventional cleaners?

It is extremely important to consider the effect on personnel who come in contact with cleaning solutions. Fluorosolvents are much less toxic to the workers handling them than nPB and TCE. In order to use nPB safely in vapor degreasing applications, companies need to reduce worker exposure levels to at least 0.1 ppm. To use TCE, they must reduce exposure levels to 10 ppm. Reducing exposure to such levels is cost prohibitive because it may require respiratory protection and special equipment like enclosures and ventilation systems.

In addition, fluorosolvent cleaners don't create a fire hazard. nPB and TCE do not have flash points but do have upper and lower flammability limits in the vapor phase, so these solvents are generally not suitable for use in conditions where there may be direct contact with liquid, pure oxygen or an external source of ignition. In contrast, fluorosolvents like HFEs and HFCs have no flash point or flammability limits, so explosion-proof equipment is not required. In addition, fluorosolvents can be recycled with distillation.

Health Risks from Exposure to nPB

- Lung cancer
- Kidney toxicity
- Liver toxicity
- Reproductive toxicity
- Neurotoxicity

Do fluorosolvents cost more than traditional solvents?

Though the purchase price is higher, fluorosolvents can be more cost-effective because of the following:

- Less solvent is used.
 - Fluorosolvent grades have low surface tension, improved wetting characteristics and reduced drag-out loss.
 - Fluorosolvents can often be recovered via distillation or carbon recovery.
- Less energy is used in the cleaning process.
- Residues don't have to be removed after the cleaning process.

A cost-benefit analysis is recommended to evaluate the true cost of changing cleaners.



Cost Considerations when Switching to Fluorosolvent Cleaning

- No capital cost required because existing vapor degreasing equipment can be used
- No floor plan changes necessary
- Process doesn't require additional labor
- Lower energy consumption
- Decreased environmental reporting and permitting
- Reduced liability or insurance costs

Fluorosolvents vs. Traditional Solvent Cleaners

	Fluorosolvents	nPB	TCE
Low toxicity	✓		
Don't have a strong, foul odor	✓		
Nonflammable	✓	✓	✓
Compatible with metals	✓	✓	✓
Compatible with plastics	✓		
EPA doesn't require a use report	✓		
Not scheduled for phase-out	✓		
Not being evaluated by EPA for risk assessment	✓		
Remains stable during vapor degreasing	✓		
Doesn't require additional energy for heating	✓		
Exempt from VOCs	✓		
Fast drying	✓		
Low surface tension	✓		



What makes fluorosolvents safer to the environment than conventional solvents?

AGC has studied the environmental impact of fluorosolvents, and test results show that they have a very low global warming potential (GWP) and little to no ozone depletion. In fact, fluorosolvents create less ground-level ozone or smog than ethane.

Are fluorosolvents considered sustainable technology?

Yes. Fluorosolvents can help your company's efforts to reduce greenhouse gas emissions and environmental impact. They are classified by the EPA as non-VOC, so you don't need to use incineration equipment to control ground-level ozone.

AGC AsahiKlin™ and AMOLEA™ fluorosolvents are ideal replacements for nPB and TCE in critical cleaning applications. They are manufactured by AGC Chemicals Americas, a wholly owned subsidiary of AGC Inc., a \$13.6 billion multinational corporation. Headquartered in Exton, PA, including a state-of-the-art technology center, AGCCA maintains manufacturing operations in nearby Thorndale, PA, a satellite sales office in São Paulo, Brazil, and warehouses and distributors located throughout North America.



To learn more about fluorosolvents or for help determining the right grade for your application, **visit agcchem.com or contact an AGC product expert at 1-800-424-7833.**



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