

# ARICA:2019 | ARICA:2022

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## Elisabete Cordeiro

Master's degree in urban fire safety engineering and is currently completing her PhD in Civil Engineering

Several years of experience in the development of fire safety projects, as well as a fire safety trainer with several published articles related with the human behavior in case of fire

# Presentation overview

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03. Use
04. Scope
05. Procedure
06. Factors
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08. Calculation
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10. Information needed
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## ARICA:2022

01. Purpose
02. Framework
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04. Hazard Index
05. Profile of the occupants
06. Comparison
07. Scores/weights
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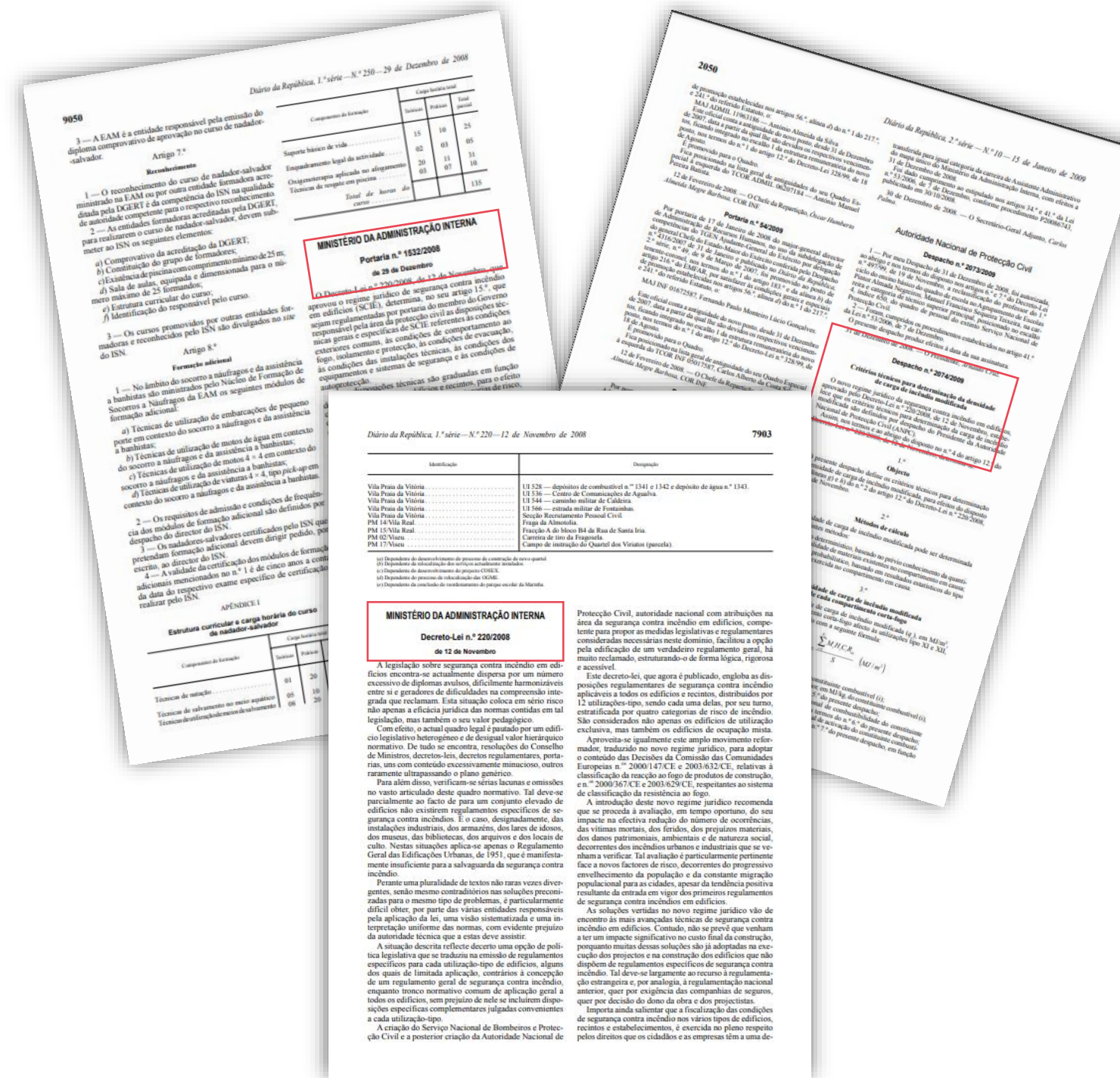
# ARICA:2019

Is an assessment method developed  
to determine the fire safety level of an existing building

# 2. Framework

Based on the Portuguese Fire Regulations:

- Decree-Law no. 220/2008, 12 November
- Ordinance no. 1532/2008, 29 December
- Order no. 2074/2009, 15 January





### 3. Use

- It can be used to exempt the compliance with some provisions of the fire safety legislation in case of interventions in existing buildings (articles 3 and 14-A of Decree-Law no. 220/2008)
- It enables to compensate non-compliance of some requirements with measures that ensure an equivalent level of fire safety

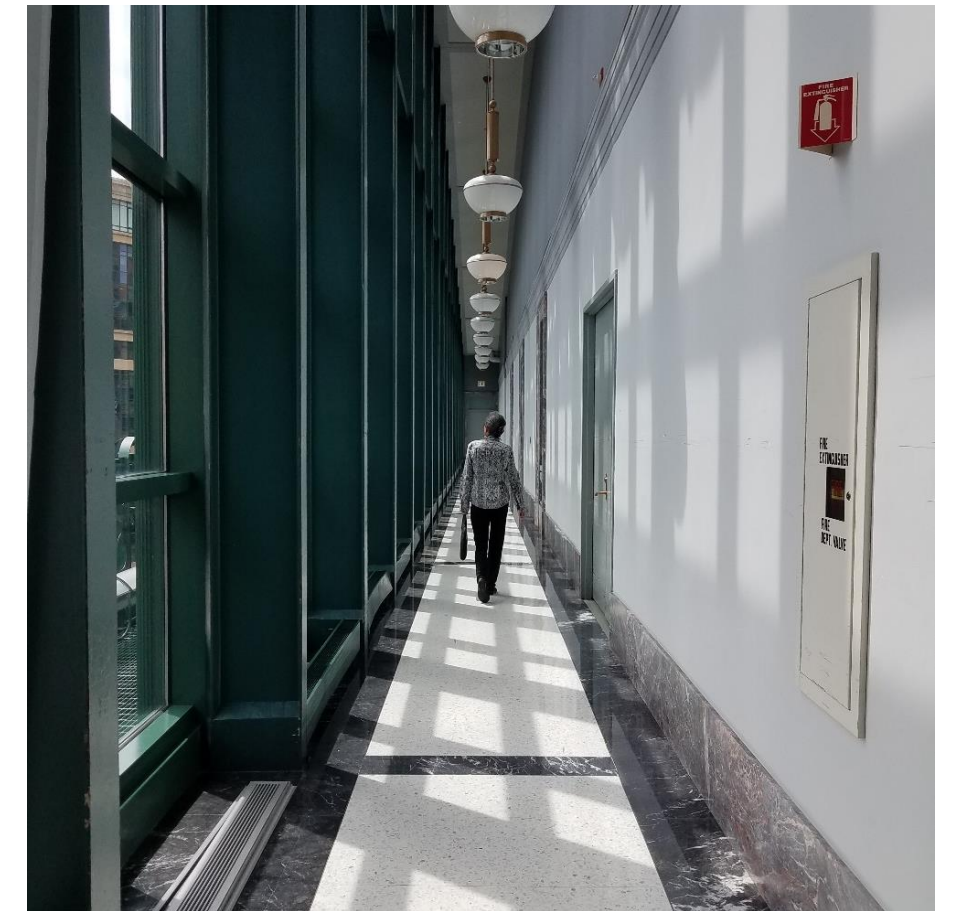


## 4. Scope

It is applied to construction works in **existing buildings**

It can not be applied to:

- Buildings with spaces that have **more than 199 people**
- Buildings with horizontal escape routes with **more than 500 people** or vertical escape routes with **more than 1000 people**
- Reconstruction preceded by **complete demolition** of the pre-existing building



<https://unsplash.com/photos/lh1QIG6o8g>

## 5. Procedure

ARICA:2019 is applied considering **two** situations:



### Initial conditions (CI)

Safety conditions before  
the refurbishment



*Index of fire safety for initial conditions ( $I_{SICI}$ )*

### Project conditions (CP)

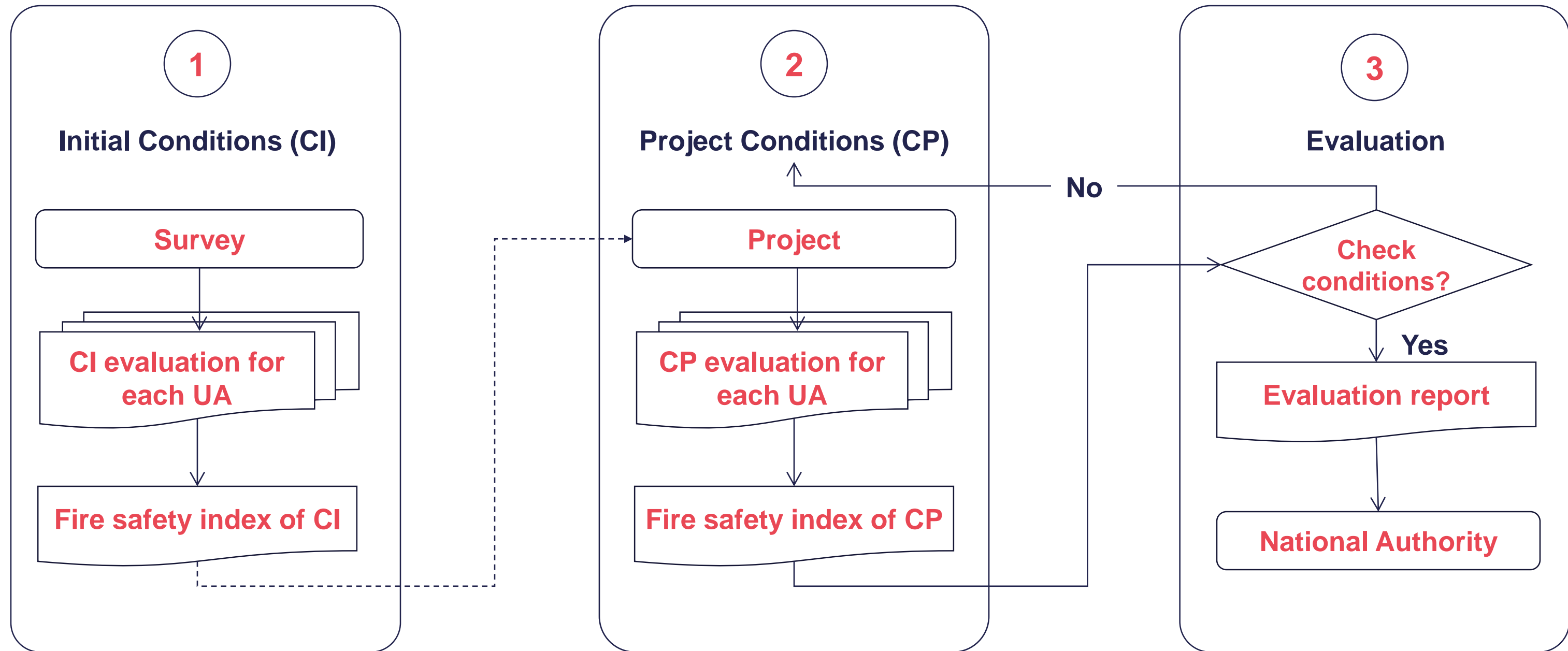
Safety conditions that will result  
after the refurbishment



*Index of fire safety for project conditions ( $I_{SICP}$ )*



# 5. Procedure



## 6. Factors

ARICA:2019 is divided into  
4 global factors

Each global factor is divided in  
**partial factors** →



# 6. Factors

## ① Start of fire

### 1.1 Anomalies that can cause a fire

### 1.2 Technical installations

Electrical installations

Gas installations

Heating installations - Thermal plants

Heating installations – Switchgear

Food preparation and conservation facilities

Combustion effluent evacuation installations

Air conditioning and ventilation installations

# 6. Factors

## ① S ② Development and propagation of the fire

1.1 Anomalies that

1.2 Technical insta

Electrical insta

Gas installatio

Heating install

Heating install

Food preparat  
facilities

Combustion e  
installations

Air conditionin  
installations

**2.1 Reaction material of the occupancy place**

**2.2 Reaction material of the escape route**

**2.3 Isolation and protection of the occupancy place**

**2.4 Compartmentation**

**2.5 Isolation and protection between different occupancy**

**2.6 Security teams**

**2.7 Fire detection, warning and alarm**

# 6. Factors

- ① S ② Development and propagation ③ **Evacuation**

1.1 Anomalies that

1.2 Technical instal

Electrical instal

Gas installation

Heating install

Heating install

Food preparat  
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Combustion e  
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Air conditioning  
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2.2 Reaction mater

2.3 Isolation and p  
occupancy place

2.4 Compartmen

2.5 Isolation and p  
different occupanc

2.6 Security teams

2.7 Fire detection,

**3.1 Number of exits**

**3.2 Dimensions of horizontal escape route**

**3.3 Dimensions of vertical escape route**

**3.4 Isolation and protection of escape routes**

**3.5 Analysis of the smoke control**

**3.6 Analysis of the emergency signaling**

**3.7 Analysis of the emergency lighting**

**3.8 Security teams**

**3.9 Fire detection, alert and alarm**

**3.10 Evacuation drills**



# 6. Factors

- 1 S
- 2 Development and propagation
- 3 Ev
- 4 Firefighting**

1.1 Anomalies that o  
1.2 Technical installa  
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3.6 Analysis of the em  
3.7 Analysis of the en  
3.8 Security teams  
3.9 Fire detection, ale  
3.10 Evacuation drills

## 4.1 Accessibility and means of non-automatic intervention

- Building accessibility
- Fire hydrants
- Hose reels
- Fire extinguishers
- Armed fire networks

## 4.2 Automatic extinguishing means

## 4.3 Security teams

## 7. Example

The **score/weight** of the factor «emergency lighting at the escape routes» is:

- 1.80** Escape routes equipped with emergency lighting, although **regulations do not require it**
- 1.00** Escape routes equipped with emergency lighting **as required by regulations**
- 0.60** Escape routes equipped with emergency lighting that **does not comply with regulations**
- Escape routes not equipped with emergency lighting, but **regulations also do not require it**
- 0.20** Escape routes not equipped with emergency lighting, **despite regulations requiring it**

## 8. Calculation

The fire safety index ( $I_{SI}$ ) is the **average** of the scores/weights obtained in each global factor

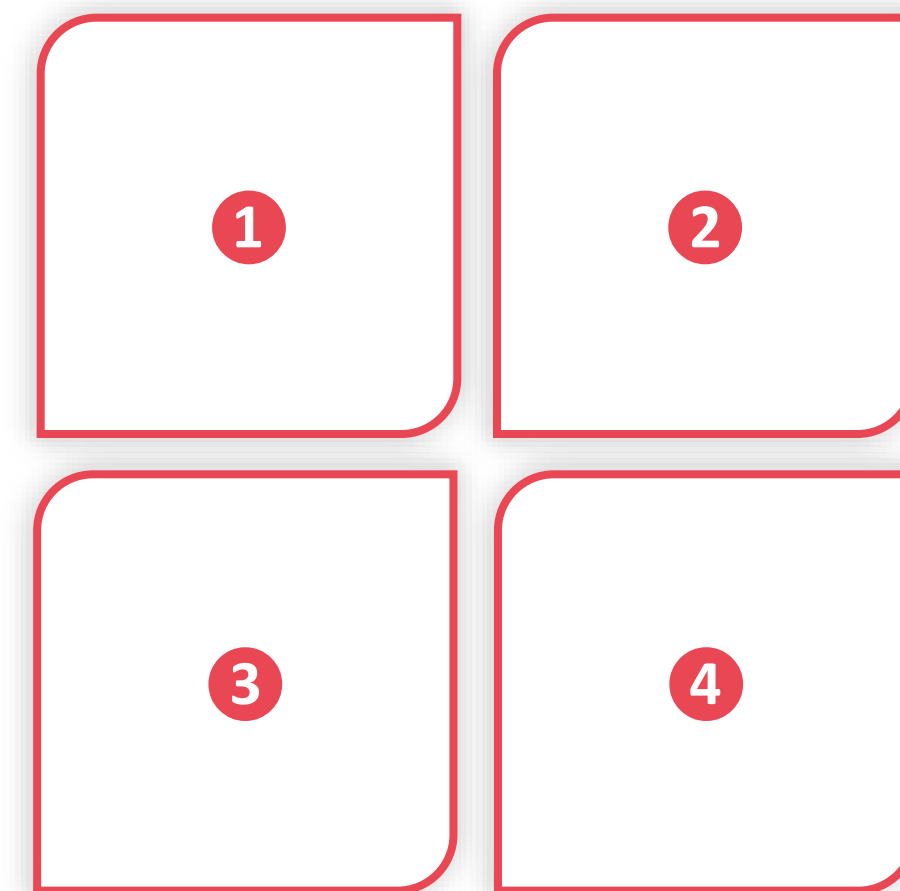
The value of the  $I_{SI}$  has the following meaning:

$I_{SI} > 1.00$  Safety level **higher** than the regulations

$I_{SI} = 1.00$  Safety level **identical** to the regulations

$I_{SI} < 1.00$  Safety level **lower** than the regulations

In some circumstances,  $I_{SI}$  values lower than 1.00 are admissible, but that depends on the intervention type →



## 9. Intervention-type

- According to the **extent** of the refurbishment, the interventions are classified into **four types**
- The **criteria to** classify the type of intervention are related to fire safety
- The more extensive the intervention is, the more **demanding** the requirements to be met are

Type of occupancy

Level of occupancy

Occupancy space risk

Number and width of exits  
from occupancy space risk

Escape routes

# 10. Information needed

The main **sources** to obtain the information needed to apply the method are

- Building inspection (building condition)
- Survey of the building (dimensions)
- Architectural project
- Fire safety project



[https://image.freepik.com/foto-gratis/rollos-planos-arquitectura-planos-casas-sobre-mesa-herramientas-dibujo-arquitectos\\_51530-1074.jpg](https://image.freepik.com/foto-gratis/rollos-planos-arquitectura-planos-casas-sobre-mesa-herramientas-dibujo-arquitectos_51530-1074.jpg)

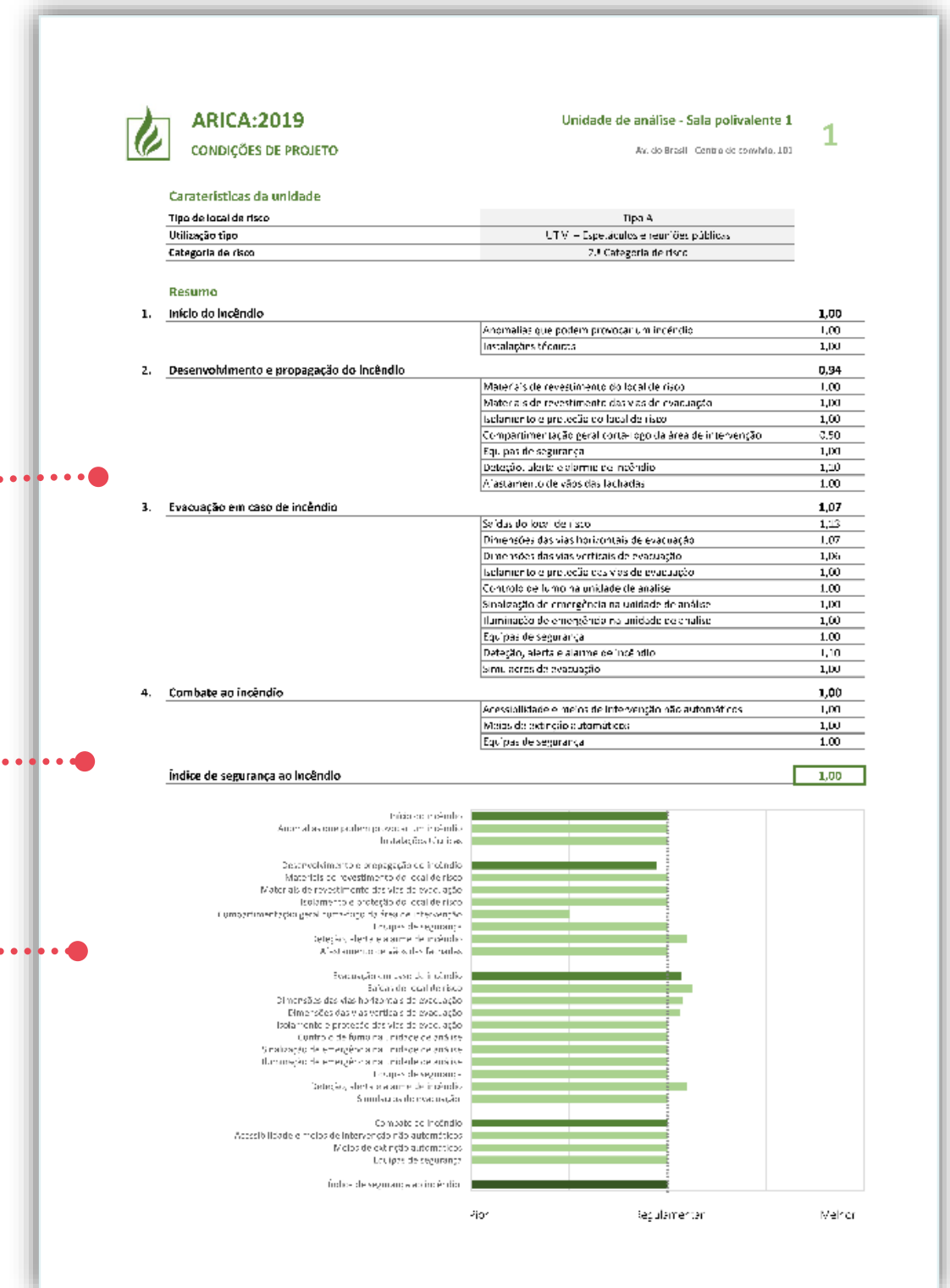




# 12. Spreadsheet

Based on the characterization of the initial and project conditions of each UA, the spreadsheet automatically:

- Determines the score of each factor
- Calculates the fire safety index
- Displays results on a graph
- Verifies compliance with conditions



## 13. Benefits

With ARICA:2019 it is intended to:

- Ensure an **adequate level** of fire safety
- **Overcome constraints** imposed by the characteristics of existing buildings
- Find **appropriate design solutions**
- Streamline the **design process**
- Promote **economy** of refurbishment works

As a consequence,  
it is expected to  
**minimize the impact on  
built heritage  
and the environment**

# 14. Development and dissemination

ARICA:2019 was developed at the **National Laboratory of Civil Engineering**, from Portugal, between May and November 2019 by the following team:

- António Leça Coelho (LNEC)
- João Branco Pedro (LNEC)
- Marta Vicente (LNEC)
- Tiago M. Ferreira (University of Minho)

Training took place between December 2019 and December 2020



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# ARICA:2022

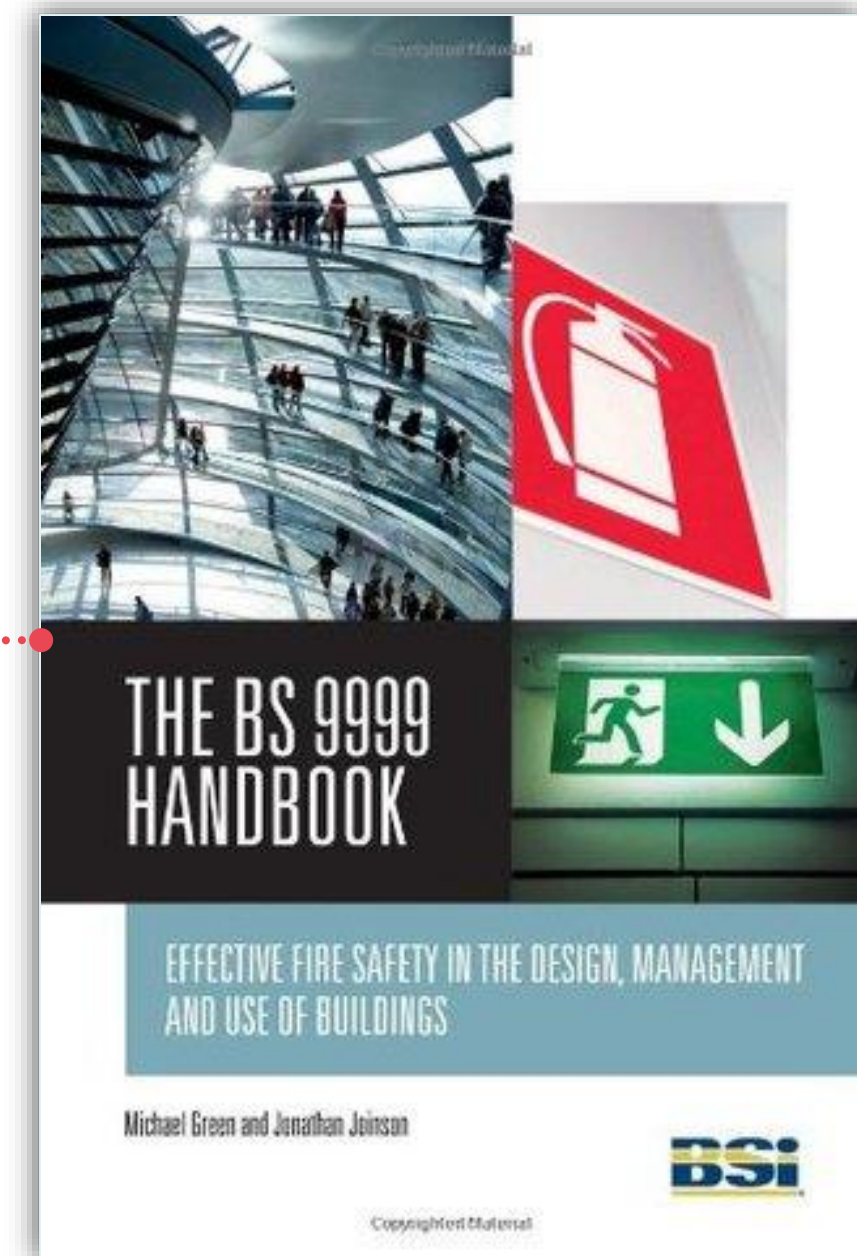
Maintains the same <sup>(1)</sup> four global factors and <sup>(2)</sup> procedure

Differs in <sup>(1)</sup> partial factors, <sup>(2)</sup> requirements and <sup>(3)</sup> scores/weights

## 2. Framework

ARICA:2022 is not based on the **Portuguese Fire Regulations** (except for Technical Installation and Organization and Management of fire safety – Emergency Plan)

ARICA:2022 is inspired by **BS9999**



[https://images-na.ssl-images-amazon.com/images/I/51plqmPkNjL\\_SX327\\_BO1,204,203,200\\_.jpg](https://images-na.ssl-images-amazon.com/images/I/51plqmPkNjL_SX327_BO1,204,203,200_.jpg)

# 3. Requirements

Set by the  
**PORTUGUESE FIRE REGULATIONS**

- **Technical Installation**
- **Organization and Management of fire safety** (Emergency Plan)

Set by the  
**METHOD**

**All other requirements** (passive or active), depend on **Hazard Index** →

## 4. Hazard index

Depends on:

- **Speed of fire development**  
(which depends, among other factors, on the nature of the fire loads in the locations to which the UA belongs)
- **Height of the UT and number of floors below the reference plane**
- **Number of occupant**
- **Profile of occupants** →



<https://www.rkrealtors.com/blog/wp-content/uploads/2018/11/fire-safety-measures-730x410.jpg>

## 5. Profile of the occupants

**Six different profiles**, which depend on:

- Whether or not they are **physically present**
- Whether or not they are **active**
- Whether or not they **know the building**
- Whether or not there is **fire safety organization and management**



<https://static.bodet-software.com/images/content/EY/access-control/FES/conduct-evacuation-drill.jpg>

## 6. Comparison

The safety index of each **UA** will be calculated identically to **ARICA:2019** but with different **scores/weights** and **requirements**

The **scores/weights** assigned to each factor will be based on compliance with the requirements of the method according to the **Hazard Index**



# 7. Scores/weights

Scores/weights were set based on:

1. **Hypothesis methodology**
2. **Knowledge** and **experience** of the authors
3. Validation by **comparing results** of the method with those obtained from the application of fire safety engineering



[https://www2.deloitte.com/content/dam/Deloitte/lu/Images/header\\_images/knowledge-management-header-4x1.jpg/\\_jcr\\_content/renditions/af5damweb1400.350.desktop.jpeg](https://www2.deloitte.com/content/dam/Deloitte/lu/Images/header_images/knowledge-management-header-4x1.jpg/_jcr_content/renditions/af5damweb1400.350.desktop.jpeg)



## 8. Benefits

With ARICA:2022 it is intended to:

- Integrate **application experience**
- **Increase accuracy**
- Broaden **scope of application**

Finalize the software  
Test and validate the method  
Promote training  
Support the implementation



Thank you!

I will be happy to answer your questions



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