HAZOP Study Based on ANFIS Layer of Protection Analysis in Unit Kiln PT. Semen Indonesia Factory Tuban

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Abstract - Process safety and risk assessment are vital demand for any industry to characteristic hazard and their for personnel, environment and loss of money. Unit Kiln are part of industrial cement, operated at high temperature and high pressure. Security so the process must be maintained so as not to pose a hazard with a high risk. Risk matrix is a very useful tool to estimate of process or equipment that helps decision making process. HAZOP (Hazard and Operability) study is one method to know risk assessment. Thus ANFIS logic method for risk assessment is selected as a new and efficient way to industry resource management. This study generally include quantitative review of possible accident, based on previous accident experiences that may occur in a typical process in unit kiln. For the HAZOP study the possible exist to limit failure in case definition and risk modeling to only accident that may include fire, exploitation and toxic effect risks. Consequence a ANFIS risk matrix is based on Layer Of Protection Analysis (LOPA) and HAZOP Study procedure for analyzing. The result from this research that have be done study HAZOP unit kiln PT. Semen Indonesia Factory Tuban and also know risk impact and get SIL rating for this plant.

Term Index - HAZOP, ANFIS, Unit Kiln, LOPA.

INTRODUCTION

Nowdays, Artificial Intelligent (AI) computational methods, such as knowledge-based system, neural network, genetic algorithm, and fuzzy logic, have been increasingly applied to several industrial researcher. Chemical and process unit contain huge amount of dangerous chemical product and substances that may be exposed to any kinds of hazard, like natural and process hazard [1]. In recent years cement industry, quantitative risk analysis have provided valuable information for decision process in the planning phase [2]. Risk analysis techniques based on particular characteristics are divided into four categories: deterministic, probabilistic, quantitative and qualitative. Some methods of risk analysis are: HAZOP, Event Tree Analysis (ETA), Fault Tree Analysis (FTA), Quantitative Risk Assessment (QRA), Layer of Protection Analysis (LOPA) that is used to identify potential accident scenarios, estimate their likelihoods and consequences and improve system safety and operation. However, knowledge is developing rapidly, but there is still lacking and uncertain process information, implicit in the variable, model and in the large accident hazard consequently [3].

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METHOD

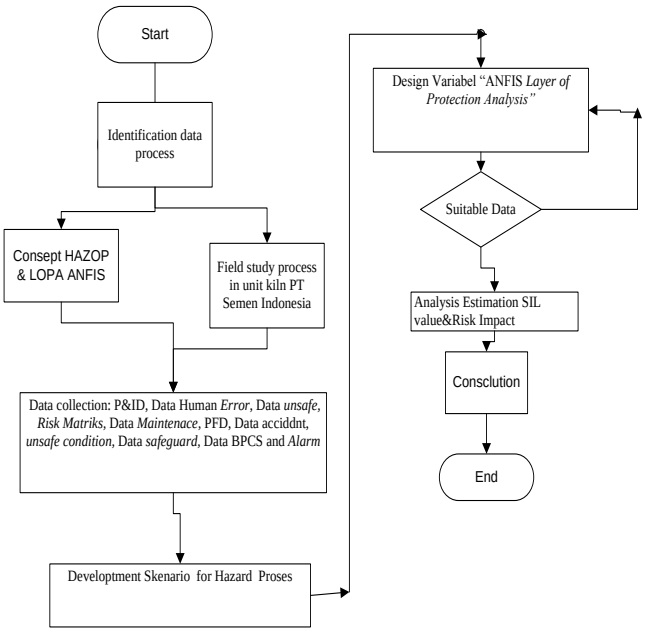

Figure 1. Flowchart Research Method

Adaptive Neuro Fuzzy Inference System (ANFIS) is one modern method that can be used in implementing an assessment, estimations and prediction qualitatively and quantitatively. ANFIS is merger of Fuzzy Inference System (FIS) mechanism, which is described in the neural network architecture.

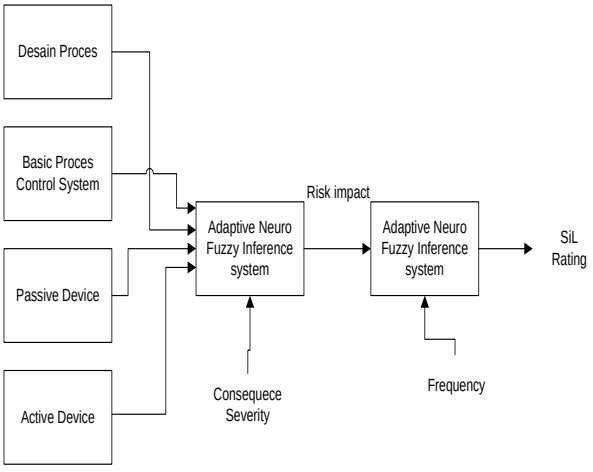

Figure 2. Architecture Adaptive Neuro Fuzzy Inference System Layer of Protection Analysis (ANFIS LOPA) for search SIL.

RESULT AND DISCUSSION

Analysis severity risk impact based on ANFIS look at surface view in picture 3.1. Unit Kiln in PT. Semen

Indonesia divided 4 node: node 1 (process in blending silo and kiln feed), node 2 (suspension preheater), node 3 (rotary kiln) and node 4 (clinker cooler). Surface view ANFIS for risk impact:

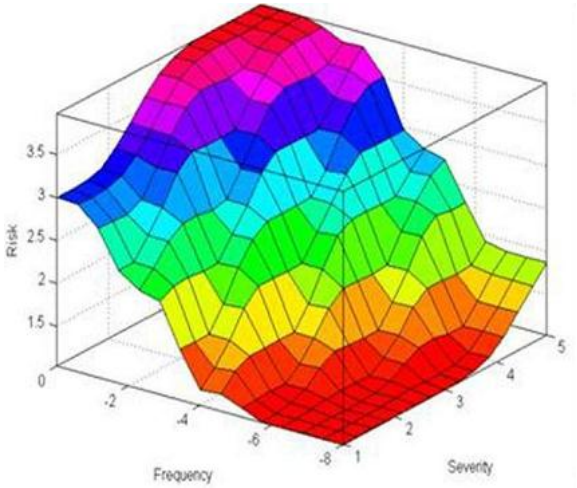

Figure 3. Surface Viewer for Seveity Risk Impact

Risk impact assesment for node 1- node 4 show that picture 3.2

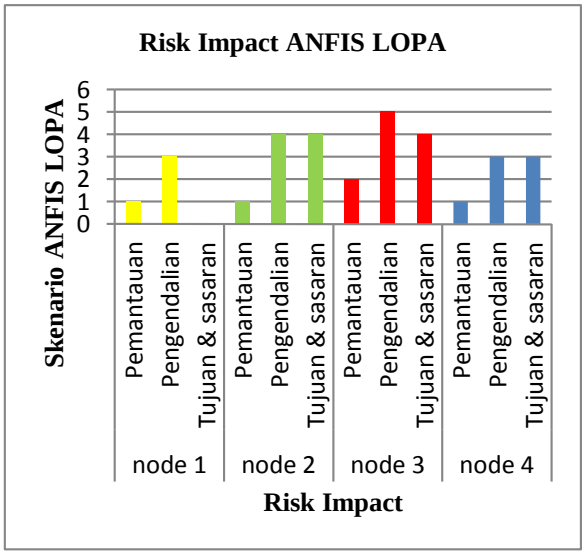

Figure 4. Risk Impact with ANFIS LOPA for node 1- node 4

For search SIL rating, see the table 3.1

Table 1. SIL rating

Node	SIL Rating	Scenario Fuzzy
1	SIL 1	1
2	NR	1
	SIL 1	3
3	NR	2
	SIL 2	3
	SIL 3	5
4	SIL 1	2
	SIL 2	3

CONCLUSION

Based in the research and analysis, can get concluded that have be done study HAZOP Unit Kiln PT. Semen Indonesia Factory Tuban and also know risk impact and get SIL rating for this plant. For node 1 get SIL 1, node 2 get SIL 1, node 3 get SIL 3 and node 4 get SIL 2.

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