INGERSOLL RAND WHITE PAPER

Mitigating Food Contamination Risk Associated With Compressed Air

A Review of HARPC and Monitoring/Sampling Strategy to Ensure Food Safety in Contact with Compressed Air

Ingersoll Rand

What's Inside

Introduction

High-quality compressed air is essential to food and beverage production. Often referred to as the fourth utility, compressed air impacts many aspects of food production and processing—leaving little room for error.

Due to the wide assortment of applications using compressed air, incidental contact with product or preparation surfaces is, in most cases, unavoidable. Therefore, manufacturers must be meticulous about their manufacturing standards to ensure the utmost safety.

Guidance provided by the Office of Food Safety in the Center for Food Safety and Applied Nutrition at the U.S. Food and Drug Administration (FDA) outlines Hazard Analysis and Risk-Based Preventive Controls (HARPC) which can help structure practices for insuring food safety. This paper will address specific issues in practicing HARPC with compressed air.

Hazard analysis and risk-based preventive controls

HARPC is an approach to food safety recognized by the international food and beverage community. A systematic method of preventative measures to reduce risk from external factors such as biological, chemical, radiological, or physical hazards, HARPC exists to ensure product quality rather than end of line inspection. Instead of only looking at process steps where controls can be applied (as in HACCP plans), HARPC relies on the applicable FDA regulations, standards, and guidance documents to develop a Preventive Controls Plan.

> "The hazard analysis helps you to focus resources on the most important controls applied to provide safe food. For every hazard you identify as requiring a preventive control, you must identify and implement at least one preventive control measure"
>
> —HARPC Guidance Document

The guidance document offers steps to a successful implementation of HARPC:

1. Assess the hazards
   - **a.** This includes the normal product-specific hazards, along with a broad range of other hazards and facility-specific concerns such as food defense and emergency management issues.

2. Institute preventive controls
   - **a.** Each control point must include measurable critical limits to prevent, eliminate, or reduce food safety hazards to a safe and acceptable level.

3. Monitor effectiveness of the controls

4. Establish corrective action measures

5. Establish verification measures

6. Follow proper and required recordkeeping

7. Reanalyze the plan once every 3 years, or when needed

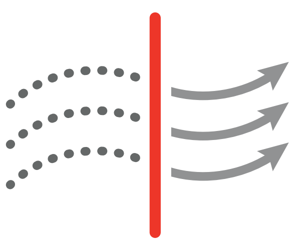
Compressed air ISO air quality is a potential hazard because the air can come in contact with a food product or food container which impacts food safety. For purposes of this whitepaper, the focus will be upon establishing appropriate preventive controls for the compressed air purity.

Example of a CCP and Monitoring/Sampling Strategy

Process Step	CCP	Critical Limits	
Air Rinse Container Prior To Fill	Yes	Compressed Air, moisture content:	-40 °F PDP
		Compressed Air, oil content:	0.1 mg/m³
		Compressed Air, non-viable content:	0.5 mg/m³
		Compressed Air, viable content:	0.03 cfu/ft³

Table 1 - Example of CCP using compressed air in an air rinser application

Application Description – Air in contact with product contacting surface



- Compressed air is delivered throughout a distribution loop in the packaging area utilizing 2" extruded aluminum piping and thermoplastic push-fit fittings. A drop is provided for the air rinser application prior to fill-seal.
- Prior to the loop, an oil-free compressor generates the compressed air and moisture is removed by an air-cooled aftercooler. It is further dried by the desiccant air dryer reaching a dew point at -40°F. The dryer communicates exiting compressed air dew point in real time to the DCS (Distributed Control System)
- Filtration rated for oil coalescing to 0.01 mg/m³ is before the dryer and particulate to 0.1 μm follows the dryer.
- A large, carbon steel air receiver tank stores the cleaned and dried compressed air for delivery at the required pressure. The tank has a pressure transducer for real time monitoring of delivered pressure to the DCS.
- The application is a rotary style rinser utilizing a star wheel infeed section from an airveyor to deliver the containers, which inverts the containers to receive a pulse of ionized air eliminating any presence of liquid and or particle contamination prior to filling. The rinsed bottle is then returned to a discharge transfer which advances it to the rotary filler infeed for the next step in the process.

Figure 1.1 Key Components of System (bypass piping removed for simplicity)

Monitoring of Effectiveness

The monitoring and sampling strategy for the compressed air at the CCP is determined for each of the criteria being measured. Dew point is monitored real time. Particulate and oil are sampled.

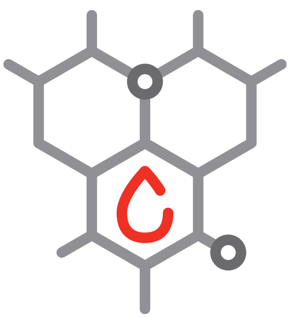
Moisture Content

Utilize alarm feature of dryer dew point monitor in DCS to alert of dryer malfunction.

An additional standalone dew point meter could provide additional safety at point of use. Multiple types of hygrometers exist for determining dew point; chilled mirror, electrolytic, and impedance type.

Applying a hygrometer at the generation point of the compressed air following the dryer and in line at the point of use will help determine if there is the possibility of moisture ingression into the compressed air as it is expanded to atmospheric pressure or through the piping system.

Hydrocarbons/Oil



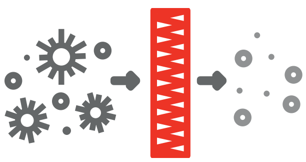
Utilizing an oil-free compressor minimizes the likelihood of oil in the air stream, however, oil based fumes can be ingested into the compressor especially if the intake is located near a loading dock or other combustion source or chemical process.

Pipe threading lubricant can also be a source of hydrocarbon contamination, therefore degreased material should be specified. In this example, the extruded aluminum with push to fit fittings should not generate this concern.

The installation includes coalescing filtration to further ensure against hydrocarbon contamination. Filter life is dependent upon temperature and flow of the air as well as the quality of the air intake to the filter.

Testing/Sampling:

Frequency	Location	Method
Quarterly	Sample prior to filter for air quality prior to the filter. Sample post filter to measure against standard for delivered air quality Sample prior to point of use to ensure no further contamination was ingested in the distribution ring	Indicator tube (commonly known by its brand name: Dräger® tube)



Viable and Non-Viable Particulate

An inlet air filter draws ambient air into the compressor as the first point of filtration, catching larger particulate. Following compression, a coalescing filter rated for 0.01 mg/mg^3 further filters the air prior to the dryer. Following the dryer is the final system filter, a 1 μm particulate filter insuring any particles associated with the dryer such as "desiccant dust" are caught prior to going to the point of use. Product protection at point of use would be provided by local filters installed at each outlet where air will contact product, product contact surfaces, or product primary containers.

Testing/Sampling:

Frequency	Location	Method
Quarterly	Sample prior to filter for air quality prior to the filter. Sample post filter to measure against standard for delivered air quality	Laser particle

Note: Other methods of particle detection are included in ISO 8573, part 4.

Microbial Levels

Viable particulate can exist in the intake air to the compressor. When using an oil-free dry running rotary screw compressor, due to the high temperatures of 400 to 500°F in the compression process, most or all pathogens are eliminated. Testing is required since ambient air can ingress into the system compressed air lines.

Sampling for viable particulate shall follow the requirements of ISO 8573, part 7.

Testing/Sampling:

Frequency	Location	Method
Quarterly	Same as non-viable sampling locations	Slit-to-agar

Further protection could be achieved by utilizing a 0.2 μm sterile grade filter just prior to point of use.

Using HARPC can help deliver repeatable food quality and safety. Addressing the compressed air quality upstream of its point of use allows for early detection of possible contamination. For further information, consult the FDA guidance on HARPC here or contact us today to connect with an Ingersoll Rand compressed air expert.

Contact Us to Talk to a Compressed Air Expert Today

Notes

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