Risk assessment and response to concerns raised by residents of the Estate housing the Mushroom Farm.

1. Risk assessment

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1 - Health risks of mushrooms spores

Issues have been raised by the potential effect that the project may have on health of the residents of the area surrounding the farm, due to the action of the spores of the mushrooms grown in the farm.

There are certain kind of moulds (a type of fungi) that can harm humans. In the project we are not aiming to grow any mould, and the standards of hygiene of the farm will prevent their appearance.

The next potential cause of concern is the existence of certain respiratory diseases related to certain agricultural activities, (the handling of compost, or the growth of mushrooms) which can be associated with the project. These are referred as farmer's lung and mushroom worker's lung.

Farmer's lung:

Mainly associated with the handling of compost, hay, grain, straw, and dust in general, that can go mouldy, and thus produce the spores(of thermophilic actinomycetes) that can be inhaled by the farmer and cause the disease.

There are other materials which can also cause the disease, like dust and debris of poultry and livestock operations.

Mushroom worker's lung:

In this case, it is the specific handling of the compost for mushroom which also gives raise to this micro-organisms. It is rare for mushroom spores to cause this disease, but some case studies have related the onset of the disease with inappropriate practices on the farm.

Effects:

Short-term effects include:

- Irritation of the nose and eyes;
- Acute bronchitis with cough and phlegm;
- Acute farmer’s lung, with fever, headache, chest tightness, breathlessness and weight loss;
- Acute occupational asthma with chest tightness and wheezing

Longer-term effects include:

- Chronic bronchitis with cough, phlegm and shortness of breath;
- Chronic farmer’s lung with increasing shortness of breath and weight loss;
- Chronic occupational asthma with persistent chest tightness and wheezing; damage to the heart.

The spores of certain varieties of mushrooms we are aiming to grow (shiitake and oyster) have also been shown to cause disease in farm workers, specially in Japan.

The development of those diseases have resulted from a long exposure to high concentrations of spores inside the farm. Some case studies have described the occurrence of lung diseases after working at mushroom farms for many years (10 – 50) without any kind of protection.

This project will not use compost as a substrate to grow the mushrooms. We are growing Shiitake and Oyster mushrooms, and they will grow out of a substrate (Probably straw, beer hops or coffee grounds) which will be pasteurized, thus eliminating the possibility of mould growing out.

When it comes to dealing with spores of both shiitake and oyster mushrooms, a series of measures will be taken. Those are briefly described on the following tables and on the next section.

What is the hazard?	Who might be harmed?	How it might be harmful?	Level of risk	Management of the risk	What else could be done?	Who will do it?	When will be done?
Mushroom spores. Mushrooms fruiting on fruiting rooms of the farm will release spores as they develop. The high concentrations of spores on the closed room could increase the inhalation of spores by staff working on the room. This could give raise to respiratory diseases	Workers of the farm	Asthma, farmer's lung and mushroom worker lung's (MWL) disease	High	- **Inform** employees of the risk involved and measures to reduce the risk. - **Train** employees in appropriate measures to reduce risk during normal working operations. - **Control of the exposure by**: - **Restrict access** to only allow trained people into fruiting rooms. - **Minimize the exposure** to the spores by reducing visit times to the room. - Provide appropriate **protective respiratory equipment** (APF 40) to employees, as well as clothes that don't retain dust when visiting fruiting rooms. - **Cleaning** of the fruiting rooms with **type H vacuum with HEPA filters**. - **Provide appropriate air flow** to fruiting rooms to allow for reduction of spores concentration in fruiting rooms. - Installation of **HEPA filters** on **air intake and air exhaust**	- Trials with varieties of mushrooms which don't produce spores.	- Operational manager of the farm will be responsible for the correct daily operations of the farm. - Article No. 25 will provide adequate equipment and apparatus for employees. - Employees will be responsible to wear the protective equipment and clothes when entering the fruiting rooms.	- Check on the daily operations will be carry daily. - Equipment and apparatus checks will be done weekly. - Protective respiratory equipment will be checked weekly and records of checks will be maintained for a period of 5 years.

				of the fruiting rooms to avoid release of spores into other sections of the farm or to the public spaces. - Periodical **health surveillance** and screening of employees of the farm.			
Mushrooms will produce spores as they developed and if spores where to exit the farm and achieve high concentrations in the specific surroundings people could be affected.	Residents of the state	Respiratory diseases	Very low	- Installation of **HEPA filters** on **air intakes and air exhaust** of growing rooms of the farm and on those of the farm with the exterior, which will stop the spores from exiting the farm. - HEPA filters will be periodically cleaned and checked for effective operational status.	- Trials with varieties of mushrooms which don't produce spores.	- Article No. 25 will provide the filters and train employees in checking and replacing filters.	- Filters will be checked on a weekly basis and replacing them when necessary.

1.1.1 Explanation of measures taken to reduce risk to employees:

a. Inform and train employees:

- Each employee will be given information about the health risks associated with exposure to mushroom spores and other micro-organisms, the relevant symptoms to look out for and the need to report any symptoms to the nominated responsible person.

- Pre-employment health questionnaires to detect susceptible individuals will be carried out: Pre-employment screening that includes a questionnaire about present or past asthma or chest illness, as well as smokers.

- Train employees on the correct use of the protective equipment provided.

b. Restrict access to risk areas:

- Exclude all non-essential personnel, including visitors, from working with high concentration of spores. This will also reduce the risk of contamination.

- Restricted access to this rooms will apply. Only trained and authorized personal will be permitted access inside the fruiting room and the lab. Also, the number of visits, as well as the time of each one, will be monitored and reduced to a minimum to decrease the exposure to the high concentration of spores.

c. Provide protective equipment when accessing the risk areas:

- Respiratory protective equipment (RPE) with an APF of at least 40, e.g. FFP2 when picking mushrooms that may be releasing spores.

- All RPE should be manufactured to a suitable standard and should be CE marked.
- Selecting the right respirator for each user is essential; a face-fitting test (either qualitative or quantitative) must be carried out for all respirators that rely on a good face seal to be effective, i.e. disposable, half and full face masks.
- All users of RPE should be adequately instructed and trained in its correct use. The importance of checking the fit before each use should be stressed.

d. Cleaning and maintenance of the risk areas:

- Cleaning with type H vacuum HEPA filters.

- Practise wet cleaning, such as low pressure washing, to minimise the creation of airborne dust and bioaerosols.

- Good housekeeping and site management support high standards of health and safety

e. Installation of filters in the equipment:

- Maintain ventilation levels in growing and packing rooms to allow for the dilution of the concentration of spores.
- Spores are only realised at the final stages of the farming of the mushrooms, so the risk will be concentrated on the fruiting rooms. The first measure is the enclosure of this rooms, and the installation of HEPA filters on the airflow outlets. HEPA filters are designed to stop any particle bigger that 0.3 microns. Spores of both shiitake and oyster are in the range of 3 – 7 micros.
- At the same time, appropriate air flow in each of the rooms and inside the farm

HEPA (High-efficiency particulate arrestance) filters

HEPA filters are a variety of filters capable of removing 99.97% of the particles of size bigger than 0.3µm from the air flow. Composed of a mat of randomly arranged fibres (fibreglass),with a diameter of 0.5-2.0µm, are capable of removing the particle by three mechanisms: interception, impaction and diffusion. HEPA filters don't actually act like sieves, but cause the pollutants to adhere to the fibres. Filters are periodically checked for working condition and replaced.

f. Health surveillance of employees:

- To minimize the risk of employees developing diseases, health surveillance will be carried out to monitor the development of any symptom.

- Employers have a legal duty to carry out health surveillance under COSHH.

- There is no means of identifying susceptible individuals prior to employment. People who are atopic are naturally predisposed to becoming sensitised to common allergens and are more at risk of reacting to exposure to compost or mushroom spores. Asthmatics and smokers are also at increased risk.

The objectives of health surveillance are to:

1. Protect the health of individual workers by detecting, as early as possible, symptoms that may be caused by exposure to substances hazardous to health

2. Help evaluate the effectiveness of measures taken to control exposure.

3. Collect information to update knowledge of health hazards in the workplace.

4. Completion of a questionnaire for all workers after employment at 6 weeks, 12 weeks (or similar intervals) and at least annually thereafter to enquire about any developing symptoms. The questionnaire must be administered by a responsible trained person who understands the purpose of the questionnaire and knows how to interpret the answers and what action to take if any adverse effects are found.

5. Keeping an individual health record for each worker. This should not include any personal clinical or medical data. Any such information should be treated in confidence and kept separately and securely.

- Lung function testing may also help with assessing a worker’s respiratory health.

- Identify a named occupational health professional (doctor or nurse) who can:

    1 - Help to develop the scheme.

    2 -Make arrangements for further investigations where necessary.

4 – Fire hazard

Fire risk will be really low.

The normal operations of the farm, the actual growing of the mushrooms, will not involve fire risk due to the high humidity of both the substrate (65% water) and the environment (with relative humidity of 85%).

The storage of the straw or other materials for the substrate of the mushrooms could be seen as a fire hazard. But actually, a straw-bale doesn't represent such a hazard due to their compact nature. Inside a straw bale there is no space for oxygen so fire can't access it.

If storage of ground coffee, sawdust or old newspaper was required, steps can be easily taken to reduce the risk involved. They will be watered to reduce the risk, as the substrate for the mushrooms will anyway require levels of 65% humidity.

The lab, were the cultivation of spores to grow into mycelium will happen, could be though as another potential area with fire hazard. This can be the result of the association of labs to hazardous chemicals. As it has been already explained, the usage of chemicals during the normal operations will be really low. This lab could be compared to a really clean kitchen with small appliances, like a fridge, an incubator, and other simple apparatus.

Some bottles of certain basic chemicals, such as alcohol for antiseptic techniques or a small cylinder the size of a camping gas, to fuel the Bunsen burner, will be the highest hazard. Normal risk assessment as when dealing with those on a lab will be carried out, reducing the risks. More detail on those on the laboratory section.

What is the hazard?	Who might be harmed?	How it might be harmful?	Level of risk	Management of the risk	What else could be done?	Who will do it?	When will be done?
Substrate of mushrooms setting on fire.	Farm and residents	Substrate could catch fire	Very low	- Avoidance of ignition sources - Appropriate maintenance of the humid conditions required for the correct growth of mushrooms. - Installation of fire detection equipment.		- Staff during the course of daily tasks.	- Daily
Electric fault of equipment on growing rooms.		- Electric fault could produce sparks that could initiate a fire.	Very low	- Correct maintenance and check of electric equipment. - Daily and weekly checks on the electric equipment. - Disconnection and switch off equipment when not in use.		- Staff during the course of daily and weekly tasks.	- Daily and weekly.

Storage materials (straw, ground coffee, newspapers, sawdust)		Inappropriate maintenance of the materials in storage (dry conditions) could lead to a risk on fire hazard	Low	- Avoiding and reducing the risk of sparks on the storage room. - Watering of materials before being store on the storage room. - Installation of fire detection equipment.			- Daily and weekly.
Flammable substances kept on laboratory		- Flammable substance can initiate a fire	Medium	- Training staff on proper storage and use of flammable substances. - Proper storage of the flammable materials - Installation of fire detection equipment.		- Staff	- Daily and weekly.
Electric fault of equipment in lab				- Training of staff on correct usage of equipment on the lab. - Correct		- Staff	- Daily and weekly.

				maintenance and check of electric equipment. - Daily and weekly checks on the electric equipment. - Disconnection and switch off equipment when not in use.			

6 – Laboratory risk assessment

As mentioned earlier, the amount of hazardous chemicals or equipment in the lab will be small. At the same time, the amount of work carried out in the lab will also be minimum.

The following is an outline of the risk assessment for the laboratory.

What is the hazard?	Who might be harmed?	How it might be harmful?	Level of risk	Management of the risk	What else could be done?	Who will do it?	When will be done?
Fire	Employees		Low	- Avoid the use of flammable substances. -Train staff on the safe use of flammable substances. - Use minimum required quantities of flammable substances. - Stores flammable substances on special cabinet. - Train staff on what to do on the event of a fire. - Keep fire extinguishers in the lab and farm. - Inspection of electric equipment prior to use.	- Minimize the risk of fire damage: - Safe doors on laboratory. Corridor fire door - Monitor storage of flammable substances on regular basis.	- Staff	- Daily and weekly operations

Glassware	Employees	- Can cause cuts and wounds.	- Low	- Train staff on the correct techniques to use glass equipment. - Dispose of chipped or broken glassware. - Dispose of broken glass in glass bin or harps bin.		- Staff.	- Daily
Spillages	Employees	- Spillage of substances can cause slippery surfaces - Depending on the substance other risk to health should be considered.	- Low	- Avoid the usage of hazardous substances. - Clear up spillage promptly. - Dispose of any hazardous materials as toxic waste according to COSSH regulations.		- Staff	- On going.
Gas cylinder	Employees	- Unproper use could cause injuries	- Low	- Train staff on proper usage of cylinder. - Minimize number of cylinder in the lab. - Proper storage of the cylinder on special cabinet. - When in use, properly chained to provide safe usage and avoid knocks.	- Use of alternative heat sources. - Use of autoclave for sterilization of materials instead of fire treatment.	- Staff	- On going

Chemical hazards	Employees	- Depending on the substances of used different damages to the user.	- Low	- Train staff on the proper use of substances. - Follow COSSH guidelines for each product used.	- Avoid as much as possible the use of hazardous substances	- Staff	- On going.
Biological hazards (spores)	Employees	- Exposure to high concentrations of spores has been proved to be related to respiratory diseases	- Medium	- Train staff on the proper handling of spores during the normal working operations of cultivation. - Reduce of exposure to spores. - Handling of spores on laminar flow cabinets to avoid contact with spores. - Use of HEPA filters in both laminar flow cabinets and air outlets of the lab to avoid exposure to spores.	- Maintenance of equipment (ventilation, and laminar flow cabinet) and periodical checks for correct functioning	- Staff	- Daily

2. Concerns

2.1- Increase in traffic

The potential disruption that the farm could cause in the local traffic has also been raised as a criticism for the project.

The project is for a pilot farm, of 200 square meters. The daily production will be of around 20-30 kilograms. Those will be delivered locally by a single push bike.

We expect to collect weekly substrate for the mushroom locally (ground coffee from coffee shops, sawdust from carpentries, …) but this will be carried out again by push bike.

The only ingredient requiring delivery will be straw. Depending on the final formula for the substrate, the amount can vary between 250 to 500 kg per month. This will require one or two monthly deliveries, to be arranged at a time of minimal disruption, by a medium sized lorry or small truck. A way of thinking of it is of a few pallets (2.5 m^3) arriving once or twice a month.

2.2- Vermin

Another issue that has been raised by the community is the potential appearance of vermin attracted by the farm.

Actually, the current state of the basements parking lots (unused and cluttered with abandoned rubbish) is more attractive to vermin that it would be if a farm is built.

The farm is to be designed with a set up closer to that of a laboratory, to maintain a clean environment that reduces chances of contamination. High standards of hygiene will be required to avoid contamination of our produce. High levels of cleanliness will be maintained to avoid the colonization of any kind of contamination (insects, moulds, micro-organisms, etc.) that could affect our produce.

What is the hazard?	Who might be harmed?	How it might be harmful?	Level of risk	Management of the risk	What else could be done?	Who will do it?	When will be done?
Vermin	Farm	Might decrease the production of the farm. It might transmit diseases	Low	- Design the farm to reduce the access and appearance of any sort of vermin. - Maintain high standards of cleanliness - Monitor for the appearance of any kind of vermin regularly and implement appropriate responses.		- Cleaning task of the farm will be done by staff. - Staff will carry on the monitoring for the appearance of any vermin.	-Cleaning task will be carried out on daily and weekly. - Checks will be carried out on daily and weekly.
	Residents	It could transmit diseases					

2.3 – Use of chemicals

We aim to adhere to organic standards, although as we will be using waste (sawdust, ground coffee, old newspapers) as a substrate, we won't be able to obtain the organic certification.

As a result, the use of chemicals that can cause harm to the environment or humans will be avoided at all costs.

In the event of using hazardous substances, proper risk assessment following COSHH guidelines will be carried out.

2.4 – Noise or odours due to the activity of the farm

Another concern raised by residents has been the potential noise or odours produced by the normal operations of the farm.

As mentioned before, shiitake and oyster mushrooms don't require the preparation of compost for their substrate. Materials can be readily treated (sterilized) to become the substrate for the mycelium growth. Therefore, the step of compost preparation and handling that could produce odours is avoided on the farm.

Normal growth of the mycelium and the mushrooms should will not produce odours. Another potential measure to avoid the release of any odours will be the installation of active carbon filters on the rooms, which will capture organic compounds exiting the room.

In terms of noise, there is no use of heavy machinery on the farm. All labour will be manual. The most noisy aspect of the production will be the chopping of a few kilograms of straw on the preparation of the substrate, carried out with a chain-saw.

Ultimately, the small scale of the pilot farm, involving 200m^2 and producing 750 kilograms per month (20-30kg per day) should show the small inputs required for the operations of the farm.

2.5 – Waste disposal

Once the mushrooms have grown on the substrate, this becomes spent mushroom compost. It can be used as a compost for gardens and parks. Daily waste of the farm of spent mushroom compost will be around 20 kg per day.

Potential uses for the spent mushroom compost will be sought locally, but in the worst case scenario, if no recipient for it is found, its safe disposal in normal organic containers will be arranged with the council.