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SPRINKLER SYSTEM EVALUATION TO MEET FIRE PROTECTION FACILITY AT THE MAIN LABORATORY AT PT. PUPUK KUJANG CIKAMPEK

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ABSTRACT

PT. Pupuk Kujang is a petrochemical manufacture that using many hazardous chemicals in the manufacturing process and also in the main laboratory, the chemical can be explosive, corrosive, reactive, flammable, and so on can cause high fire risks.
Sprinkler system is one of automatic fire protection. This tools will work when the sprinkler head is break on heat detection, and will shed water through nozzles at the sprinkler head.
The objective is to find out which sprinkler system components has meet the requirement as written on SNI 03-3989-2000 (Sprinkler System Design and installation), the procedure of designing sprinkler system, to find out which components need to be repaired, using HOQ (House Of Quality) as part of QFD (Quality Function Deployment).
The components that need to be noticed and repaired is the placement of sprinkler system head in Main Laboratory with hows variable that is placement of sprinkler system head for moderate occupation, maximum distance 4.0 m, between hows variable and whats variable has strong relationship because of the present sprinkler system were not appropriate.
Keywords: *HOQ, sprinkler system, placement*

1. INTRODUCTION

1.1 Introduction

Fire disaster is one of accident on work that could be caused by human error or work environment. Lack of fire protections or fire protections placement at industrial estate usually are not meet to Indonesian National Standard (SNI), and this situation could not make early fire disaster prevention. Sprinkler system is one of auto fire distinguisher that will be put under the roof in the room. Sprinkler system design should be reffered to SNI 03-3989-2000, the procedure of designing sprinker system.

PT. Pupuk Kujang has a main laboratory, is a place to conduct chemical sample checking and testing, such as touluene, sulfate acid, and so on, which are explosive, corrosive, reactive, flammable, and can cause high fire risks, so that evaluation sprinkler system is essential.

1.2 Problem Identification

Probem identifications can be formulated as follow,

1. How the present sprinkler system series in the main laboratory.
2. Is the sprinkler system at the main laboratory meet the SNI 03-3989-2000.
3. What sprinkler system component that need to be repaired.

1.3 Objectives

1. Determining the present sprinkler system series in the main laboratory.
2. Determining the sprinkler system at the main laboratory to meet the SNI 03-3989-2000.
3. Determining sprinkler system component that need to be repaired.

2. THEORITOCAL BACKGROUND

Quality function deployment has been used to translate customer needs and wants into technical requirements in order to increase customer satisfaction (Akao, 1990).

Quality function deployment utilizes the house of quality, which is a matrix providing a conceptual map for the design process, as a construct for understanding customer requirements (CRs) and establishing priorities of technical requirements (TRs) to satisfy them (Gonzalez, 2001).

According to Gonzalez (2001), QFD is a product development process that stresses cross-functional integration. Kim et al. (1998) stated that QFD brings the following advantages to companies: fewer and earlier design changes, reduced product development cycle time, fewer startup problems, and, above all, customer satisfaction. Armacost et al. (1992) describe an analytic hierarchy process (AHP) framework that has been established for prioritizing requirements. Franceschini and Rupil (1999) illustrate how the priority rank of design characteristics can change depending on the type of scales used. According to Ghiya et al. (1999), most Americans associate QFD with the "house of quality."

As discussed here, QFD contains far more. Clausing and Pugh (1991) and Kim et al. (1998) provide more extensive and complete views. Dean (1993) views QFD as a system engineering process, which transforms the desires of the customer into the language required for implementing a product. It also provides the glue necessary to tie it all together. Finally, it is an excellent method for assuring that the customer obtains high value from the product. Mizuno and Akao (1994), in their book, indicate that QFD is far more than has previously been disclosed. It is clearly the mechanism for deploying quality, reliability, cost, and technology throughout the product, the project to bring forth the product, and the enterprise as a whole.

Using QFD, there are two issues in the analysis of the customer requirements. First, customer requirements are often described informally using vague terms (remember that the source of information in our case is children). However, lack of a formal method for interpreting the semantics of these requirements makes it difficult to determine if a realization of the system meets its customer's needs. Second, identifying relationships between requirements is often time consuming.

Sometimes, it is difficult to arrive at a group consensus on a particular relationship between requirements (Mazur, 1991a,b).

Quality, as well as ergonomics, aims at meeting the demands of the customer. A high-quality product therefore may be regarded as an ergonomic product-a product adapted to human abilities and limitations (Gonza´lez et al., 1998). According to Nakui (1991), a number of methods have been developed aimed at simplifying and making the product development more efficient. These methods could be used in ergonomics.

Quality function deployment is a well-known and systematic method based on the idea of adapting technology to people, a method that determines the voice of the customers and examines the company response to this voice through and organized team approach (Day, 1993).

Quality function deployment adopts a customer driven approach and provides a structured way to ensure that the final product meets customer requirements (Parasuraman et al., 1985). The first QFD chart links customer attributes and technical requirements through a two-dimensional diagram.

Akao (1990) introduced QFD in Japan in 1966. He said QFD is a method for translating the consumer's demand into design targets and major quality assurance points to be used throughout the production phase. Quality function deployment is a way to assure the design quality while the product is still in the design stage (Armacost et al., 1992). As an important side benefit, Akao (1990) states that QFD has produced reductions in development time of one half to one third.

Sullivan (1986) says that the main objective of any manufacturing company is to bring products to market sooner than the competition with lower cost and improved quality and that QFD can help do this. Quality function deployment provides a means of translating customer requirements into the appropriate technical requirements for each stage of product development (i.e., marketing strategies, planning, product design and engineering, prototype evaluation, production process development and production, sales). In QFD, all operations are driven from the voice of the customer; QFD therefore represents a change from manufacturing process quality control to product-development quality control.

3. METHODOLOGY

To solve the problem, this research using QFD (Quality Fucntion Deployment) method with tool HOQ (House of Quality).
First conducting interview and then construct the result to gain HOQ. The steps are defining whast variables and hows variables.

1. Whats, in this research whats describe the sprinkler system present condition, which are

Table 1. Whats Variables

No	Whats Variables
1	Fire Pump
2	Fire Occupancy Classification
3	Head Sprinkler Placement
4	Head Sprinkler

2. Hows, is stating technical response to repair the sprinkler system based on SNI-3989-2000 that related to Whats. Construct a relationship matrix between Whats and Hows.

Table 2. Hows Variables

No	Hows Variables
1	Electric pump, diesel pump, and Jockey Pump
2	Low Occupancy Classification, Moderate Occupancy Classification group 1, Moderate Occupancy Classification group 2, Moderate Occupancy Classification group 3, High Fire Disaster Classification
3	Head sprinkler maximum distance for low fire: 4.6 m Head sprinkler maximum distance for moderate fire: 4.0 m Head sprinkler maximum distance for high fire: 3.7 m
4	Wet riser system, dry riser system

3. Diagram Matrix, is the core of House of Quality. Whats variables are associated with Hows variables

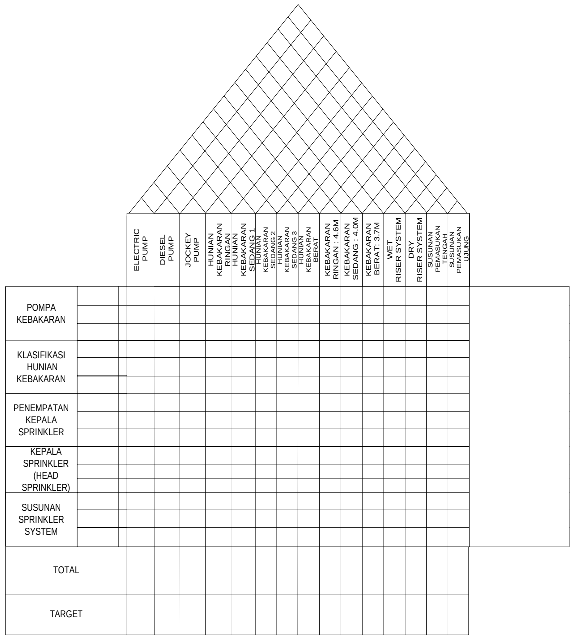

Figure 1. House of Quality

The relationship between variables is indicated by symbols inside the matrix that means correlation, Symbol and correlation are as follow,

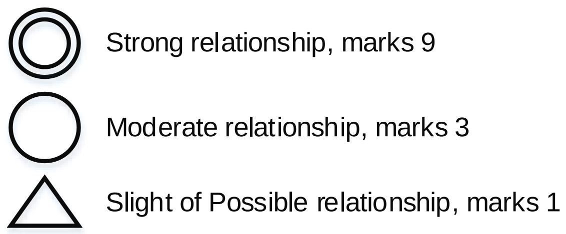

Figure 2. Symbol and Correlation

4. Target, results from diagram matrix's calculation, adjustment of whats variables and hows variables will be summed at competitive technical assessment, and the results are biggest mark to smallest mark in House of Quality.

4. RESULT

Using House of Quality, the diagram matrix is as follow,

			ELECTRIC PUMP	DIESEL PUMP	JOCKEY PUMP	HUNIAN KEBAKARAN RINGAN	HUNIAN KEBAKARAN SEDANG 1	HUNIAN KEBAKARAN SEDANG 2	HUNIAN KEBAKARAN SEDANG 3	HUNIAN KEBAKARAN BERAT	KEBAKARAN RINGAN : 4.6M	KEBAKARAN SEDANG : 4.0M	KEBAKARAN BERAT: 3.7M	WET RISER SYSTEM	DRY RISER SYSTEM	SUSUNAN PEMASUKAN TENGAH	SUSUNAN PEMASUKAN UJUNG
POMPA KEBAKARAN	Main Pump	4	△														
	Diesel pump	4		△													
	Jockey pump	4			△												
KLASIFIKASI HUNIAN KEBAKARAN	HUNIAN KEBAKARAN SEDANG 1	3					△					△					
PENEMPATAN KEPALA SPRINKLER	TIDAK DIKETAHUI	5									○	◎	○				
KEPALA SPRINKLER (HEAD SPRINKLER)	WET RISER SYSTEM	3									△	△	△		△		
SUSUNAN SPRINKLER SYSTEM	SUSUNAN PEMASUKAN UJUNG	4														△	
TOTAL			4	4	4	0	3	0	0	0	18	51	18	0	3	3	0
TARGET			4	5	-	-	6	-	-	-	2	1	3	-	7	8	-

Figure 3. Diagram Matrix

The biggest mark in diagram matrix is head sprinkler placement. In SNI 03-3989-2000 was explained that sprinkler system head placement or distance for each sprinklers for moderate occupancy classification group 1 is 4.0 m.

Beside sprinkler system head placement, there are many items to be noticed in sprinkler system series, as the figure as follows,

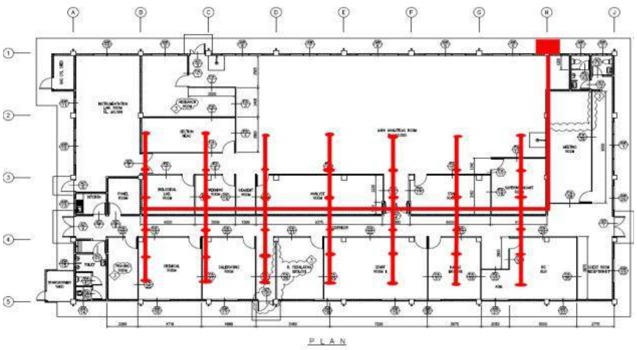

Figure 4. Sprinkler System Series

From figure 4. it shows that the red dots are sprinkler head positions. However there are many sprinkler head positions are in the building corridor and also there are sprinkler head positions in the wall, so that will not work properly

5. CONCLUSION

Sprinkler system components in the main laboratory are fit to SNI. However, still there are sprinkler head positions placement not properly placed and it may cause the sprinkler system will not working properly.

Should be conduct a preventive action to recheck the sprinkler system, replacing the obsolete or wear out components, and reorder the sprinkler system series.

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