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웹 기반 통합 안전, 보건, 환경 관리시스템의 구축

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Development of Web based Integrated Safety, Health, and Environment Management System

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1. Introduction

In chemical industry, the manufacturers are acutely aware of the rapidly changing business environment they face with increased global competition in commodity chemicals; ever increasing environmental, health, and safety (EHS) regulations; more rigorous customer demands; extensive investor pressure; and increased focus on societal image. The development of the next generation of chemical manufacturing processes needed to address these changes as well as maintenance of competitiveness in mature business segments will require a broad and multidisciplinary rethinking of the traditional development and commercialization process and will require new systems. The new systems must result in plants that assure process and operator safety, the sustained health of workers and the community, and the viability of the environment. Furthermore, designs must be robust so that the plants are capable of meeting stringent customer demands for quantity and quality under conditions of process variability.

In this paper, we used 'object oriented information flow' method for the analyzing existing chemical plant in different way that is a conceptual relation diagram of 'objects'. This method makes clear the information flow between the objects and relative objects and it can show the way the accidents are caused. After this assessment, we suggested a new integrated system to be able to manage EHS effectively and show a web-based program using this new model.

2. Analysis Using the Object Oriented Information Flow

2.1 Object Oriented Information Flow

Most managers designed their EHS system by each work procedure and former elements, but from this point of view, it is not easy to understand the relationship and the roles between the modules in the plant. So we suggested the concept of 'Object', which means the main role of the manufacturing system. This object has its information and we should manage this object constantly. The process information flows with real materials through these objects and it can be expressed with arrows. Sometimes this information needs to be supported by another auxiliary object, called 'relative object'.(Fig. 1(a))

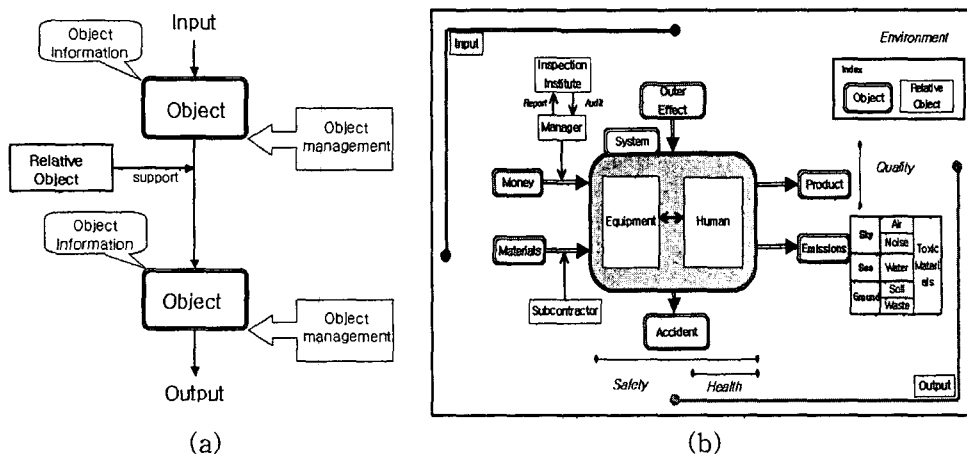


Fig 1. (a) Conceptual Design of Object and Relative Object

(b) OOIF in Chemical Process

2.2 Analysis of EHS Using the Object Oriented Information Flow

In the first, the manufacture can be divided into system and environment. System is decided when we have a focus on making product roughly. This system has main input elements as money (investment) and raw materials, main output elements as products and emissions. And outer effect like a disturbance is added as an input element and accident is also added as an output element.

The managers invest their money for the system and raw materials, utilities like steam, electrics, etc. are inputted to the system together with contractors support. The system has two main components, equipment and human (workers). The relationship between the equipment and human can cause accidents as outer effect like disaster, typhoon, domino effect, terror, etc.

This system also emits products and emissions to the environment.(Fig. 1(b)) Each object has its information and management as Table 1. We always ought to update the objects information and manage it properly pursuant to the company's policy.

If we look into this system more detailed, the equipment and human have their information and management, which can be divided into before and after accident management. We could also allocate each element as following Fig. 2 (a) and induce the overlapped work areas.

Table 1. Information and Management of Objects

Classification	Information	Object	Management
Input	Cost per Materials	Money (Investment)	Cost
	MSDS	Raw Materials	MSDS
	Weather Condition	Outer Effect	Disaster, Domino Effect, Human Error
	GIS		
System	Process Map	System	Operation, Change, Self Inspection
	Hazardous Unit	Equipment	Risk Analysis
	Medical Check Disease	Human	Emergency Plan, First Aids, Training
Output	Specification	Product	Quality Control
	Open Door Policy	Emissions	Monitoring, TMS
	Statistics	Accident	Investigation
Relative	Standards	Manager	Schedule, Code
	Law, Rule	Inspection Institute	Online Update
	Admission Code	Contractor	Work Permission

3. System Modeling and Making Web-based Program

The integrated EHS system starts with process information, for example, process maps, MSDS (Material Safety Date Sheet), hazardous equipment data, etc. The foundation of this database is the basic work of integrated risk management system. The main module of this system has integrated EHS system and education, training module and cost analysis module. Managers always make schedule of EHS education and training more efficiently and there also need cost analysis of EHS investment for the top manager.

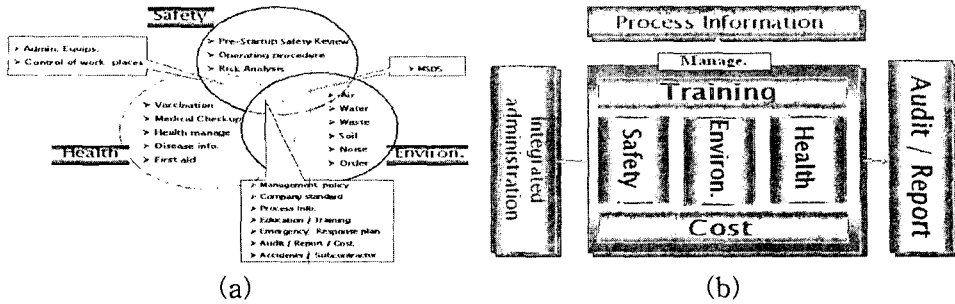


Fig 2. (a) Overlapping of EHS Management (b) Modules of the Integrated EHS System

This system cannot be separated from the company's policies and should meet the rapid change of regulations and reporting functions.

Table 2. Detailed Contents of the Integrated EHS System

Classification		Contents
Process Information		Maps / MSDS / Hazardous Equipment / Contractors
Integrated Administration		Company Standards / Code
Management	Environment	Air / Noise / Odor / Water / Soil / Waste
	Health	Medical Check-up / Vaccination / Disease Information / First Aids
	Safety	Equipment / Working Environment / Accident / Risk Analysis
	Training	Personal Check-up / Emergency Organization / ERP
	Cost	Analysis of Cost and Benifit
Audit / Report		Law / Rules / Self Audit / Report

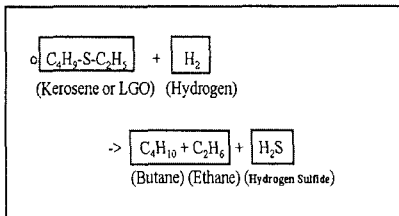
We developed this system on the network technology with web server and DB server. The web server is based on windows 2000 server as O/S and has VB ActiveX Control, ASP (Active Server Page) as an application. We used MS SQL 2000 S/W for the DB server, which also used window 2000 server as O/S. The following Fig. 3 shows the main page of this system.



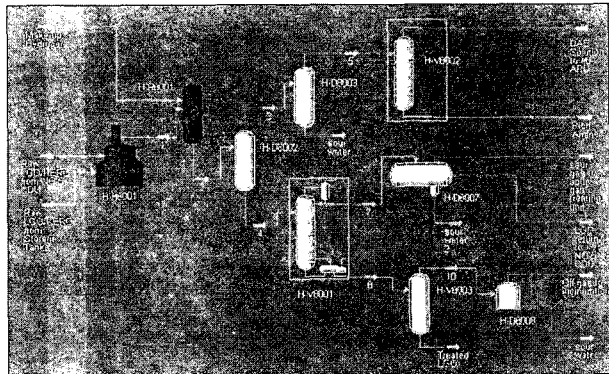
Fig 3. Web-based Integrated EHS Management System

4. Case Study

We applied our system to MDU (Middle Distillate Unit) #5 process which can desulfurize petroleum with hydrogen gas and catalyst at S company. This MDU process can change kerosene or LGO (Light Gas Oil) with hydrogen to C₂ and C₄ with hydrogen sulfide for 60,000 barrels a day.



(a)



(b)

Fig 4. (a) Stoichiometric Equation of Catalytic Desulfurization of Petroleum with Hydrogen Gas (b) Overall process diagram

With the process information as material and equipment (Fig. 5), every modules were compared with existing database and adjusted for this system. In the end, we could find that it has a good efficiency by using this system, but there need more data for the cost analysis module.

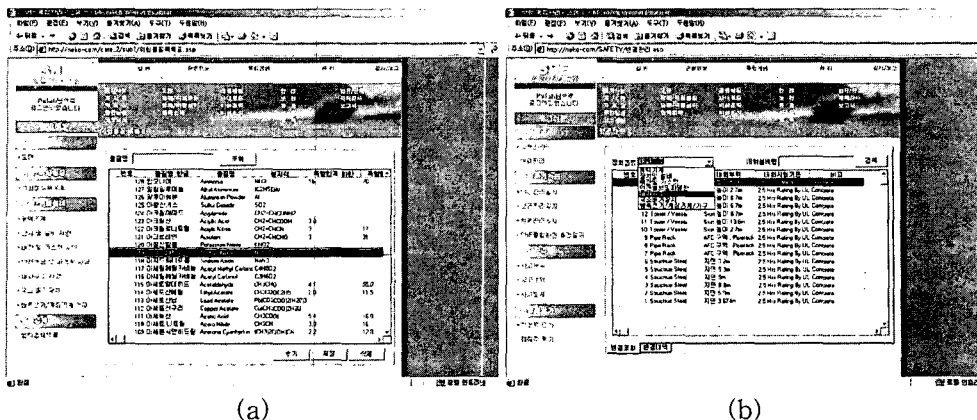


Fig 5. (a) Hazardous Materials (b) Hazardous Equipment

5. Conclusion and Future Works

We developed integrated EHS system using the object oriented information flow with proper allocation of work areas and adjusted this system to a MDU process to verify the efficiency of this. From the case study, we know that the modules of this system are well fitted to the real process. We should more develop the detailed interface of administration and user mode, and it should be operated under the security system.

Acknowledgments

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