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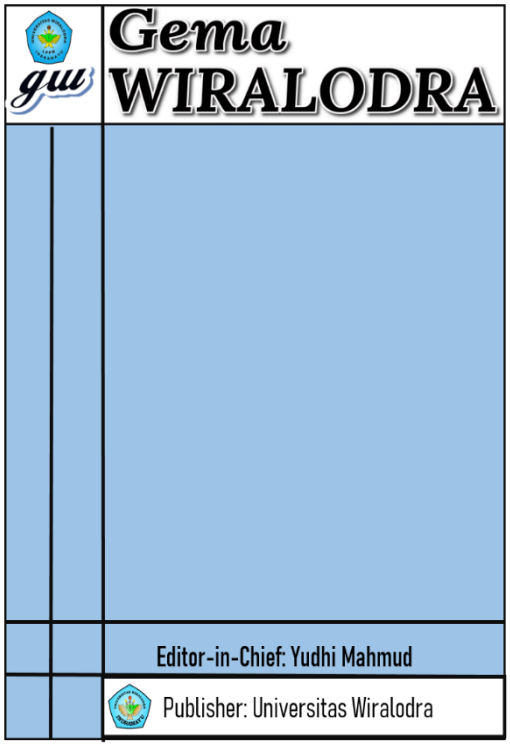

Building fire safety management analysis based on the reliability assessment method of making safety systems in greenhouse display buildings

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Original Article

Building fire safety management analysis based on the reliability assessment method of making safety systems in greenhouse display buildings

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Abstract
Fires must be watched out for and anticipated or detected as early as possible. If a fire occurs, it will have fatal consequences such as damage to buildings, infrastructure, other facilities and can even result in loss of life. Therefore, a reliable fire protection system must be implemented. To prevent or anticipate fires, detection must be carried out as early as possible and facilities and infrastructure for fire safety must be prepared. The Green House display building is an exhibition building for live plants from various mountains in Indonesia, including the Javanese mountains, the Sumatran mountains, the Kalimantan mountains and the Papuan Mountains. This building is the only building in Indonesia, which presents a mountain atmosphere precisely the same as the real mountains, both plants, soil and air temperature, but in a closed room. Plants and soil are taken directly from the relevant locations. This building is allegedly very prone to fires because there are lots of flammable materials such as leaves, wood and so on. As is the case with forests in Indonesia, especially in Kalimantan and Sumatra, where fires often occur. Therefore, the implementation of Building Fire Safety Management in this building must be implemented as well as possible. Fire safety management in question includes: completeness of facilities and infrastructure, active protection systems and passive protection systems. Active protection systems such as fire detection equipment for this building cannot use ordinary systems, because inside this building, the atmosphere is like a mountain with lots of big trees. To ensure that the building can be declared reliable in terms of building safety, especially fire safety, it is necessary to carry out reliability checks on the building. This inspection can be carried out using several methods, including analysis based on applicable standards and analysis based on an assessment of the reliability of the building safety system referring to the Center for Settlement Research and Development, Public Works Research and Development Agency, Department of Public Works in 2005 (Pd-T-11-2005-C).
Keywords: Fires, mountains, vegetation, building reliability.

1. Introduction

Fires must not only be watched out for and anticipated but must be detected as early as possible and prevented. Because, if a fire occurs, the consequences will be fatal, such as damage to buildings, infrastructure, and other facilities, and could even result in loss of life. Therefore, a reliable fire protection system, both active protection and passive protection, must be implemented as well as possible. To prevent or anticipate fires, the best possible fire hazard detection system must be implemented and can detect it as early as possible. Apart from that, the use of fire-resistant building materials must be implemented and facilities or infrastructure must also be prepared for fire safety in the event of a fire.

Because building fires often occur in Indonesia and cause a lot of material losses and even fatalities, we will research the Green House Display building located in the Cibinong Science Center (CSC) complex area, Cibinong, Bogor Regency, West Java, regarding the protection system. fires applied to the building by analyzing it in terms of building fire safety management with the method of assessing the reliability of the building safety system in terms of the use of installed active protection system equipment and the use of non-flammable building materials as passive fire protection, also related to the facilities and infrastructure provided available.

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When looking at the level of fire hazard risk, refer toRepublic of Indonesia Government Regulation Number 16 of 2021, concerning Implementing Regulations of Law Number 28 of 2002 concerning Buildings, Green Hoiuse Display Buildings are included in buildings with a high level of fire risk, because they contain a lot of flammable materials such as leaves. leaves, wood and so on, it is even possible that fires may occur due to the actions of irresponsible visitors.

The Green House Display building is very prone to fires, like forests in Indonesia, especially in Kalimantan and Sumatra, this is caused by weather factors or human activities. Therefore, the Building Fire Safety Management (MKKB) system in this building must be implemented as well as possible. The fire safety management system in question is an active and passive fire protection system. These systems include:

1) fire detection systems, both smoke and heat detectors;
2) firefighting system (hydrant and sprinkler);
3) use of fire-resistant/non-flammable building materials;
4) adequate fire evacuation routes and fire safety training.

To ensure the reliability and safety of buildings, it is necessary to manage fire hazards correctly and in a planned manner. Fire safety management requires a planned program called Fire Safety Management. By conducting this research, it is hoped that it will provide benefits such as:

1) It is hoped that it will be helpful for Green House Display - BRIN building managers to obtain information related to building data regarding the Building Fire Safety Management System implemented in the building.
2) From the analysis results, whether the fire safety equipment installed in the Green House Display building is appropriate for its function and has good reliability can be seen.
3) Can repair/perfect the fire safety systems installed in the building if, in the future, after the research, things are found that could be better.

2. Method

The research method used in this research is a quantitative descriptive research method, where direct observations are carried out according to conditions in the field. Data collection was carried out by direct observation to obtain data directly by observing things related to research on the research object and being directly involved in activities. Apart from this, direct interaction is also carried out with the actors involved in the research object. As secondary data, relevant information regarding the theoretical basis was also collected from pertinent references to the research topic, such as applicable legislation and guidebooks. To carry out research analysis, a building inspection was carried out based on building inspection standards from the Center for Settlement Research and Development, Public Works Research and Development Agency, Department of Public Works in 2005 (Pd-T-11-2005-C).

3. Results and Discussion

Quoted from the Research and Development Center for Settlements, Public Works Research and Development Agency, Department of Public Works, 2005, "Execution of building reliability checks against fire hazards must be carried out by experts appropriate to their field, and competent agencies must validate the results."

Building Safety System Reliability (KSKB) value checks carried out include (a) site equipment, (b) means of rescue, (c) active protection system, and (d) passive protection system. Value weighting standards are based on PD-T-11-2005-C, as seen in the following table.

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Table 1
KSKB Parameter Weighting (Pd-T-11-2005-C)

No	KSKB parameters	KSKB Weight (%)
1	Site Equipment	25
2	Means of Rescue	25
3	Active Protection System	24
4	Passive Protection System	26
	Amount	100

Building Safety System Reliability Values (NKSKB) include: (a) OK, if the NKSKB value is not less than 80% - 100%, (b) Quite good, 60% < NKSKB < 80%, and (c) Less, if NKSKB < 60%. In this study, 3 (three) NKSKB criteria will be taken, namely Good or "B" with an equivalent value of 100, Fair or "C" with an equivalent weight of 80, and Poor or "K" with an equal value of 60. To obtain the Condition Value, an equation taken from Pd-T-11-2005-C is used.

Condition value = (result assessment) x (sub KSKB weight) x (KSKB weight) …… (1)

Discussion on Green House Display Building Assessment

Site Equipment

Based on Pd-T-11-2005-C, site equipment consists of:

a. Water sources
   Water sources are obtained from 2 sources, namely PAM and shallow wells stored in Ground Water Tanks with a capacity of 600 m3. Based on the assessment results referring to Pd-T-11-2005-C, it can be categorized as "Good" with a condition value of 6.8%.
b. Neighborhood Road
   The environmental road in the Green House Display building area has rigid concrete pavement and a width of 3 meters. Therefore, the environmental road is only rated "Adequate", because the road width is less than the requirements in Pd-T-11-2005-C, namely a minimum width of 6 meters. So, the condition value obtained is 5.0%.
c. Distance Between Buildings
   Building, the Green House Display has a building height of 20.8 meters with a distance to other buildings of around 500 meters, so it gets a "Good" score because based on Pd-T-11-2005-C with this building height, the minimum distance to other buildings is minimum 8 meters. So, the condition value is 5.8%.
d. Yard Hydrant
   In this building there are 2-yard hydrants that function well, so that's an assessment *based on* Pd-T-11-2005-C can be categorized as "Good" with a condition value of 6.3%.

Table 2
Calculation of Site Equipment Component Values (Pd-T-11-2005-C

No	KSKB/SUB KSKB	Rating Result	Booth Evaluation	Weight	Condition Value	Number of Values
Site Equipment				25		
1	Water Sources	B	100	27	6.8	
2	Neighborhood Road	C	80	25	5.0	
3	Distance Between Buildings	B	100	23	5.75	
4	Yard Hydrant	B	100	25	6.25	
					Amount	23.8

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Means of Rescue

Based on Pd-T-11-2005-C, rescue facilities consist of:

a) Way out
b) There are 2 exits to the Green House Display building, but one of the doors is only 120 cm wide. The door leads directly to the stairs and does not have a smoke-free lobby, so the assessment for the exit is only rated "Adequate", because there is one condition in Pd-T-11-2005-C which is not fulfilled, so the condition value is 7.6%.
c) Exit Construction
   For exit road construction, the score is "Good", because all the criteria in Pd-T-11-2005-C are met, so the condition score is 8.8%.
d) Helicopter Platform
   There is no helipad in the Green House Display building, nor the surrounding areas, so this point received a "Poor" score with a condition score of 4.1%

Table 3
Calculation of Rescue Means Components (Pd-T-11-2005-C)

No	KSKB/SUB KSKB	Rating result	Booth. Evaluation	Weight	Condition Value	Number of Values
1	2	3	4	5	6	7
Means of Rescue				25		
1	Way out	C	80	38	7.6	
2	Exit Construction	B	100	35	8.8	
3	Helicopter Platform	K	60	27	4.1	
					Amount	20.4

Active Protection

a. Detection and Alarm
   In the Greeb House Display building, fire detection tools use Addressable Smoke and Heat Detectors and Aspirating Smoke Detectors (ASD) specifically for indoor mountain areas. Installation is correct 03-3986, so it can be categorized with the "Good" value criteria. For the condition value, namely1.9%.
b. Siamese Connection
   Easy-to-reach Siamese connections have been installed in this building area, so it can be rated "Good" with a condition score of 1.9%.
c. Light fire extinguisher
   The type of APAR installed is by SNI 03-3988, but the number does not correspond to the building area required in PD-T-11-2005-C, so it is assessed as "Fair" with the condition value obtained being 1.5%.
d. Building Hydrant
   Geding hydrants in this building, have been installed on every floor, and all the "Good" criteria can be met. So, the condition value is 1.9%
e. Sprinklers
   The sprinklers have been installed according to the "Good" criteria, resulting in a condition score of 1.9%.
f. Overflow Extinguishing System
   An overflow extinguishing system is not installed in this building so it can be categorized as "Poor" with the condition rating of 1.0%
g. Smoke Control
   Control equipment is not installed according to the requirements, whether in type, quantity, or location. So, the value criteria for smoke control are categorized as "Poor". The condition value is 1.2%

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h. Smoke Detection
For Smoke Detection, this building has been installed by 03-3689, all "Good" criteria categories can be met, and the condition value is 1.9%.

i. Smoke exhaust
No Smoke Exhaust equipment is installed in this building so it can be categorized as "Poor" with a condition rating of 1.0%.

j. Elevator Fire
No fire elevator is installed in this building, so it gets a "Poor" rating with a condition rating of 1.0%.

k. Emergency cahava
The emergency lighting in this building can be categorized as "Good" because this building uses glass walls and a roof; however, artificial emergency lighting is still installed in this building. So, the condition value is 1.9%.

l. Emergency power
For emergency electricity, 2 sources of electricity are installed in this building, namely from PLN and backup electricity. The generator and installation are by PUIL to be rated as "Good" with a condition rating of 1.9%.

m. Operations control room
The Operations Control Room in this building only has CCTV installed, but it is enough to help monitor the danger of fires that will occur. So, for this case, the criterion value is categorized as "Adequate" with the condition value 1.3%.

Table 4
Calculation of Active Protection Components (Pd-T-11-2005-C)

No	KSKB/SUB KSKB	Rating result	Booth. Evaluation	Weight	Condition Value	Number of Values
1	2	3	4	5	6	7
Active Protection				24		
1	Detection and Alarm	B	100	8	1.9	
2	Siames Connection	B	100	8	1.9	
3	Light fire extinguisher	C	80	8	1.5	
4	Building Hydrant	B	100	8	1.9	
5	Sprinklers	B	100	8	1.9	
6	Overflow Extinguishing System	K	60	7	1.0	
7	Smoke Control	K	60	8	1,2	
8	Smoke Detection	B	100	8	1.9	
9	Smoke exhaust	K	60	7	1.0	
10	Elevator Fire	K	60	7	1.0	
11	Emergency cahava	B	100	8	1.9	
12	Emergency power	B	100	8	1.9	
13	Operations control room	C	80	7	1.3	
					Amount	20.5

Passive Protection

a. Ketah. Fire Strk. Building
The fire resistance of this building structure is excellent because the building structure used, namely steel and concrete structures, has been researched to be fire resistant. Therefore, the value criteria for the fire resistance of building structures is "Good." The condition value is 9.4%.

b. Space Compartmentation
The compartmentation of space in this building cannot meet all the suitable criteria because the road to the location is only 3 meters wide, so the requirement for the score obtained is only "Adequate". The condition score is 6.7%.

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c. Aperture Protection

To protect openings in this building, it can meet all the assessment criteria in the Assessment in Pd-T-11-2005-C. So, it can be categorized as "Good" with a condition value of 8.3%.

Table 5

Calculation of Passive Protection Components (Pd-T-11-2005-C)

No	KSKB/SUB KSKB	Rating result	Booth. Evaluation	Weight	Condition Value	Number of Values
1	2	3	4	5	6	7
Passive Protection				26		
1	Ketah. Fire Strk. Building	B	100	36	9.4	
2	Space Compartmentation	C	80	32	6,7	
3	Aperture Protection	B	100	32	8.3	
					Amount	24.3

Ninal KSKB Green House Display Building

Based on the calculations carried out to calculate the Building Safety System Reliability Value (NKSKB) in the Green House Display building, we get:

a. Site Completeness with a weight value of 23.8% of the standard 25%
b. Rescue Facilities with a value weight of 20.4% of the standard 25%
c. Active Protection System with a value weight of 20.5% from the standard 24%
d. Passive Protection System with a value weight of 24.3% from the standard 26%
e. The total weight of the value obtained is 88.98%

So, the Reliability of the Green House Display Building Safety System, based on Pd-T-11-2005-C, is declared "Good", because it is not less than 80%. However, there are still deficiencies that must be corrected so that the building becomes more reliable regarding building safety. especially fire safety.

4. Conclusion

From the results of the research above, it can be concluded that the overall reliability value of the building safety system in the Green House Display building can be categorized as "Good" because it produces a value of 88.98%, from the good criteria inPd-T-11-2005-Cwith a value between 80% - 100%. However, the means for exits and environmental roads need to be improved because the width of the road still needs to be improved than the required requirements. In the control room, only CCTV is installed to monitor events, while the conditions must be provided with complete fire safety equipment.

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