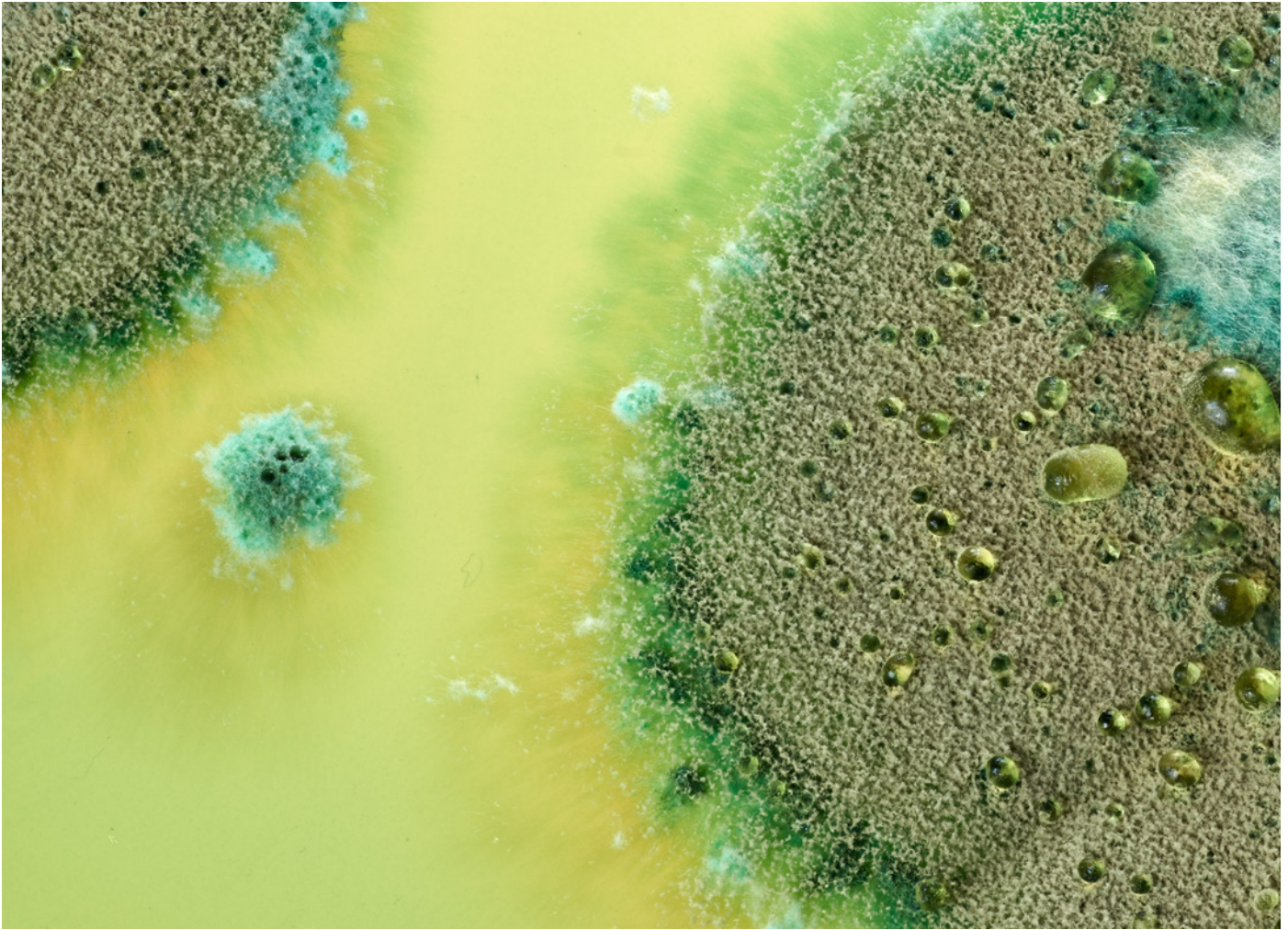


Quick guide for safe-handling of Novonesis microbial products

This quick guide is designed to give you a good understanding of how to handle Novonesis microbial products in a knowledgeable and safe way.



We want you to know how to stay safe

This quick guide is for employees in production facilities handling Novonesis microbial products that are used as raw materials to produce, reformulate or repack final products.

Here you can find operational safe-handling procedures for daily work.

Novonesis shares this information as inspiration for anyone working with our products.

Novonesis microbial products have been assessed as safe to use, however it is important to handle the products with care. The following sections will provide you with practical how-to information.

For more detailed information, please reach out to your supervisor, or see our Safe-Handling Manual, which is available in English.

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1.

Safe, but handle with care

When the recommended safe-handling guidelines are followed, Novonosis microbial products are safe to handle and use.

Like other substances containing organic particles, microbial products should be handled with care.

Novonosis thoroughly screens each microbial strain to avoid any toxic or infectious organisms. Even so, it is important to handle microbial products safely at the workplace to prevent health reactions that can occur from breathing aerosols comprised of microbials or organic dust.

What are microbial products?

As a world leader in biotechnology, Novonosis produces a variety of naturally occurring, beneficial microbial products. These products include yeasts, fungi and bacteria. They range from tech-grade to feed- and food-grade.

We commonly refer to these products as “microbials”. Microbial products are used to improve the performance of a wide variety of final products used in agriculture, industrial and consumer cleaners, human health supplements, and many other applications.

Novonosis develops products only from micro-organisms that have no harmful effects on humans. However, inhalation of bioaerosols (including microbial products) or dust of any organic matter (e.g. pollen, bacteria, flour, soils, etc) above a certain threshold can lead to unwanted health reactions. These can be avoided by proper handling.



2.

All our products are evaluated for safety

Novonosis' safety assessment ensures that:

- 1. The microbe is safe**
(Novonosis microbes cannot cause disease or toxicity)
- 2. Handling it in production is safe**
(Novonosis microbes are not likely to be used in a way that creates high levels of bioaerosols if handled properly)
- 3. Use in final products is safe**

Definition of bioaerosol

A general industry rule of thumb describes inhalable bioaerosols as organic dust particles (100 microns or less in diameter) or aerosol microdroplets that float in the air and can be inhaled. Bioaerosols can be generated from liquid or dry microorganisms, dead or alive, or from raw materials such as peat or yeast.



3.

Pay attention to bioaerosols at your workplace, and handle the products correctly

Breathing in bioaerosols or dust that contains any organic matter (e.g. pollen, bacteria, flour, soils, etc.) should be avoided, because this can lead to unwanted health reactions.

This is particularly true when handling microbial products that are supplied as freeze-dried or spray-dried products that may include an organic carrier as well as the microbe. These products may present a higher risk of exposure to bioaerosols than a liquid product.

Pay attention – even at low volumes or concentrations

While it is unlikely to occur in facilities taking the proper precautions, if a worker inhales high concentrations of bioaerosols or dust from organic materials, the person may develop organic dust toxic syndrome (ODTS). ODTS is a temporary and non-infectious illness that is caused by overloading the lungs with bioaerosols. The symptoms are often described as flu-like, including weakness, headache, fever, chills, body aches, coughing or shortness of breath.

ODTS can occur within several hours after inhalation. It typically resolves within 24 hours to a few days. Medical treatment is usually not required for otherwise healthy individuals.

The same factors that can cause ODTS can also lead to a rare, chronic, and often irreversible lung disease known as hypersensitivity pneumonitis (HP). Here are some examples of working environments with risky exposures for HP:

- farmers working with mouldy hay
- poultry handlers breathing in particles from feathers and bird droppings
- bakers working with contaminated flour

ODTS is usually linked to high temporary exposures, whereas HP can develop after being exposed to lower levels of bioaerosols for a longer time. So if your facility is doing a health risk assessment, you should pay attention to repeated or daily respiratory exposure – even at low concentrations.

Detection of ODTS is a valuable indicator that the working environment needs improvement. Efforts to prevent ODTS also reduce the risk of HP.

Table 1: Summary of the inhalation/respiratory health effects of bioaerosols and organic dust

	Organic Dust Toxic Syndrome (ODTS)	Hypersensitivity Pneumonitis (HP)
Exposures	Few, very high exposures	Frequent repeated exposure
Consequence of re-exposure	Temporary	Can develop into chronic illness
Physical signs at examination	Absent	Chest X-ray abnormalities, decreased pulmonary function and blood gases

4.

Use respiratory protective equipment when it's needed

You may not need respiratory protective equipment when handling microbial products if you are working in an enclosed area with a good ventilation system. You should consult your supervisor for guidance.

If high levels of bioaerosols are suspected, it's a good idea to consider respiratory protective equipment. Below are some examples:

- When there has been a significant spill of a microbial product
- When equipment for handling microbial products is being cleaned, for example before repair or maintenance
- During open-handling processes in non-ventilated areas
- During manual disposal of packaging materials
- When the exhaust ventilation system is not working properly

- When handling material collected by the local exhaust ventilation system
- When an enclosed section of a process line is open for any reason
- If instructed by your supervisor, your safety officer, or medical staff

It is important that respiratory protection is clean at all times and checked for proper fit to ensure optimal protection. Masks should be stored in a non-production area and away from potential microbial exposure.

Novonosis recommends that production facilities conduct a risk-assessment based on their own production setup, employees and local regulations.

Examples of respirators

N95 or P2
filtering facepiece respirator



N100/P100 or P3
filtering facepiece respirator



P100 or P3
elastomeric particulate respirator



5.

How to use microbial products safely in production

Prevent exposure

Industrial hygiene experts recommend that production facilities be designed, equipped and operated in such a way that, wherever possible, employees can perform normal work using a minimum of personal protective equipment.

The use of personal protective equipment (e.g., respiratory protection) should be necessary only during special situations such as cleaning of spills, maintenance work, and open handling of materials that can generate bioaerosols.

The workplace should minimize dust, aerosols, spills, etc.

Safe handling

Adding Novonosis microbial products as late as possible in the production process will reduce the risk of exposure to organic bioaerosols and contamination of the workplace from microbial products. It is important that microbial products are handled (mixed, transported, and dispensed) using equipment that minimizes creation of bioaerosols.

Packing finished products

If not properly designed, filling machines may trap or generate bioaerosols. Additionally, large quantities of product spillage can build up. It is recommended that filling machines be encapsulated and have an efficient local exhaust.

Equipment design

All equipment used to contain or transport microbial products should be evaluated for their potential to create bioaerosols. In general, be aware of equipment with moving parts. When handling liquids, pay attention to mixing and dispensing systems that might generate bioaerosols.

All leaks and openings in equipment containing microbial products should be closed, encapsulated or repaired (if applicable).

Ventilation systems

Exposure to bioaerosols can be minimized by renewing the air in the workplace constantly, and by using local exhaust ventilation, which will capture bioaerosols at the processing points where they are likely to be generated.

Follow your facility's ventilation procedures.

Keep in mind

- For dry products, avoid high-velocity pneumatic transporters and drag conveyors
- For liquids, avoid splashing or spraying without proper engineering controls
- If a dedicated microbial line is not used, then cleaning with a detergent is typically sufficient. If there are concerns about cross-contamination, after cleaning is done, an appropriate disinfection agent should be used



Storing and handling microbe containers

It is good practice to keep microbial products in their original packaging. Follow product instructions for storage temperature and humidity. Any open containers that are partially used can be resealed to prevent any possible exposure.

Emptying containers

Emptying packages is an operation that requires the handling of concentrated microbial products. Industrial hygiene experts suggest the following:

- Make sure that the area is well ventilated and demarcated from the rest of the plant
- Employees should receive training to perform this operation
- Wear appropriate protective equipment when opening and emptying microbial-product containers
- The emptying procedure and the equipment should be designed to avoid and contain any spillage
- Specially-designed emptying stations are available. For emptying smaller containers, downflow air booths are safe and convenient solutions
- Local exhaust ventilation should be provided at points where there is a risk of microbe-release into the working environment

Removal of empty microbial product containers

Nearly-empty containers can be a source of airborne dust and microbes if the containers are mishandled. Packaging waste must be safely contained until further processing.

Respiratory protection and local exhaust ventilation should be used when handling waste material.

Empty containers may be incinerated or washed and recycled, depending on the type of container and local regulations.

Damaged containers

Damaged microbial product containers or packages can cause spills and generate airborne organic dust and bioaerosols during transport and shipping. It is therefore necessary to handle such containers and packages carefully.



6.

Cleaning and how to manage spills

Maintaining high standards of cleanliness in the production environment is a good safeguard against exposure to bioaerosols. A clean workplace makes it much easier to quickly detect spills and leaks, and to keep a safe environment.

Routine cleaning

Work facilities should be easy to clean. A general recommendation is that cleaning be performed by washing with a soft stream of water from a hose, wet mopping, or vacuum cleaning to avoid bioaerosols. Vacuum cleaners should be equipped with High Efficiency Particulate Air (HEPA) filters.

Do not sweep with brooms or use high-pressure to flush with air or water. These can create high levels of bioaerosols.

Spills

Spills of microbial-containing material in the workplace should be cleaned up immediately and in compliance with your local procedures. In general, industrial hygiene experts suggest that you pay attention to the following steps in case of a significant spill or exposure to airborne bioaerosols:

- Leave the area (in case of a major spill with dust emission, the entire area should be completely evacuated)
- Notify your supervisor, who will instruct you

Some general guidance

- Collect the appropriate personal protective equipment, safety equipment, and cleaning tools
- Contain the spill
- For wet spills, clean with a soft stream of water (no pressure or splashing)
- For dry spills, use a vacuum cleaner with HEPA filter. If a vacuum with a HEPA filter is not available, carefully shovel the bulk of the product into a plastic-lined container suitable for enclosure and safe disposal. Finish up with a soft stream of water
- Safely clean or dispose of all equipment, tools, and clothes used in the cleaning operation
- Discharge of water containing microbial products should be performed according to local legislation, where such exists.



For minor dry spills, use a vacuum cleaner with HEPA filter to remove the bulk of the product and finish up with a soft stream of water from a hose.



For minor wet spills, use a soft stream from a water hose (not jets or high pressure). Discharge of water containing microbial products should be performed according to local legislation, where such exists.

7.

Personal hygiene is essential

As a general rule of thumb, industrial hygiene experts recommend the following standards when working with materials that can generate bioaerosols:



Remember



- Wash your hands before eating, smoking or using the restroom
- Use water and a mild soap, and dry your hands thoroughly afterwards
- Change your work clothes frequently
- Take a shower at the end of each work day

Avoid



- Direct contact with the product
- Contamination of clothes, as microbial residues can be carried to other parts of the plant or to your home
- Washing work clothes at home

8.

First aid

Personal hygiene is important. As a general rule of thumb, industrial hygiene experts recommend the following standards when working with materials that can generate bioaerosols:

If microbial products are swallowed

- Rinse your mouth and throat thoroughly with water and spit out
- Notify your manager and seek medical attention if irritation occurs

If bioaerosols are inhaled

- Move to an area with fresh air
- If symptoms of irritation occur (for example shortness of breath, wheezing, or severe coughing), notify your manager and seek medical attention if symptoms persist

If your skin or eyes come into contact with a microbial product

- Rinse skin with plenty of water
- Hold your eyelids open while rinsing with plenty of water (use an eye fountain or an eye-rinsing bottle if available)
- Notify your manager and seek medical attention if irritation occurs

If clothes are contaminated with a microbial product

- Remove and wash contaminated clothing before using them again
- Avoid taking work clothes home
- Wash affected body parts or take a shower before you change into clean clothes



We hope you've found this handbook useful.

For more information about our products and company,
please consult Novonosis website or your sales representative.

www.novonosis.com

Novonosis is a global company leading the era of biosolutions.

By leveraging the power of microbiology with science, we transform the way the world produces, consumes and lives. In more than 30 industries, our biosolutions are already creating value for thousands of customers and benefiting the planet. Our 10,000 people worldwide work closely with our partners and customers to transform business with biology. Let's better our world with biology.

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