RISK ASSESSMENT FOR BIOLOGICAL AGENTS

Summary

Biological agents are everywhere, and while they may be very beneficial for life they may also be dangerous. Biological agents are relevant to many trades and occupations, and a sizeable portion of the working population faces the risk of exposure. Despite this, workers and employers tend to know little about the risk of exposure to biological agents. Risk assessment for biological agents is challenging, for many reasons. First, because of the diversity of these agents. In addition, occupational exposure limits (OELs) have not been set for many of them. Pathogenic micro-organisms may be hazardous at extremely low concentrations, and of course biological agents are not visible to the naked eye. Even if no biological agent is detected, it is possible for micro-organisms to provoke a toxic or allergic effect via their metabolites (mycotoxins or their component endotoxins). Unlike other dangerous substances, biological agents are able to reproduce. Under favourable conditions, a small number of micro-organisms may multiply in a very short time to create a considerable problem.

Preventing biological risks is mandatory by law according to Directive 2000/54/CE. Trades and occupations exposed to biological agents are well defined, and it is also known how workers are infected. The basic mechanism of infection is the transmission chain from the reservoir – source of infection – to the host (the worker). Prevention will concentrate on cutting one or several links in the transmission chain.

Most of the time, basic personal hygiene measures and wearing personal protective equipment (PPE) provides sufficient protection against biological agents. Risk assessment will concentrate on identifying the hazards, assessing the risks and then controlling those risks.

Following a brief introduction to biological agents and the hazards generated by these agents, e-fact includes sections on ‘How to do a Risk Assessment’ and ‘How to use a Checklist’. A checklist is then presented to help identify the hazards potentially posed by biological agents. An extensive list of ‘proposed solutions and examples of preventive measures’ is then considered in the light of some of the questions raised in the general checklist. An example of risk assessment relating to legionella is then presented. Finally, sources of further information are presented at the end of the e-fact.

Introduction to biological agents

Biological agents are living organisms or products of living organisms. They include viruses, bacteria and fungi and their metabolites, as well as parasitic worms and plants. They can enter the body by inhalation, by ingestion or by absorption through the skin, eyes, mucous membranes or wounds (bites from animals, needlestick injuries, etc.). If the living conditions are favourable viruses, bacteria and fungi can reproduce very rapidly in a very short time. In addition, some of them can be passed from one person to another.

The European directive 2000/54/CE divides biological hazards (pathogens) into four groups, based on the inherent hazard of the organism. (This classification refers only to the level of infection risk of the biological agent concerned.)

Group 1 – Unlikely to cause human disease;

Group 2 – Can cause human disease and might be a hazard to workers; unlikely to spread to the community; there is usually effective prophylaxis or treatment available;

Group 3 – Can cause severe human disease and present a serious hazard to workers; it may present a risk of spreading to the community, but there is usually effective prophylaxis or treatment available;

Group 4 – Causes severe human disease and is a serious hazard to workers; it may present a high risk of spreading to the community; there is usually no effective prophylaxis or treatment available.

It should be noted that as the biological agents included in Group 1 are too numerous to specify, if an agent is not listed this does not mean that it automatically falls into Group 1.

But biological agents are not only a risk because they are infectious and toxic – they can also cause allergic reactions such as hypersensitivity pneumonitis, allergic rhinitis, some types of asthma and organic dust toxic syndrome (ODTS). The sensitising effects of biological agents are not related to the risk groups. Sensitising effects are known for fungi, bacteria and few parasites. Normally they affect the respiratory system but a few affect the skin. In addition, some biological agents may have a carcinogenic effect after a chronic infection.

This issue is a serious health at work matter and it overlaps with the public health sphere.

Hazards generated by biological agents

Biological agents are necessary to life and have beneficial effects, although in some cases they may endanger human life. Biological risks have been around ever since living organisms appeared on earth, and they are to be found everywhere.

Biological agents may be used deliberately, but most of the time workers are exposed to them unintentionally. This E-fact will deal with situations where workers are potentially exposed to biological agents as a result of their work and does not distinguish between intentional and unintentional exposures.

Infection at the workplace can occur via different sources such as (Advisory committee on Dangerous Pathogens, 2003):

- blood and other body fluids;
- human bodies, animal carcasses and raw meat;
- human or animal waste products such as faeces and urine;
- respiratory discharges such as coughs and sneezes;
- skin contact.

Allergic and toxic reactions can occur via:

- moulds or mould spores;
- dust mites, feathers, animal hairs, pollen.

Scientists, doctors and laboratory staff are aware of these risks but most employees and employers know little about them, not least because they are invisible. This may explain why risk assessment is difficult to undertake. Lack of adequate information on biological risks and the inadequate provision of OSH training to workers can also inhibit effective risk assessment.

To determine where biological risks are present one has to consider the activity taking place. If living or dead humans or animals, food, plants and wood, soil or water are present in the work environment, biological risks must be assessed. Relevant activities include farming, the food industry, health care and social services, veterinary services, waste and wastewater management, and funeral services. Fishing, ceramic tile making, cotton and paper production, cork making and many other economic activities are also potentially at risk from biological hazards.

Another way to pinpoint critical places is to consider the occupation. In addition to farmers, health care staff and food industry workers, many other occupations are affected, such as gardeners, sewage workers, prison warders, emergency services workers and even museum staff or people working on roofs littered with bird droppings. It is apparent that a sizeable percentage of the working population is potentially at risk.

Technologies using biological agents in metal working shops are increasing the spectrum of at-risk trades, as is the use of high-pressure water generating aerosols.

Some examples of workplaces with potential exposure to biological agents:

1. Food production plants
2. Agriculture
3. Activities where there is contact with animals and/or products of animal origin (abattoirs)
4. Health care, including isolation and post-mortem units
5. Refuse disposal plants (waste handling and sorting plants)
6. Sewage purification installations

Picture 1: Health care workers are exposed to biological agents.

Source: HVBG – Germany

Picture 2: Workers exposed to biological agents in a waste sorting plant.

Source: Willer, BGF

Directive 2000/54/EC on the protection of workers from risks related to exposure to biological agents at work lays down particular minimum provisions in this area. According to this Directive the risk assessment shall entail:

- a hazard identification, which consists in identifying the biological agents or their products likely to be present and the adverse effects that they have an inherent capacity to cause;
- a dose (concentration) – response (effect) assessment, which is the estimation of the relationship between the level of exposure to a substance and the incidence and severity of an effect;
- an exposure assessment, which is the determination of the concentrations, routes of exposure, potential for absorption, and the frequency and duration of exposure, in order to estimate the doses to which workers are or may be exposed;
- and a risk characterisation, which is the estimation of the incidence and severity of the adverse effects likely to occur in workers due to the actual or predicted exposure to a substance.

In addition Directive 92/85 EEC provides specific protection for pregnant workers or women who have recently given birth. Under it, employers must take all appropriate steps to ensure that neither the worker nor the unborn child is exposed to a health risk in the workplace. Young workers are additionally protected by Directive 94/33/EC.

These two working populations have to be considered during the risk assessment.

How to do a Risk Assessment

Risk assessment is the process of evaluating risks to workers' safety and health from workplace hazards. A risk assessment is a systematic examination of all aspects of the work undertaken to consider what could cause injury or harm, whether the hazards could be eliminated, and if not what preventive or protective measures are, or should be, in place to control the risks.

For most businesses, especially small and medium-sized enterprises, a straightforward five-step approach (incorporating elements of risk management) such as the one presented below should work well.

- Step 1. Identifying hazards and those at riskLooking for those things at work that have the potential to cause harm, and identifying workers who may be exposed to the hazards.
- Step 2. Evaluating and prioritising risksEstimating the existing risks in terms of severity and probability of possible harm and prioritising them in order of importance.
- Step 3. Deciding on preventive actionIdentifying the appropriate measures to eliminate or control the risks.
- Step 4. Taking actionPutting in place the preventive and protective measures through a prioritisation plan.
- Step 5. Monitoring and reviewing

The assessment should be reviewed at regular intervals to ensure that it remains up to date.

However, it is important to know that there are other methods that work equally well, particularly for more complex risks and circumstances.

For more information: http://osha.europa.eu/en/topics/riskassessment

Some situations where workers are likely to be exposed to biological agents may appear complex but the transmission chain concept discussed below may be used by anybody who has to proceed with a risk assessment. The overall risk assessment method does, however, have to be adapted to the particular biological risk concerned.

The transmission chain

Reservoir: the source of the infectious agent: any contaminated part of a human being or of an animal, soil, water or object,

↓

Portal of exit: for contamination to happen, the biological agent has to get out of the reservoir or has to be accessible,

↓

Mode of transmission: direct (inhalation or contact), semi-direct (transmitted on dirty hands) or indirect (the biological agent uses a carrier: insect, contaminated instrument, etc.),

↓

Portal of entry: respiratory tract, digestive tract, intact or damage skin: previous injury or via a contaminated instrument or mucus,

↓

Potential host: the worker at his/her work station.

The process of infection can therefore be seen as a chain. The first link is the biological agent's reservoir. The second is the process by which the agent escapes from the reservoir through the portal of exit, the method of transmission of the biological agent (inhalation, ingestion or absorption) and the portal of entry to the host. The final link is the potential host or worker.

Breaking a link at any point will reduce the risk of infection. When a hazard has been identified (by using the checklist), one must work out what the links composing the chain are in order to identify the best way to break one – or several – of the links to control the risk. Ideally, the link(s) closest to the reservoir should be targeted in particular.

General measures

EU legislation sets a hierarchy for exposure control measures to be applied if a risk assessment reveals risks:

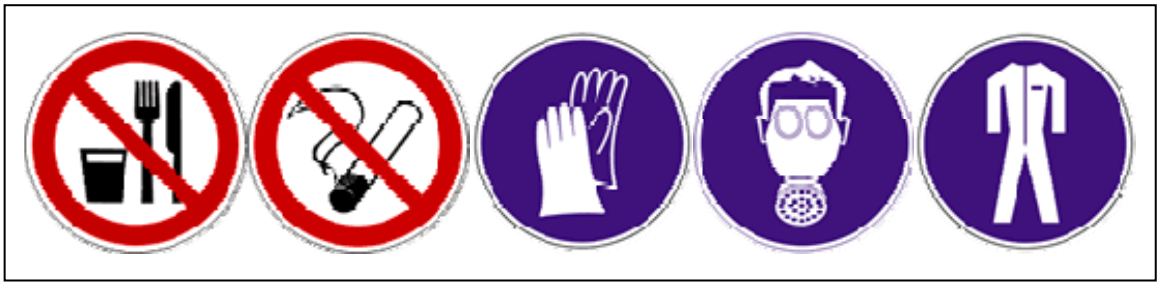
- Elimination of the hazard by changing the process or product is at the top of the hierarchy.
- If elimination is not possible, then the dangerous substances or the process should be substituted with another, non-hazardous or less dangerous one.
- Where the risks to workers are not prevented, control measures should be implemented to remove or reduce the risks to workers' health. The following control hierarchy should be followed:
    a. Design work processes and controls, and use adequate equipment and materials to reduce the release of dangerous substances.
    b. Apply collective protection measures at the source of the risk, such as ventilation and appropriate organisational measures.
    c. Apply individual protection measures including personal protective equipment where exposure cannot be prevented by other means.

Controlling the risk of infection is relatively straightforward. Usually, simple but effective personal hygiene measures, such as washing hands, are sufficient. In some cases additional measures may be necessary, such as wearing PPE.

The presence and the number of pathogenic micro-organisms have an impact on the infection risk – maintaining good personal hygiene is crucial in keeping these numbers down.

Health and safety at work signs

Some of these signs may be used when biological risks can't be eliminated (INRS, 2005).



These warning signs have to be complied with.

Red signage signifies something that is not permitted, or the presence of a particular danger. Blue colouring on a sign highlights an obligation.

The red signs shown here point out that it is forbidden to drink, eat or smoke where the relevant sign is posted. The blue signs indicate an obligation to wear gloves, a protective mask, and protective overalls, respectively.

More about safety and/or health signs at work

Directive 92/58/CEE:

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0058:EN:HTML

What is (and is not) a checklist and how to use it

- A checklist can help identify hazards and potential prevention measures and, used in the right way, forms part of a risk assessment.
- A checklist is not intended to cover all the risks of every workplace but to help you put the method into practice.
- A checklist is only a first step in carrying out a risk assessment. Further information may be needed to assess more complex risks and in some circumstances you may need an expert's help.
- For a checklist to be effective, you should adapt it to your particular sector or workplace. Some extra items may need to be covered, or some points omitted as irrelevant.
- For practical and analytical reasons, a checklist presents problems/hazards separately, but in workplaces they may be intertwined. Therefore, you have to take into account the interactions between the different problems or risk factors identified. At the same time, a preventive measure put in place to tackle a specific risk can also help to prevent another one; for example, air conditioning put in place to combat high temperatures can also prevent stress, given that high temperatures are a potential stress factor.
- It is equally important to check that any measure aimed at reducing exposure to one risk factor does not increase the risk of exposure to other factors; for example, reducing the amount of time a worker spends reaching above shoulder level may also increase the time spent working in a stooped posture, which may lead to back disorders.
- It is essential that checklists are used as a means of development support, not simply as a 'tick-the-box' exercise.

General examples of preventive measures

This is a general, non-exhaustive checklist that can be used as a model.

- The purpose of a checklist is to promote safety awareness and encourage safe work practices. It should serve as a reminder of things that can be done to enable people to work more safely.
- Where biological agents are concerned, this checklist should be seen as a first step only, since a more activity-oriented checklist may be necessary depending on the activity.
- If your employees are working with or have direct contact with humans or human body fluids, animals or animal body fluids, food products, soils, wastewater and wastes in general, they may be at risk from biological agents.

Picture 3: PPE such as gloves and protective overalls are necessary in some jobs that pose a risk from biological agents, such as waste removal.

General checklist

Part A.	Does the hazard exist at the workplace?		
Questions	**1 – Work activities**	**Yes**	**No**
1.1	Are workers in direct contact with humans?	☐	☐
1.2	Are workers in direct contact with animals?	☐	☐
1.3	Are workers in direct contact with soil or plant materials?	☐	☐
1.4	Are workers in contact with water – plain, spray or aerosol?	☐	☐
1.5	Are workers in contact with any kind of natural products?	☐	☐
1.6	Are workers in contact with natural or processed food products?	☐	☐
1.7	Are workers in contact with human or animal solid or liquid wastes?	☐	☐
1.8	Are workers in contact with human or animal body fluids?	☐	☐
1.9	Are workers in contact with human or animal corpses?	☐	☐
	2 – Workers		
2.1	Are workers unaware of hazards they are being exposed to?	☐	☐
2.2	Are some workers particularly at risk of biological diseases: pregnant workers, workers with particular allergies or asthma, low immune system?	☐	☐
2.3	Are pregnant workers in contact with biological agents?	☐	☐
2.4	Are workers and management unaware of the chain of infection and possible routes of entry and transmission of the biological agents: inhalation, ingestion, absorption through the skin?	☐	☐
2.5	Do you have cleaners or maintenance staff that may have contact with biological agents? (e.g. if they empty waste containers).	☐	☐
2.6	Should warning and safety signs used at the workplace? Do workers have to use warning or safety signs?	☐	☐
2.7	Are new or young workers in contact with biological agents?	☐	☐
2.8	Are there workers for whom the national language is a foreign language? (Do workers have difficulty understanding the national language?)	☐	☐
	3 – Workplace		
3.1	Is waste material disposed of without special measures? Is waste material disposed of in an unsafe manner? Is waste material easily accessible?	☐	☐
3.2	Are workplaces cleaned irregularly and without disinfection?	☐	☐
3.3	Are separated restrooms for workers missing?	☐	☐
3.4	Do the workplaces need ventilation?	☐	☐
3.5	Are workers unaware of (uninformed about) the results of any exposure monitoring or health surveillance?	☐	☐
	4 – Work organisation		
4.1	Should the proper implementation of established procedures be checked?	☐	☐

	5 – PPE		
5.1	Do workers need (wear) personal protective equipment?	□	□
5.2	Do workers wear protective equipment when leaving the workplace?	□	□
5.3	Do workers need respiratory protection?	□	□
5.4	Are workers at risk of splashes and spills contaminated with biological agents?	□	□
	6 – Hygiene	□	□
6.1	Do workers drink and eat at their workplace?	□	□
6.2	Are hand washing facilities limited or not available for all workers?	□	□
6.3	Do workers have injuries or wounds?	□	□
	7 – First aid/evacuation of workers	□	□
7.1	Are workers unaware of how to check and spot when things go wrong and to whom they should report any problems?	□	□
7.2	Is an emergency plan missing?	□	□
7.3	Are first aid kits lacking in some workplaces?	□	□
7.4	Should there be designated personnel responsible for first aid in the workplace?	□	□

The proposed solutions presented in Part B are examples of preventive measures that can be taken to prevent or reduce risks. The preventive measures correspond to the questions in Part A.

Part B. Question no.	**Examples of preventive measures**
	1 – Work activities
1.1 – 1.9	Informing workers about the biological risks. Consider posting written information in the workplace.
1.1 – 1.9	Regular training of workers about risks posed by biological agents and how they can be handled safely.
1.1 – 1.9	Registering exposed workers and their work activities. Specific conditions apply to workers exposed to biological agents of group 3 and 4 (a list of the names of such workers has to be kept for ten years).
1.1 – 1.9	Assessing the nature, degree and duration of workers' exposure to biological agents.
1.1 – 1.9	Classifying (ranking) identified biological agents according to one of the four groups described above.
1.1-1.9	Providing/implementing immunisation programmes for workers when necessary.
1.1-1.9	Examining workers regularly with regard to health risks at their workplace.
1.4	Avoiding generation of aerosols by using low pressure.
	2 – Workers
2.1	Informing workers about possible risks and hazards.
2.1	Providing Safety Datasheets and guidance material on biological agents.
2.1/2.2	Examining workers regularly with regard to health risks at their workplace.

2.1/2.2	Regular training of workers about risks posed by biological agents and how they can be handled safely.
2.2	Informing workers about their rights and special safety and health precautions. Arranging suitable instructions and information.
2.2	Giving special attention to workers at risk.
2.2	Preventing exposure to biological agents that can affect the unborn child (e.g. chlamydia, toxoplasma, rubella, listeria).
2.1/2.2	Providing/implementing immunisation programmes for workers when necessary.
2.1/2.2	Training workers on how to use personal protective equipment.
2.3	Providing information about biological agents and work activities that can affect the unborn child.
2.4	Informing and training workers about the chain of infection.
2.5	Ensuring that cleaners and maintenance staff are informed about biological risks.
2.5	Training cleaners and maintenance staff on how to deal with contaminated workplaces (biological agents).
2.6	Ensuring that workers are aware of and informed about safety and warning signs and how to use them.
2.7	Ensuring that new and young workers are trained.
2.7	Ensuring that young/new workers are appropriately supervised.
2.7	Training workers on how to use personal protective equipment.
2.8	Ensuring that all workers understand the safety information and training.
2.8	Providing information in different languages and/or with many illustrations.
	3 – Workplace
3.1	Establishing waste management procedures.
3.1	Ensuring that waste material is collected and disposed of in a safe manner and that it cannot be accessed easily (preventing public access).
3.1	Providing special waste disposal (e.g. special containers for needles and sharps).
3.2	Regular cleaning and disinfection.
3.2	Keeping records on cleaning activities (cleaning plan).
3.3	Providing appropriate restrooms, washing equipment, eating areas for all workers.
3.4	Installing adequate ventilation.
3.4	Inspecting and cleaning exhaust ventilation systems on a regular basis to maintain maximum efficiency and to decontaminate.
3.5	Informing all workers about exposure monitoring and health surveillance.
3.5	Advertising results of exposure monitoring and health surveillance.
	4 – Work organisation
	Accident procedures have been developed such as persons to notify, measures to take, accident reporting and record keeping.
	5 – PPE
5.1	Providing appropriate protective equipment.

5.1	Ensuring that the PPE is appropriate to EU Standards and CE marking.
5.1	Training of workers on how to use PPE.
5.1 – 5.2	Making sure that protective equipment is stored where it cannot be contaminated by biological hazardous substances and where it will not contaminate outdoor clothing.
5.1 -5.2	Carrying out regular technical checks of the personal protective equipment and respiratory protection.
5.2	Ensuring that PPE is not used outside the workplace.
5.2	Providing appropriate changing rooms.
5.2	Ensuring that the workers have enough time to change their clothes.
5.3	Providing appropriate respiratory protection if necessary.
5.4	Providing face visors (effective against splashes).
	6 – Hygiene
6.1	Prohibiting smoking, eating, drinking and application of cosmetics at the workplace.
6.2	Providing adequate (hand) washing facilities (with soap and if necessary disinfectants).
6.2	Ensuring that all workers have easy access to (hand) washing facilities.
6.1- 6.2	Washing hands before eating, drinking, smoking.
6.3	Cleansing and disinfecting all wounds and covering wounds with plaster.
	7 – First aid/evacuation of workers
7.1	Informing and training workers about what to do in case of emergency or problems.
7.1	Providing well-trained safety personnel.
7.1	Encouraging workers to report problems at the workplace.
7.2	Developing an emergency plan in close cooperation with safety representatives.
7.2	Informing workers about the emergency plan.
7.3	Providing first aid kits for each workplace.
7.3	Checking the content of first aid kits regularly.
7.4	Training personnel in first aid.
7.4	Ensuring that trained first aid personnel are available for each worker.

An example of risk assessment: Legionella

Legionella are bacteria that are commonly found in dapm environments. They occur naturally in rivers, lakes and sometimes in soil. They will also proliferate in some artificial water systems such as domestic hot water supply systems, the cooling systems of some industrial processes and air conditioning units. They may give rise to outbreaks of Legionnaires' disease, which may occur as single cases or epidemics.

Legionella may cause diseases to humans when very fine water aerosols are inhaled. Infection by ingestion or skin contact has not been demonstrated. There is no transmission between human beings. Working populations which may be exposed to this risk include those having to work close to or within cooling plants, spa baths or installations generating water aerosols.

Applied to legionella the concept of the transmission chain works as follows:

- the reservoir is a source of water warm enough to encourage the proliferation of legionella
- the transmission exit door comprises water droplets less than 5 mm wide
- transmission is by direct inhalation
- the transmission entry door is the respiratory tract
- the host is the worker entering the cooling installation.

As risk assessment aims to find out if a particular water system (including the associated equipment such as pumps, heat exchangers, showers and so on) is likely to create a risk of aerosol dispersion, the following questions must be asked:

- Could present conditions encourage bacteria to multiply in the reservoir? Is the water temperature between 20 and 45 °C, for example?
- Could water droplets be produced, and if so could they be dispersed over a wide area?
- Could someone come into contact with the contaminated water droplets?

More specifically, in the case of a cooling tower, risk prevention will consider the design of the cooling tower, the correct management of its equipment and then a maintenance and cleaning programme appropriate for the equipment. Risk is reduced by focusing on work organisation instead of individual protective measures – collective measures come first. As inhalation is the cause of human infection, in addition to collective measures or when exposure cannot be avoided by other means, wearing PPE adapted to the task is advised, for example when repairing or doing maintenance on cooling towers.

More about risk assessment for legionella:

Legionella in the working environment / National Research and Safety Institute (INRS – 2001) – France. http://www.inrs.fr/INRS PUB/inrs01.nsf/inrs01_catalog_view_view/33D8549DAC4F2928C1256CD90050393B/$FILE/ed5012.pdf

Legionnaire's disease. A guide for employers / Health and Safety Executive (HSE – 2001) – UK

http://www.hse.gov.uk/pubns/iacl27.pdf

Further information

[1] European Agency for Safety and Health at Work (EU-OSHA):

Report - Expert forecast on Emerging Biological Risks related to Occupational Safety and Health

Factsheet 68 - Expert forecast on Emerging Biological Risks related to Occupational Safety and Health

Biological agents. Factsheet 41: http://osha.europa.eu/en/publications/factsheets/41/view

EU / Member State legislation

[2] Directive 2000/54/EC of the European Parliament and of the Council of 18 September 2000 on the protection of workers from risks related to exposure to biological agents at work (seventh individual directive within the meaning of Article 16(1) of Directive 89/391/EEC). http://osha.europa.eu/en/legislation/directives/exposure-to-biological-agents/77

[3] This document from Sweden presents the law to be implemented by employers: Microbiological work environment risks – Infection, Toxigenic effect, Hypersensitivity. Statute Book of the Swedish Work Environment Authority – AFS 2005:01: http://www.av.se/dokument/inenglish/legislations/eng0501.pdf

[4] German legislation http://www.baua.de/de/Themen-von-A-Z/Biologische-Arbeitsstoffe/TRBA/TRBA.html__nnn=true

[5] Spanish legislation http://www.boe.es/g/es/bases_datos/doc.php?coleccion=iberlex&id=1997/11144&codmap=

Other Member State information

[6] Guidance for funeral services: Spain: http://www.insht.es/InshtWeb/Contenidos/Documentacion/TextosOnline/Guias_Acc_Preventiva/Ficheros/gap_028.pdf

[7] Biological risks in the fishing industry: Spain: http://www.insht.es/InshtWeb/Contenidos/Documentacion/FichasTecnicas/NTP/Ficheros/601a700/ntp_625.pdf

[8] BAUA, Abfallbehandlungsanlagen einschließlich Sortieranlagen in der Abfallwirtschaft (TRBA 214), 2007 http://www.baua.de/cae/servlet/contentblob/673026/publicationFile/48584/TRBA-214.pdf

[9] BAUA, *Sicherheit und Gesundheit bei Tätigkeiten mit biologischen Arbeitsstoffen in abwassertechnischen Anlagen* (TRBA 220), 2002 http://www.baua.de/cae/servlet/contentblob/673018/publicationFile/48573/TRBA-220.pdf

[10] BAUA, Handlungsanleitung zur Gefährdungsbeurteilung und für die Unterrichtung der Beschäftigten bei Tätigkeiten mit biologischen Arbeitsstoffen TRBA 400, 2006 http://www.baua.de/nn_15164/de/Themen-von-A-Z/Biologische-Arbeitsstoffe/TRBA/pdf/TRBA-400.pdf

[11] BAUA, *Effectiveness of measures to prevent needlestick injuries among employees in health professions, 2006* http://www.dguv.de/ifa/en/pub/rep/pdf/rep05/nadelstich/gesamt.pdf

[12] BAUA, Technische Regeln für Biologische Arbeitsstoffe (TRBA), 2010 http://www.baua.de/cln_137/de/Themen-von-A-Z/Biologische-Arbeitsstoffe/TRBA/TRBA.html

[13] HSE, Biological agents, *Managing the risks in laboratories and healthcare premises,* Advisory Committee on Dangerous Pathogens, 2005

[14] INRS, 2000a, *Responsables d'abbatoir – Pourquoi et comment évaluer les risques biologiques.* Approche participative par branche filière viande de boucherie http://www.inrs.fr/INRS-PUB/inrs01.nsf/IntranetObjectaccesParReference/ED+859/$File/ed859.pdf

[15] INRS, 2002, *Centre d'équarrissage - Pourquoi et comment évaluer les risques biologiques*, http://www.inrs.fr/INRS-PUB/inrs01.nsf/inrs01_catalog_view_view/A74807BFFB8A6222C1256CD90051217D/$FILE/ed890.pdf

[16] INRS, 2003, *Evaluer les risques professionnels en abattoir et atelier de découpe.* Approche participative par branche filière viande de boucherie http://www.inrs.fr/INRS-PUB/inrs01.nsf/IntranetObject-accesParReference/ED%20898/$File/ed898.pdf

[17] Tiefbauberufsgenossenschaft, 2000, *Gesundheitsgefährdung durch Taubenkot, Handlungsanleitung zur Gefährdungsbeurteilung nach Biostoffverordnung* http://www.bgbau.de/d/pages/koop/forschung/Handlungsanleitung_Tk.pdf

[18] BAUA, 2010, *Über den* Ausschuss für Biologische Arbeitsstoffe – ABAS, , http://www.baua.de/cln_137/de/Themen-von-A-Z/Biologische-Arbeitsstoffe/ABAS/ABAS.html

[19] **EFICATT** database from INRS – France. This database gives information about the potential exposure of workers to biological agents and how to behave in the working environment. It currently contains 20 records and it will be expanded. Its aim is to help occupational physicians in their treatment of workers who have been exposed to pathogenic biological agents.http://www.inrs.fr/

References

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