

Industrial Air Purification

# FRIDGE RECYCLING



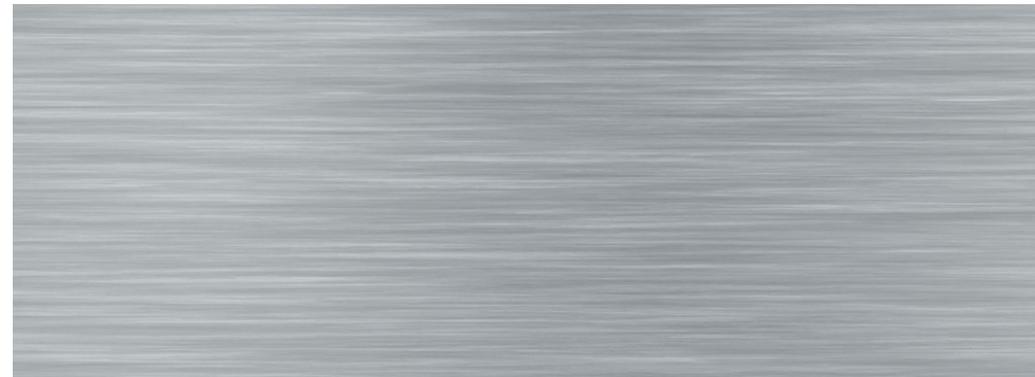
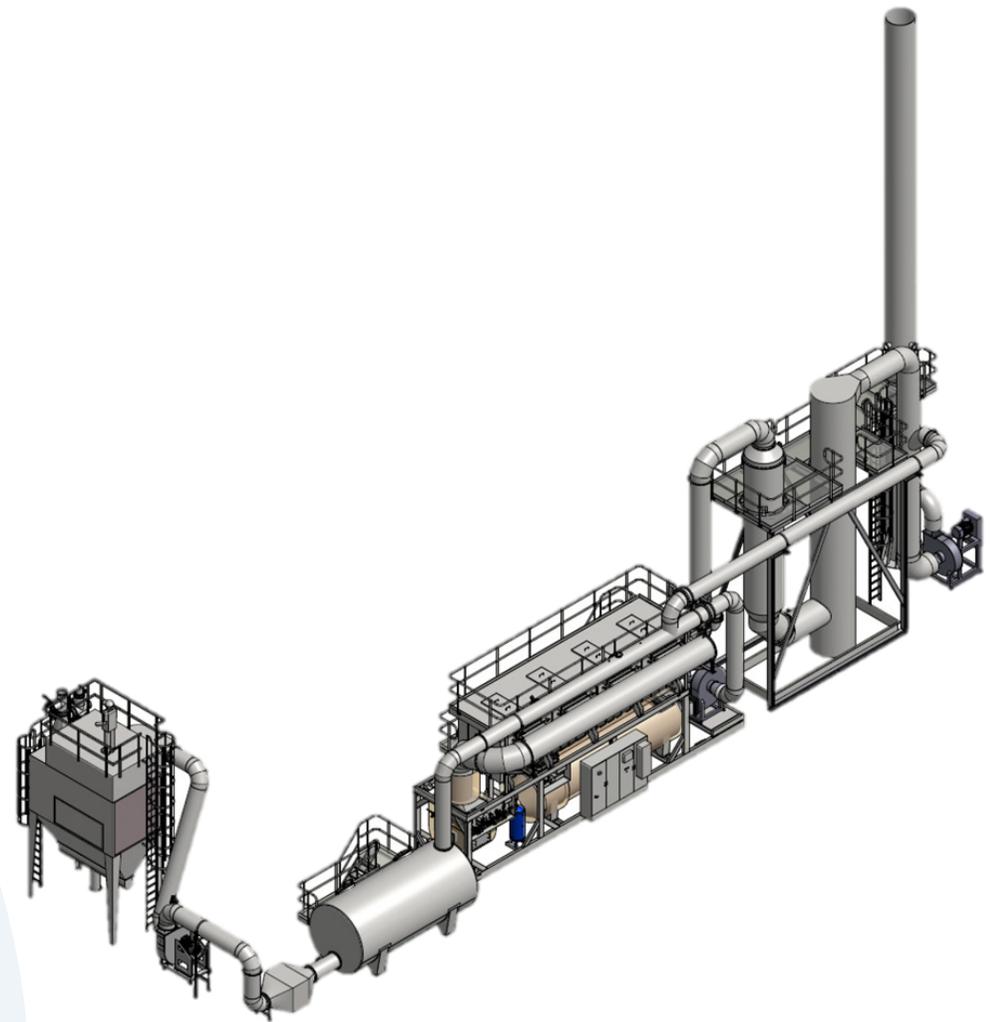
Purification of all CFC / HCFC / HFC / VOC

## Purification of Emissions from Fridge Recycling Process

The combined CFC / Pentane abatement plant provides a favourable and economical total air purification solution for onsite recovery and instantaneous destruction of all CFC and hydrocarbon gas emissions.

Thus, treating all refrigerant gases as released into the contained process air extraction system, both from stage 1 (compressors), and from stage 2, with various other separating and shredding steps of the fridge defragmenting process. Hence, improving general operating environment, while eliminating the need to transfer refrigerant as hazardous waste for external destruction or disposal of liquid waste formed, and consequently operating costs.

The mixture of refrigerants used as blowing agent released during the mechanical shredding and pulverisation of the fridge freezer units are completely extracted into confined air stream and purified to within European and international standards for air emission limits.

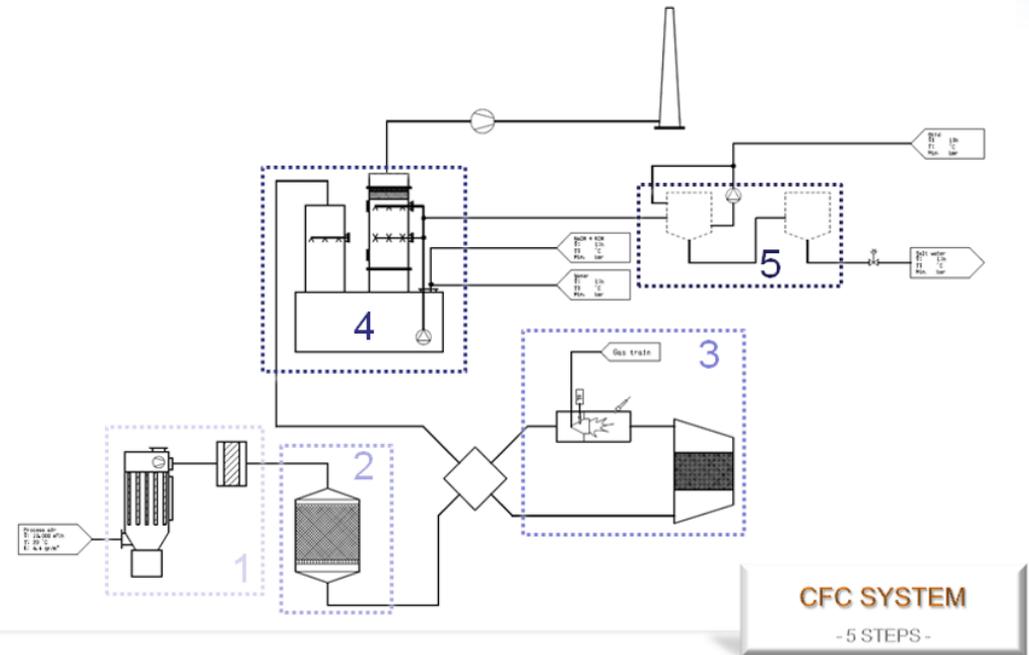


The extraction blowers delivering the exhaust fumes from the various stages of the mechanical pulverisation process maintain the airflow movement through the plant. This ensures that purification plant is continuously operating under negative pressure; thus ensure higher capture of all gas released and avoid fugitive leaks and emissions to the operating area.

The whole abatement plant is supervised and operated from a dedicated control cabinet and PLC with touch operating panel, complete with all safety features for monitoring, trending and recording recovery of gas and performance.

The LESNI plant includes 5 separate stages to control peaks and eliminate various pollutants:

1. **Dust Filter**
2. **Adsorber**
3. **Catalytic Abator**
4. **Chemical Scrubber**
5. **Neutralization of Waste Water**



The image shows a large industrial facility with several tall, cylindrical stainless steel tanks and a complex network of pipes and walkways. The tanks are supported by metal frames. In the foreground, a large horizontal pipe is visible, with the brand name 'LESNI' printed on it. The background shows more industrial equipment and a high ceiling with structural beams. A semi-transparent blue box with white text is overlaid on the upper right portion of the image.

This well proven and developed solution has been successfully in operation for more than 15 years, where LESNI CFC Catalytic Abatement Plant is used to purify all exhaust air containing ODS (OZONE DEPLETING SUBSTANCES) such as Freon 11 & Freon 12, Pentane and Isobutene from recycling of fridge freezers.

## Dust Filter

Pulse jet filter and cartridge filters are used to collect any duct particles and prevent foam from accessing the other parts of the abatement plant.

## Adsorber

Selected media is used to dampen gas peaks and remove heavy metals.

## Catalytic Abator

For this process, the selective catalyst encourages thermal oxidation of refrigerants such as Freon 11 and 12 as well as hydrocarbons such as Pentane and Isobutane used in modern fridges at low operating temperature.

While oxidation of VOC normally converts hydrocarbons into  $\text{CO}_2$  and  $\text{H}_2\text{O}$  in the gas phase; for CFC, HFC and HCFC refrigerant compounds, the selective catalyst used facilitate certain primary reactions on the chemical active surface to occur than direct oxidation in the gas phase, which partly is due to the high surface area and high number of internal pores of the catalyst.

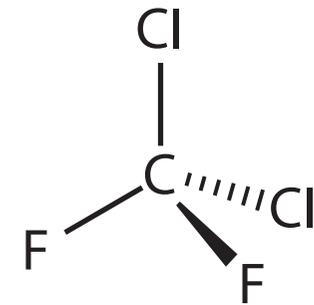
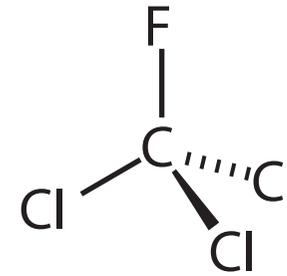
So in order to get the refrigerant oxidized, the refrigerant must first diffuse from the gas phase into the pores of the catalyst, on which they will adsorb, followed by a reaction with oxygen on a active site and finally desorption and diffusion back into the gas phase. This thermal cracking of the pollutants completes the conversion of fluoride and chloride ions selectively to HF and HCl gas.



The carrier exhaust air extracts from the shredding, separation and pulverisation stages are introduced through a recuperative heat recovering system where the heat is supplied by the already cleaned air, before going into the catalytic chamber. Heater is used for preheating the process air to achieve the set controlled temperature for the purification process above.

The LESNI catalytic plant system for decomposing CFC and HCFC from the fridge recycling process was specifically developed so that a very high degree of safety and purification is achieved.

Once the inorganic gases CFC (Freon 11, 12 etc.) and other HCFC have been selectively converted in the catalytic abator, according to the chemical reactions below, the acid gases generated are treated in the next step of the LESNI purification process.



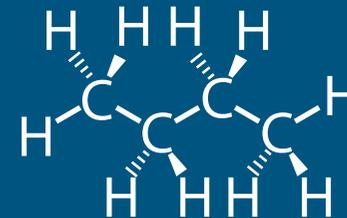
### Example for Freon 11



### Example for Freon 12



### Example for Pentane



## Chemical Scrubber

The chemical scrubber downstream of the catalytic abator placed to neutralise the acid exhaust generated before discharging to atmosphere.

The scrubber will treat the inorganic gases that formed in the previous step such as HCl and HF. The gases are initially cooled in a quenching tower and then absorbed and neutralised in the absorption column. The scrubber liquid will be kept alkaline and the gases together with the NaOH form soluble salt products.

When the concentration of salt reaches a certain level, the controller will desalt the scrubber tank and refresh the liquid by adding water and caustic soda automatically.

## Neutralisation of Waste Water

The waste water/salt mix generated from previous step is then neutralized in the final step before permitting discharge of the final salt solution effluent to the drains or sewers depending on local authorities and demands.





Air purification by physical and chemical scrubbers



Activated carbon plants for VOC purification, odour removal and solvent recovery



Air purification systems for removing mist, dust and particulate matter



Safe and efficient catalytic and thermal oxidisers for VOC purification and solvent destruction



LESNI has developed a variety of innovative solutions for specific pollutants and processes in operation worldwide



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