



BIOLOGICAL RISK FACTORS AT WORKPLACES

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OSHPRO 2019, MOMBASA KENYA

HAZARDS AT WORKPLACES



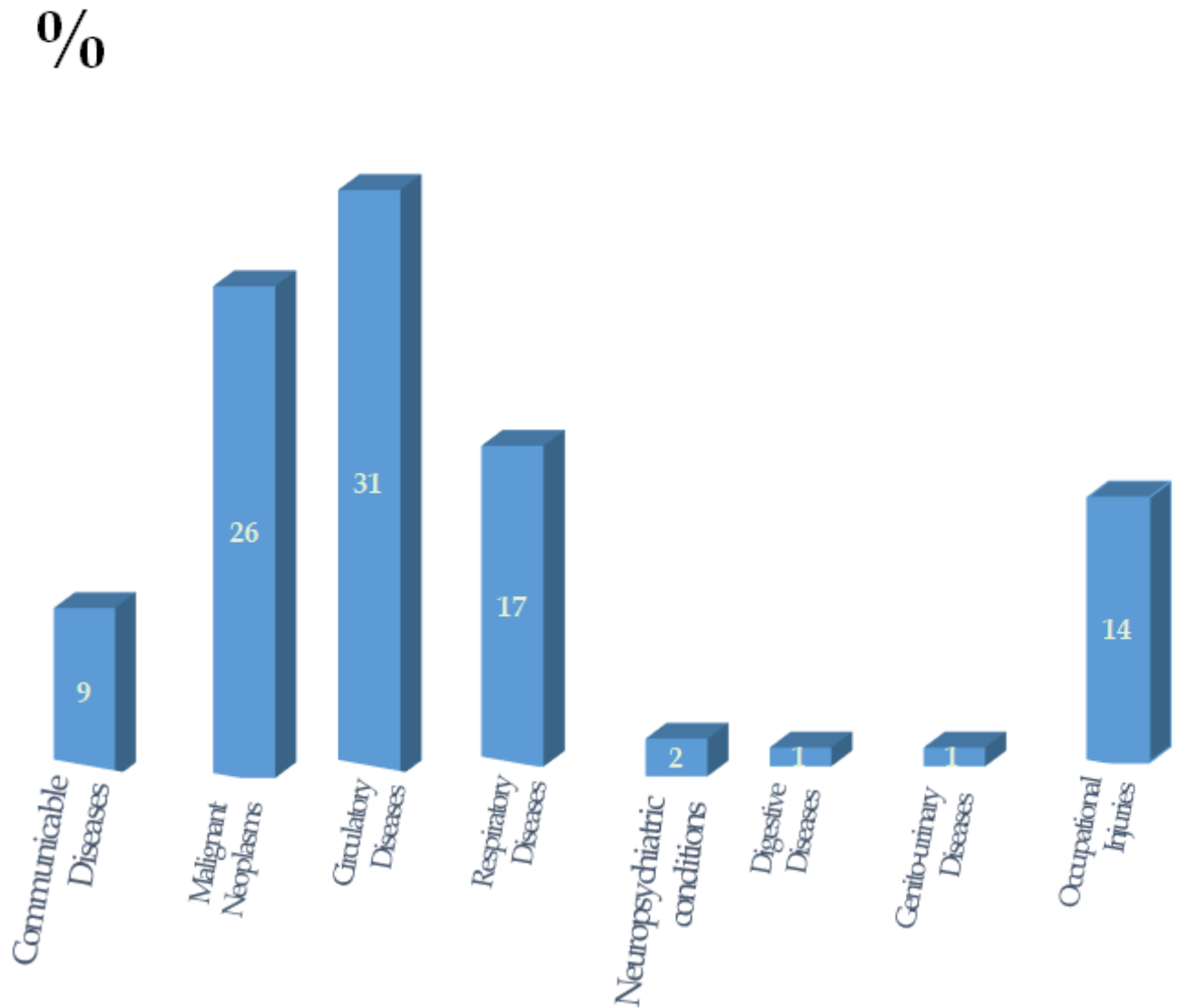
BIOLOGICAL

PHYSICAL

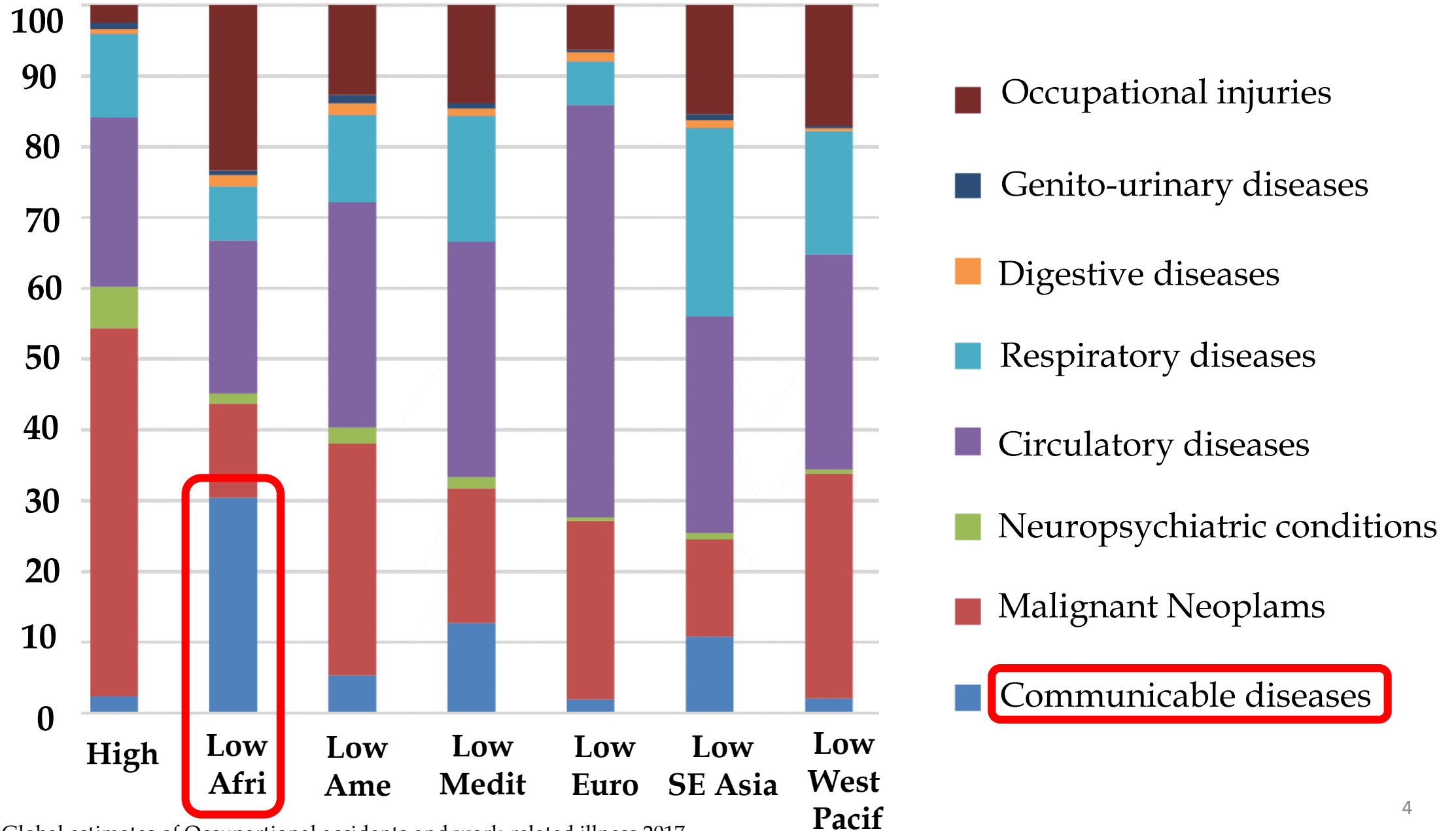
ERGONOMICAL

PSYCHOSOCIAL

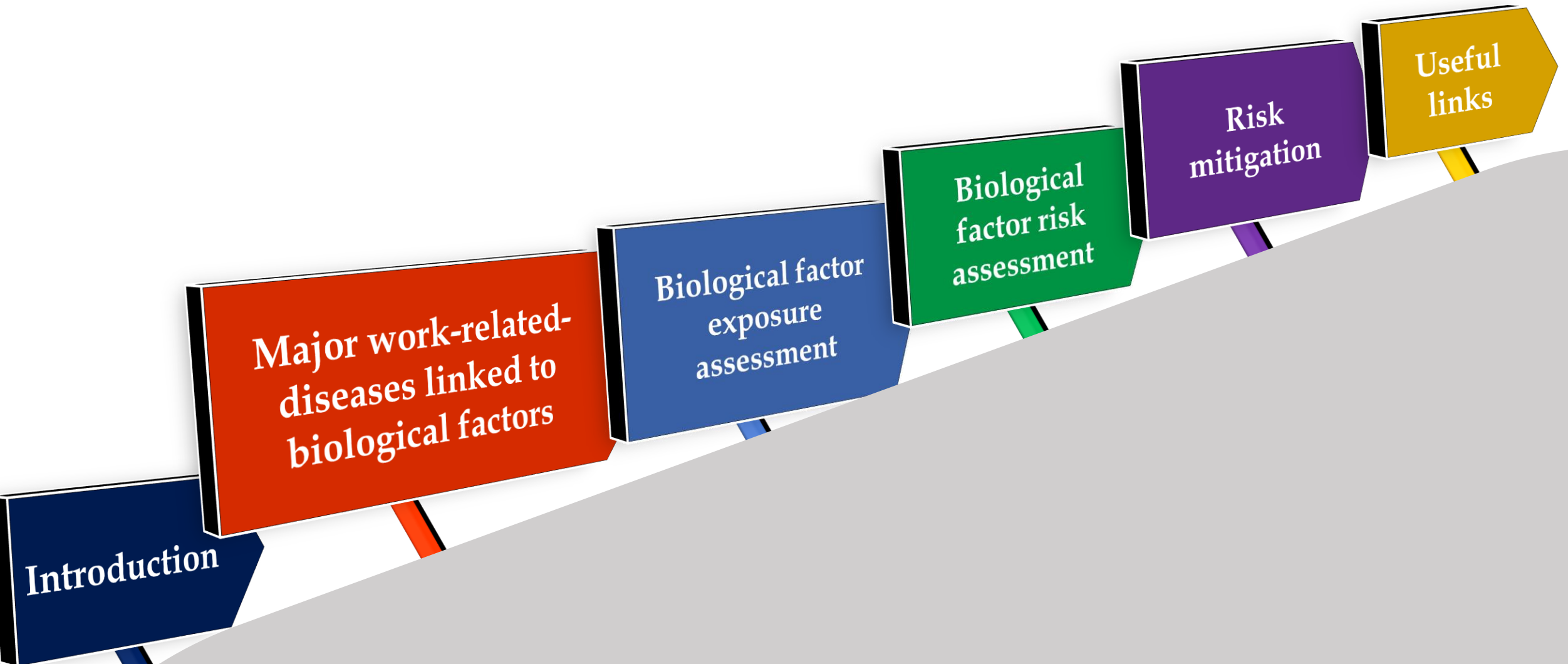
WHY FOCUS ON BIOLOGICAL FACTORS AT WORKPLACES?



WHY FOCUS ON BIOLOGICAL FACTORS AT WORKPLACES?



Outline



DEFINITION

Biological agents or Biological hazards (Biohazards)

Include many agents:
microorganisms
with associated
toxins,
cell cultures,
human parasites,

Whole or
fragmented
as
bioaerosols

may cause **morbidity**
and/or **mortality** in
human through
infection,
allergy or
toxication

CLASSIFICATION BY PATHOGENIC POTENTIAL

Non-pathogenic

Not known to cause infection, but some may be associated with inflammatory and immuno-toxic reactions.

They include microorganisms, constituents and metabolites from microorganisms, plant and animal materials.

Ex: *Saccharomyces cerevisiae*

Bacillus subtilis

Endotoxins from G⁻ bacteria

Mycotoxins from fungi

Pathogenic

Known to cause diseases through infections and/ poisoning.

Pathogenic biological agents include **microorganisms** and **prions**.

Ex: *Bacillus anthracis* that causes Anthrax

Coxiella burnetii that causes Q fever

Clostridium tetanum that causes Tetanus

CLASSIFICATION BY BIOSAFETY LEVELS

BSL IV

Are very serious hazards to workers and public.
Include microorganisms that **cause severe or lethal disease** to healthy adult humans. **No or limited prophylaxis and treatment** available. Ex: *Small pox virus, Ebola virus*

BSL III

Are hazards to workers and public.
Include microorganisms that **can cause serious or potentially lethal disease** to healthy adult humans. **Effective prophylaxis and treatment** available. Ex: *Yersinia pestis, Mycobacterium tuberculosis, rabies viruses*

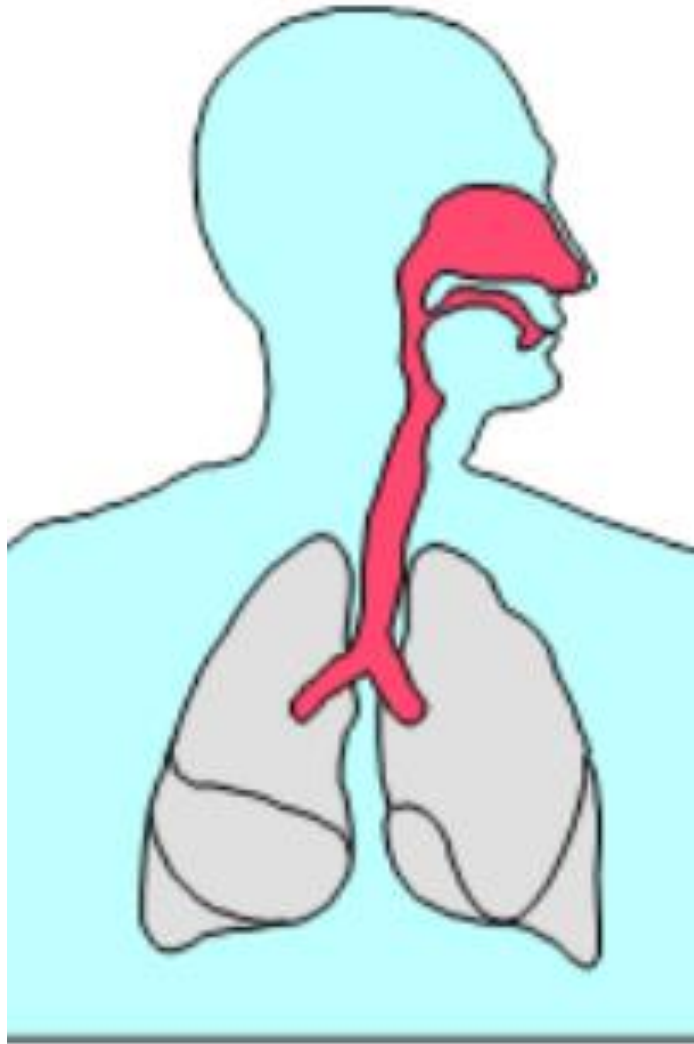
BSL II

Moderate potential hazards to worker and public.
Include microorganisms that **can cause mild disease** to healthy adult humans. **Effective prophylaxis and treatment available.**
Ex: *Aspergillus fumigatus, Streptococcus pyogenes, Herpes virus*

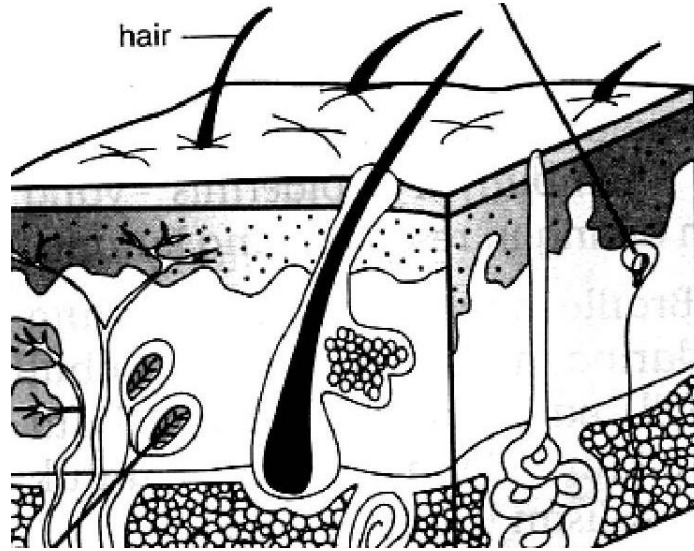
BSL I

No or Minimal hazard to workers and the public.
Not known to consistently cause disease in healthy adult humans.
Ex: *Saccharomyces cerevisiae*

EXPOSURE ROUTES



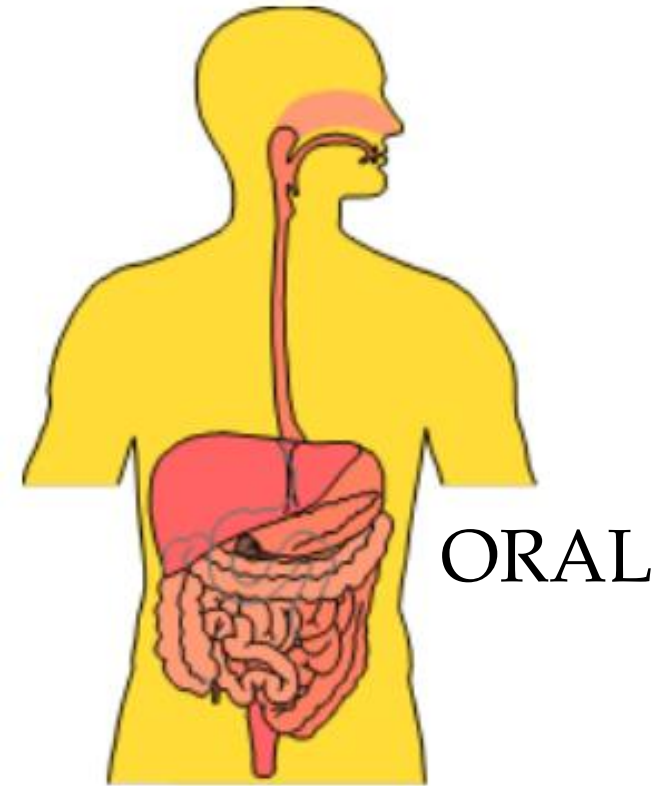
INHALATION



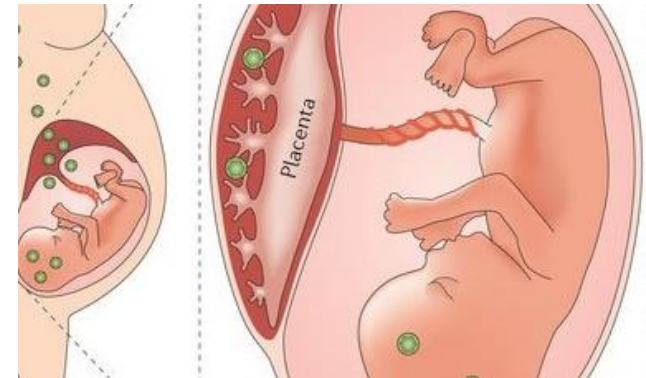
SKIN



EYES



ORAL



PLACENTA

WORK-RELATED DISEASES LINKED TO BIOLOGICAL AGENTS



Healthcare/Hospitals
Veterinary medicine

Laboratories
(Medical, Bioscience, Archeology)

Wood processing



<https://www.usaid.gov/malawi/fact-sheets/malawi-health-systems-strengthening-fact-sheet>

<https://www.biograd.co.uk>

<https://ktpress.rw/2019/07/rwanda-to-launch-an-open-competition-for-wood-dealers/>

WORK-RELATED DISEASES LINKED TO BIOLOGICAL AGENTS

Tetanus

AIDS

Leptospirosis



Bacteria
Viruses
Fungi
Parasites
Prions

Healthcare/Hospitals
Veterinary medicine

Agriculture

Waste management plants

Forestry/ Rangers



<https://www.usaid.gov/malawi/fact-sheets/malawi-health-systems-strengthening-fact-sheet>



<https://glm-lic.iza.org/thematic-areas/ta2/111/>



<https://www.abc.net.au/news/2017-03-15/fro-kerbside-yellow-bins-to-the-recycling-facility/8352310>



<https://www.shutterstock.com/nb/search/forestry>

WORK-RELATED DISEASES LINKED TO BIOLOGICAL AGENTS

Agriculture

COPD

Farmers lung

Chronic Alveolitis

Organic dust
Endotoxins
Mycotoxins
Glucans
Allergens
Mites

NON-ALLERGIC
RESPIRATORY
DISEASES

Fungi
Bacteria
Viruses
Parasites

Waste Management



https://www.waste.ccacoalition.org/sites/default/files/files/city_assessment_lome_v2.pdf

Food production,
processing & packaging



<https://www.nytimes.com/2017/10/11/world/australia/vegemite-blend-17.html>

Wood processing
industry



<https://ktpress.rw/2019/07/rwanda-to-launch-an-open-competition-for-wood-dealers/>

Textile industry, Paper
production



<https://vietnamnews.vn/economy/484005/viet-nam-targets-40-billion-in-exports-from-textile-and-garment-industry.html#DVQhHSgOQsdIvq6G.97>

WORK-RELATED DISEASES LINKED TO BIOLOGICAL AGENTS



Agriculture
Atopic asthma

Hypersensitive pneumonitis

Allergic rhinitis

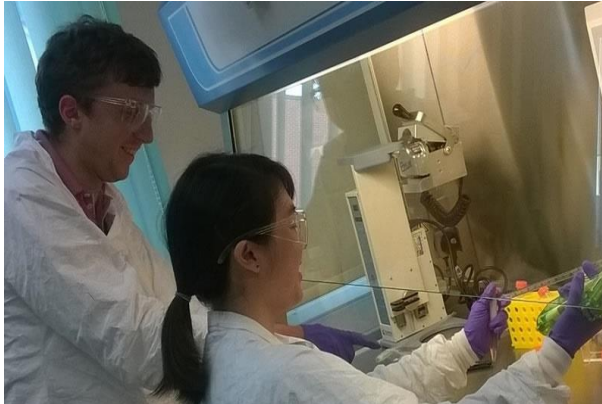
[areas/ta2/111/](https://www.who.int/news/areas/ta2/111/)

**Healthcare/Hospitals
Veterinary medicine**

Laboratories

**Food production,
processing & packaging**

**Wood processing
industry**



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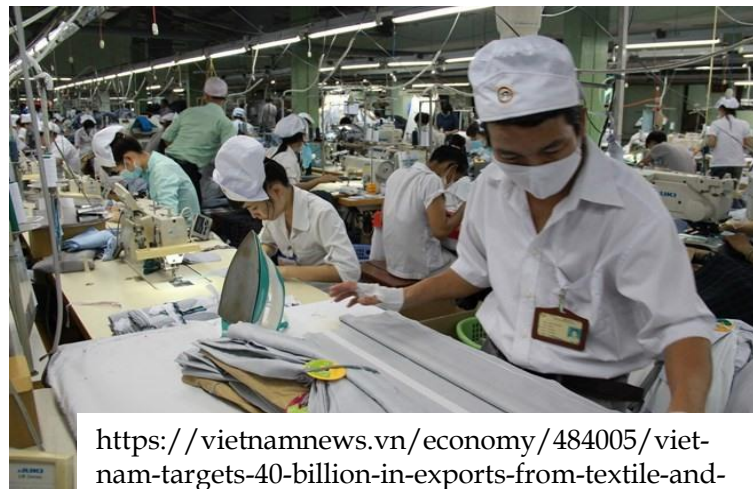
WORK-RELATED DISEASES LINKED TO BIOLOGICAL AGENTS

Organic dust
Fungi
Bacteria
Endotoxins
Toxins
Glucans
Allergens
Mites



**SICK
BUILDING
SYNDROM**

Textile & Paper production



<https://vietnamnews.vn/economy/484005/vietnam-targets-40-billion-in-exports-from-textile-and-garment-industry.html#DVQhHSgOQsdIvq6G.97>

Libraries (Archive), Museums



<https://fotota.hypotheses.org/4161>

EXPOSURE ASSESSMENT OF BIOLOGICAL AGENTS

Volumetric Sampling required

Impactors

Filter in cassettes eventually in combination with Cyclones

Impingers



SAS SAMPLER



ANDERSON IMPACTORS



Figure 1. SKC BioSampler Components

EXPOSURE ASSESSMENT OF BIOLOGICAL AGENTS

Quantitative detection:

Gravimetry

Microscopy

Cultivation

Molecular techniques (qPCR)

Immunoassays

Chemical methods (PLFA,

Ergosterol, Glucans)

The exposure assessment of biological agents can be quite challenging, however the following steps help monitoring in occupational settings:

- Identify the sources
- Identify the tasks determinant for the exposure
- Assess the exposure intensity and frequency

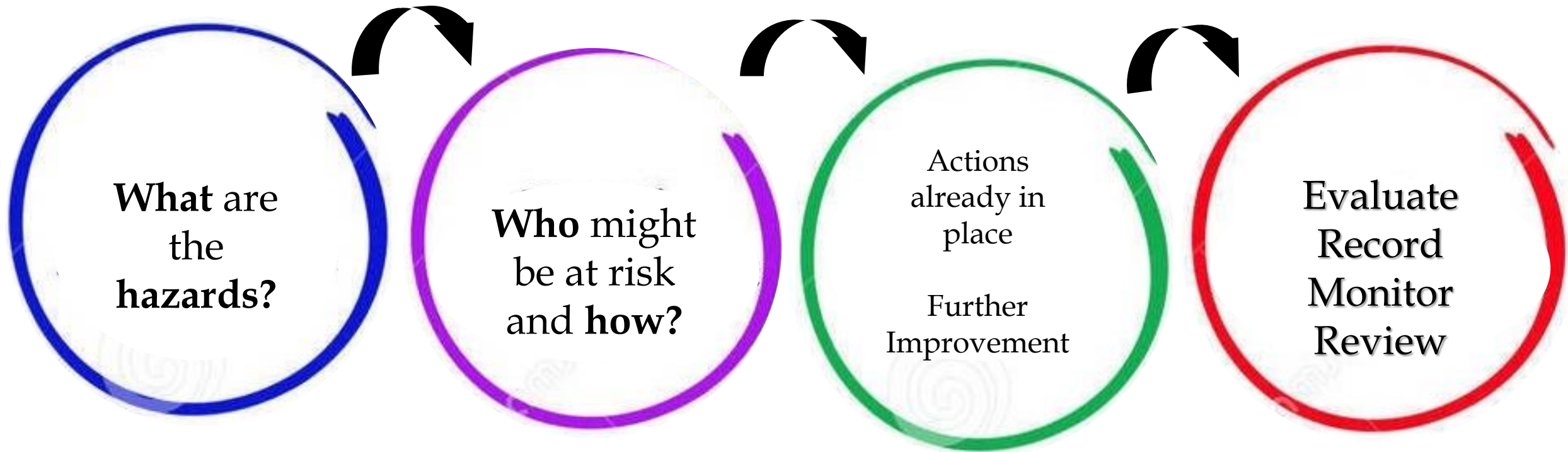
EXPOSURE ASSESSMENT OF BIOLOGICAL AGENTS

With the non-pathogenic biological agents that are associated with morbidity, the exposure levels are compared to nationally or regionally established occupational exposure limit (OEL) .

Examples of OEL:

Endotoxins	90EUm ⁻³ (some EU countries)
Fungal spores	10 ⁵ m ⁻³ (Nordic countries)
Actinobacteria	10 ⁵ m ⁻³ (Nordic countries)
Wood dust	5mg/m ³ (EU Today)

RISK ASSESSMENT OF BIOLOGICAL AGENTS



RISK ASSESSMENT OF BIOLOGICAL AGENTS

$$\text{RISK} = \text{SEVERITY OF HARM} \times \text{LIKELIHOOD OF HARM}$$

Severity of the agents (S)			
Exposure levels	Biosafety levels	Description	Value
Background levels	BSL1	First aid. No consequence	1
High levels	BSL2	Illness with reversible effects	3
Very High levels	BSL2	Illness with reversible major effects	7
Extremely high levels	BSL3	Illness with Irreversible major effects	15
	BSL4	Death	40

Frequency (F)	
Description	Value
< 1 per year	0.5
1 per year	1
1 per month	2
< 1 per week	3
Daily	6
Continuously	10

Probability of occurrence (P)	
Description	Value
Highly unlikely: cannot occur	1
Unlikely: can occur but never occur	3
Likely: occur occasionally	6
Very likely: occur frequently	10

$$\mathbf{R = S \times F \times P}$$

R < 70: Acceptable risk

70 < R < 400: Improvable risk

R > 400: Undesirable risk

BIOLOGICAL AGENT RISK MITIGATION

1. Eliminate the risk to workers by elimination or substitution if possible
2. Reduce the risk by prevention and control
3. Inform and train workers
4. Provide health surveillance as appropriate



BIOLOGICAL AGENT RISK MITIGATION

- Vaccination of workers at risk
 - Surveillance of workers
 - Follow up of workers

PPE to reduce exposure to biological agents (Last option)



USEFUL LINKS

OSHWiki: https://oshwiki.eu/wiki/Biological_agents

Bioagent IFA (Germany):

<http://gestis.itrust.de/nxt/gateway.dll/bioen/000000.xml?f=templates&fn=default.htm&vid=gestisbioeng:biosdbeng>

Occupational health in developing countries:

<https://www.futurelearn.com/courses/occupational-health-developing-countries/8/steps/535095>

TAKE HOME MESSAGES

Biological risk factors in almost every occupation

Biological risk factors can be pathogenic or non pathogenic

Different work related diseases are linked to exposure to both group of biological agents

Information and Awareness of workers are of the greatest importance in the preventing work diseases related to biological risk factors

As last option, implementation of protective measures against biological agents are very effective



THANKS