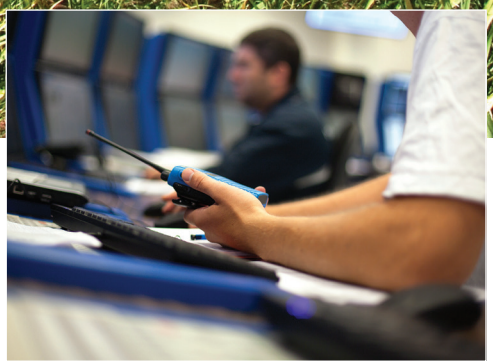


THE WORLD LEADER IN CLEAN AIR SOLUTIONS



Corrosion Control for Control Rooms & Process Control Environments

AIRBORNE PARTICULATE AND GASEOUS CONTAMINANT SOLUTIONS

AAF has an in-depth understanding of the filtration challenges for control rooms and process control environments. This understanding and technical ability makes AAF the preferred partner in protecting and maintaining high process efficiency.

Corrosion Control—Control Rooms & Process Control Environments

AAF understands the need to provide gas-phase and particulate filtration systems for process control environments. Employing such systems can:

- Eliminate process shutdown due to control equipment failures
- Maintain high process efficiency
- Extend circuit board life and reduce replacement cost

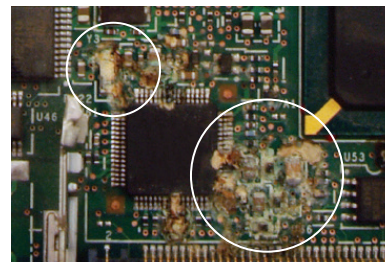
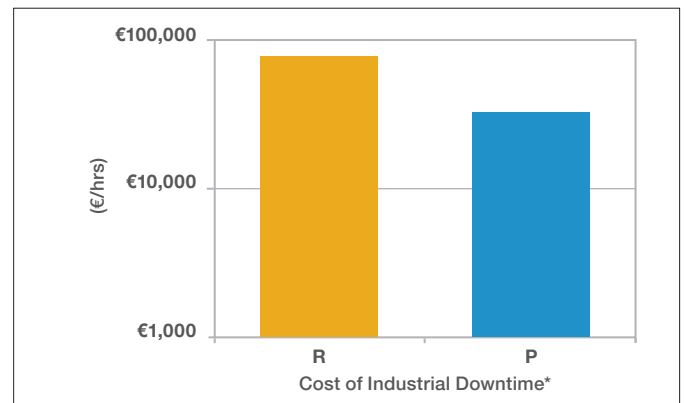
Control rooms are utilized by large-scale industrial plants to monitor and control plant operations. Examples of such plants are geothermal power plants, petrochemical refineries, and pulp and paper plants. The control room and network of control equipment are essential to plant operation and enable the plant to maintain the highest efficiency possible. If the control room malfunctions, it can cost a plant tens of thousands of dollars per hour (see Cost of Industrial Downtime chart).

Corrosive gases in industrial environments (ammonia, chlorine, hydrogen sulfide, mercaptans, nitrogen oxides, sulfur oxides) can cause corrosion of control equipment circuitry, as shown in the circuit board picture on the right. Corrosion products form random circuit paths and nonconductive layers, which result in false signals and loss of process control.

In response to these problems, ISA (Instrumentation, Systems, and Automation Society) developed a standard to classify control rooms and process control environments—ISA 71.04. Most equipment manufacturers require that the control room environment meet the ISA G1—Mild classification to maintain a reliable communication network in industrial environments (see ISA classification scheme below). The only way to meet this requirement in many industrial environments is to protect the control room with gas-phase and particulate filtration.



Control Room



Corrosion Formed on Circuit Board Components

ISA-71.04-2013 Classification Scheme

Classification	Copper Angstroms /30 days	Silver Angstroms /30 days	Reliability Statement Summary
G1 Mild	< 300	< 200	Sufficiently well controlled
G2 Moderate	< 1000	< 1000	Effects of corrosion are measurable
G3 Harsh	< 2000	< 2000	High probability that corrosive attack will occur
GX Severe	≥ 2000	≥ 2000	Only specially designed and packaged equipment would be expected to survive

*R = Refinery; P = Pulp and Paper Mill; Assumptions – European styrene production; 446,000 tons/yr; 24/7 operation; €1,253/ton. 4.78 M tonnes of pulp/46 days; 24/7 operation; Pulp price of €554/ton.

Clean Air Technology

Optimize Your Environment

Protection of an industrial control room includes, at a minimum, pressurization with purified air. This prevents corrosive gases from infiltrating the control room and causing corrosion problems. Additionally, recirculation air may require cleaning, if the room is a high traffic area or there are other internal sources of contaminants.

Proper filter selection and maintenance is essential to keeping HVAC systems operating effectively and efficiently. There are multiple facets of the filter and the system it's installed in that must be taken into consideration. These considerations include system airspeed, fan efficiency, filter resistance, service life, efficiency, and cost.

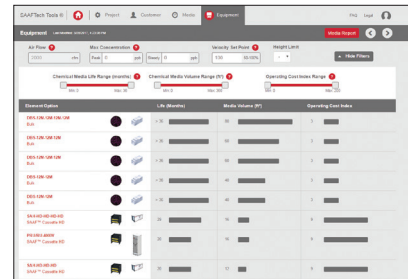
In considering the Total Cost of Ownership (TCO), it is important to keep in mind that in order to have a cost-effective building, planning maintenance is an important step in maintaining energy efficiency, minimizing costly downtime, and extending the lifespan of your equipment.

Comprehensive Purchase Perspective

Selecting the proper filtration for your HVAC system can help your facility to reduce spend, decrease risk, and save time. Control room and process control environment managers need the support of a trusted advisor who can perform Air Filtration Audits and Diagnostics to ensure that the most optimal effective solution is selected and installed in their air filtration systems.

SAAF™ Tech Tools

SAAF Tech Tools is a decision-sciences software for configuring clean air products to remove airborne gaseous contaminants. Using SAAF Tech Tools, AAF experts can enter application specific data or select from a list of predefined applications to configure the exact clean air solution required for our customers. Detailed information on contaminants, adsorbers, oxidants, and links to industry information relevant to specific applications is also readily available.

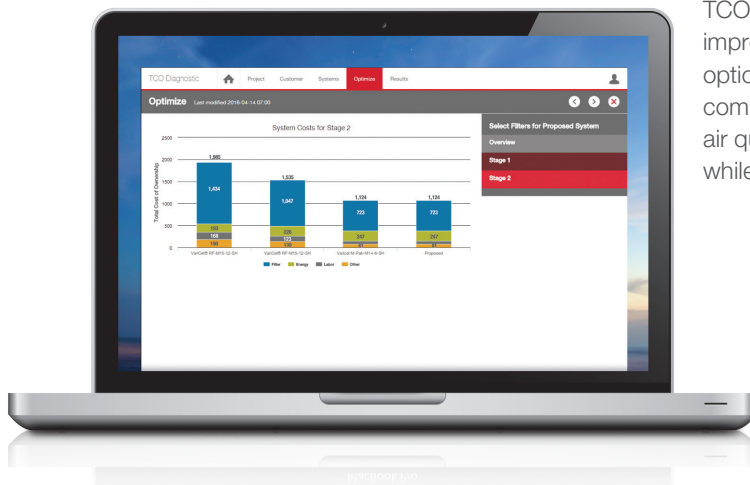


TCO Diagnostic®

A thorough air filter audit of your HVAC Systems is the first step that AAF takes in order to provide you with professional guidance and analysis for cost savings and risk reduction. By conducting this audit, we will be able to understand your current state and then utilize TCO Diagnostic®, an advanced analytical software tool, to identify how you can perform even better.

The purpose of TCO Diagnostic is to assist you in selecting the best filters for your air handling systems and to understand their sensitivity to your operating conditions, in order to operate your system in the most optimal and effective manner.

TCO Diagnostic provides the insight to identify improvement opportunities, find the optimized options and tailor to your specific needs for a comprehensive purchase perspective—improving air quality, energy savings, and operational flexibility while reducing total cost of ownership.

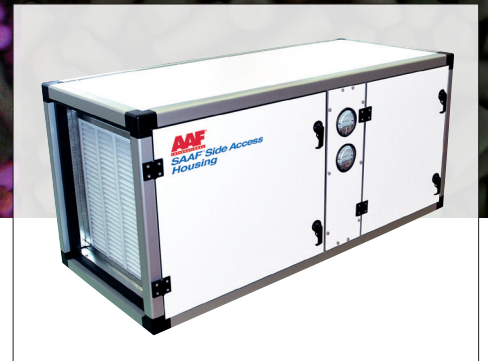


Gaseous Filtration Solutions

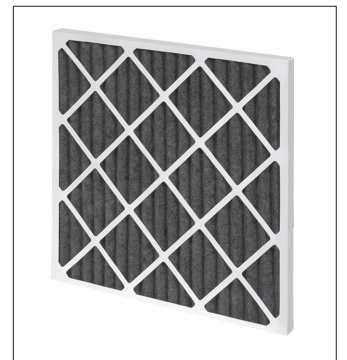
AAF has assumed an industry leading position with the development of its innovative SAAF (pronounced as "SAFE") product line, designed to reduce or eliminate harmful gaseous contaminants. In combination with our expertise in airborne particulate filtration, SAAF products and solutions allow us to develop unique and effective total filtration solutions to protect people, processes, and equipment.

No other company offers this combination of experience, expertise, innovation, and capability to combat airborne contaminants, particulate and/or gaseous, and deliver the best clean air solutions.

The SAAF product line features:



- Patented chemical media cassettes with superior sealing and energy savings. These cassettes also fit in most legacy units. The housings are designed for quiet operation and durability.
- Complete chemical media line – adsorbents, oxidants, and blends configured by and produced under the supervision of our world-class global research and development teams
- Environmental Measurements related to the ISA Standard S71.04: "Environmental Conditions for Process Measurement and Control Systems. Airborne Contaminants to determine types of contaminants and their relative concentrations"
- RoHS compliant Corrosion Control
- Comprehensive, industry leading software – SAAF Tech Tools analyzes applications, develops solutions, configures equipment and media, and delivers a complete technical proposal
- Full line of gas-phase equipment, including side access housings, air purification systems and machine intake filter systems











Gaseous Filtration Solutions

SAAF™ Chemical Media

Protection of an industrial control room includes at a minimum pressurization with purified air. This prevents corrosive gases from infiltrating the control room and causing corrosion problems. Additionally, recirculation air may require cleaning if the room is a high traffic area or there are other internal sources of contaminants. The following diagram displays typical methods of accomplishing these filtration goals, as well as monitoring the condition of air inside the space.

SAAF™ Media for Control Room & Process Control Environment Applications

		ammonia	chlorine	hydrocarbons	hydrogen sulfide	mercaptans	nitrogen dioxide	sulfur dioxide	VOCs
	SAAFBlend™ GP		✓	✓	✓	✓	✓	✓	✓
	SAAFBlend™ GP SC		✓	✓	✓	✓	✓	✓	✓
	SAAFCarb™		✓	✓		✓	✓		✓
	SAAFCarb™ MA		✓		✓	✓	✓	✓	
	SAAFCarb™ MA.HT		✓	✓	✓	✓	✓	✓	✓
	SAAFCarb™ MB	✓							
	SAAFOxidant™				✓			✓	
	SAAFOxidant™ SC				✓			✓	

Chemical Media Remaining Life Analysis (RLA)

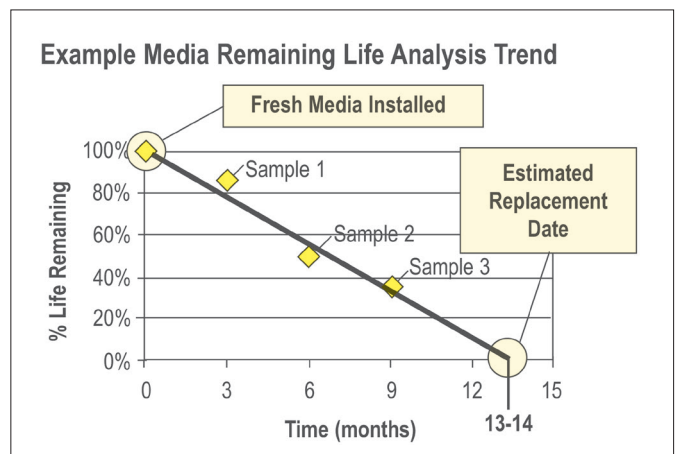
As a service to its customers, AAF offers remaining life testing services of chemical media. This information can be used to determine the characteristics of an existing filter system, system adequacy, filter replacement schedules, replacement filter ordering schedules, and filter inventory requirements.

Media Sampling and Frequency

Media life analysis requires a sample of media to be sent to a SAAF Laboratory. This media is tested according to applicable industry or AAF internal methods to determine the remaining capacity of the media. The best way to estimate a media replacement date using media remaining life analysis is by trending the results over time. This requires the establishment of a media sampling schedule. One conservative method is to sample the media every quarter during the first year and develop a history of media life analysis.

Remaining Life Data Analysis

As an example, this graph displays 9 months of remaining life analysis results from a gas-phase filtration system. It shows that the end user installed fresh media at time zero. The end user sampled the media after 3 months of service. At the 3 month period, the media had 85% of its original life. The end user sampled the media again after 6 months of service. At the 6 month period, the media had 50% of its original life. The end user sampled the media again after 9 months of service. At the 9 month period, the media had 35% of its original life. Using this data to extrapolate a replacement date points to the 13–14 month period as the end of life. This information can be used to help end users budget for and schedule media replacement.



Air Quality Assessments

SAAF laboratories and tools allow clients to assess control room air quality, as well as evaluate the performance of the gas-phase filtration systems. These tools include Reactivity Monitoring Coupons to assess air reactivity over a 30 day period, and the Environmental Condition Monitor to assess air reactivity in real time. All tests are carried out and correlated to applicable industry standards.

Reactivity Monitoring Coupons (RMCs)

Reactivity Monitoring Coupons provide the ISA Classification of an environment or information on the performance of a gas-phase filtration system during a 30 day exposure. Results relate directly to the ISA 71.04 classifications of G1-Mild through GX-Severe.

RMCs can indicate the presence of gas types, because different gas types will form different corrosion films. From these film types and the film thicknesses, the corrosive environment is classified and gas concentration ranges can be estimated.

There are two types of coupons available, metal coated glass coupons and full metal coupons. The metal coated glass coupons are ideal for environments with lower concentrations of corrosive gases, while the full metal coupons are ideal for applications involving higher concentrations of corrosive gases (fresh air intakes at industrial facilities, industrial site surveys directly exposed to outdoor air).



Metal Coated Glass Coupons



Full Metal Coupons



SAAF™ Reactivity Monitoring Coupon Report

SAAFShield® Technology

SAAFShield technology allows users to take immediate action to protect expensive electronics by monitoring corrosion in real time or on a periodic basis to determine equipment or material vulnerability to corrosion. The SAAFShield Detecting Unit works together with either the SAAFShield Reading Unit or the SAAFShield Communications Module to display and trend corrosion data over time, which allows users to evaluate operational procedures, environmental factors, or other items that occur at specific times, for their impact on sensitive materials.



SAAFShield® Detecting Unit, SAAFShield® Reading Unit, and SAAFShield® Communications Module

The SAAFShield® Detecting Unit utilizes quartz crystal microbalance to measure the corrosion of metal due to reactions with the environment.

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