Novec 1230 (FK 5-1-12) clean agent **01/20/2025**

The AES Story of why the Thermal Runaway System works and is safe:

Definition of Clean Agent - that it has no ozone depletion potential and evaporates quickly and doesn't mess up equipment. ***(Pretty limited scope of clean?)***

Novec 1230 does not burn; it is a fire extinguishing agent designed to suppress flames by removing heat from a fire, meaning it is specifically formulated to not combust itself. [1]

Key points about Novec 1230:

- Function: It works by rapidly vaporizing when released, effectively cooling the fire and extinguishing it.
- Clean agent: Considered a "clean agent" because it leaves no residue after extinguishing a fire, making it suitable for sensitive equipment.
- Environmental impact: Has a low global warming potential compared to older fire suppression agents.

AES stops the story here.

The rest of the story:

NOVEC 1230 decomposes at temperatures more than 500°C (932°F) and it is therefore important to avoid applications involving hazards where continuously hot surfaces are involved. Upon exposure to the flame, NOVEC 1230 will decompose to halogen acids.[2]

Key points about Novec 1230 decomposition:

- High temperature trigger: Decomposition primarily occurs at very high temperatures, exceeding 500°C.
- Fire exposure: When discharged onto a flame, Novec 1230 can decompose due to the intense heat.
- Decomposition products: The main concern is the creation of halogen acids as byproducts of decomposition.
- Rapid discharge importance: To minimize decomposition products, Novec 1230 should be discharged quickly to extinguish a fire rapidly.

Examples of halogen acids

- Hydrofluoric acid (HF): A weak acid that dissolves easily in water
- Hydrochloric acid (HCl): A halogen acid formed when halogen acid gases react with hydrogen
- Hydrobromic acid (HBr): A halogen acid formed when halogen acid gases react with hydrogen
- Hydroiodic acid (HI): The strongest halogen acid because iodine is the least electronegative halogen

This is possibly what happened at the latest Moss Landing Fire. It appeared the fire was being controlled by the Fire Suppression System. Reignition occurred with already hot surfaces, any subsequent Novec 1230 would then have decomposed as opposed to vaporize.

Hydrofluoric acid (HF) toxicity can cause severe burns, tissue damage, and organ failure, and can be fatal. The severity of the effects depends on the concentration of the acid, the duration and size of exposure, and the area of the body affected. [3]

HF (hydrogen fluoride) is not flammable; it is considered a non-flammable gas, meaning it will not burn under typical fire conditions. [4]

Key points about HF:

- Non-combustible: HF does not ignite easily and is classified as non-combustible.
- Corrosive hazard: While not flammable, HF is highly corrosive and can cause severe burns upon contact with skin.
- Potential for hazardous reactions: When exposed to certain metals, HF can generate flammable hydrogen gas.

One often used scenario suggesting limited ability to pollute is that any toxic components would be consumed in a fire. However, HF is not flammable.

Here is how HF combines with the external cooling spray and enters the environment as ground water pollution. HF condenses out of the flame plume when cooling water reduces the temperature of the plume to the point that the HF becomes a liquid.

HF (Hydrogen Fluoride) can be a liquid, specifically a colorless, fuming liquid at lower temperatures, while at higher temperatures it exists as a gas; it is considered a corrosive and highly hazardous substance. [5]

Key points about HF as a liquid:

- Hydrogen bonding: The ability of HF to form strong hydrogen bonds allows it to exist as a liquid at room temperature, unlike other hydrogen halides like HCl which are gases.
- Appearance: Liquid HF is clear and colorless with a strong, irritating odor.
- Temperature dependence: Below its boiling point, HF is a liquid, but above that point it becomes a gas.

Hydrogen Fluoride (HF) is lighter than air. While the gas itself is lighter than air, under certain conditions, a cloud of vapor or aerosol from HF can appear heavier than air due to its potential to form a heavier mist when released. [6]

Key points about HF and air density:

- Density comparison: HF has a lower density than air, meaning it will rise when released.
- Vapor formation: Although the gas is lighter, the vapors produced from HF can sometimes be heavier than air, creating a potentially hazardous situation.
- Important consideration: When handling HF, always take proper safety precautions due to its corrosive nature, even though it is lighter than air.

HF is combined with the water and water vapor of the cooling spray and becomes heavier than air and settles to the ground with the water or settles into lower regions of the area as combined with water vapor.

Sources:

[1] https://blog.koorsen.com/what-is-novec-1230#

[2] https://www.suppression.com/catalog/suppression/clean-agent-suppression/novec-1230/kidde-novec-fk-5-1-12#

[3] https://www.ncbi.nlm.nih.gov/books/NBK441829/#

[4] https://cameochemicals.noaa.gov/chemical/2013#

[5] https://www.cdc.gov/chemical-emergencies/chemical-fact-sheets/hydrogen-fluoride.html

[6] **https://www.ivhhn.org/information/information-different-volcanic-gases/hydrogen-fluoride#**