Chapter 3

Outline of the Information Infrastructure in ASEAN and East Asia

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CHAPTER 3

Outline of the Information Infrastructure in ASEAN and ASEAN and East Asia

In this chapter, the basic concept and outline of the proposed information infrastructure is described. Regarding the name of the infrastructure, basically there would be two options taken in to consideration: whether to describe the (legal) entity by itself only, or to describe it as one function. In the following chapter, a more comprehensive entity shall be proposed, and the infrastructure described below could be one function of that entity. Therefore, in this chapter, the infrastructure is described as a named function of that entity, and is hereafter referred to as the "ASEAN Chemical Safety Database."

1. Basic Concept of the ASEAN Chemical Safety Database

1.1. Mission of the ASEAN Chemical Safety Database

1) Target Setting

The ASEAN Chemical Safety Database pursues the achievement of the following targets, with the aim of establishing smooth distribution of chemical substances with assured safety.

1. *To share information on risks and hazards*
2. *To enhance transparency and reduce compliance risk through providing information regarding local regulations*
3. *To facilitate regulatory convergence among ASEAN and East Asian Countries*
4. *To reduce costs of duplicative testing and the burden of assessment*

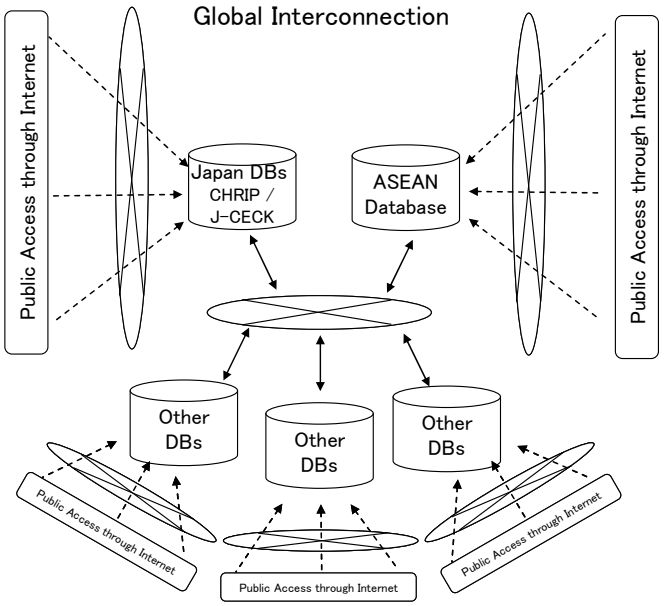
2) Previous Concept

Figure 1 illustrates the general schema of the ASEAN Chemical Safety Database examined until the last year. The ASEAN Chemical Safety Database is briefly summarized as follows:

- ✓ The ASEAN Chemical Safety Database shall be made accessible through the internet, so that it can be utilized by the public at large.
- ✓ The ASEAN Chemical Safety Database shall design mutual links with databases constructed by ASEAN, and databases in other countries, so the data can be used to best effect.

- ✓ The ASEAN Chemical Safety Database shall exchange data with information on risks and hazards with databases constructed by ASEAN and CHRIP in Japan in order to make use of information on risk and hazard data.

Figure 1: Thought starter



1.2. Possible Use of the ASEAN Chemical Safety Database

1) Investigation and Analysis of the Current Conditions

In order to understand the current conditions, we analyzed the need in each ASEAN Member States based on the questionnaire survey on the ERIA workgroup members. Moreover, in order to understand the conditions of databases in the world, we organized databases according to the way they manage their information on chemical substances.

A) Results of Questionnaire Survey on ERIA WG Members

The results of the questionnaire for the ERIA WG members are shown in Figures 2 to Figure 5.

Figure 2 displays the questionnaire on what chemical substance management information is needed. In the questionnaire, what chemical substance management information is needed is evaluated in 5-point scale, where 1 is the highest priority information, and 5 is the lowest priority information. We assigned 5 points for a response of 1, 4 points for 2, 3 points for 3, 2 points for 4, 1 point for 5, and 0 points for no response, and plotted the total number of points earned for each item. Since we obtained responses from 11 members, the maximum number of points is 55.

Figure 3 shows the results of the questionnaire on operations that use information of the Database, Figure 4 shows the answers to questions regarding the expectations of the Database, and Figure 5 shows the answers to questions on functions considered necessary for the Database. For the questionnaire, the number of responses obtained is plotted for each item.

Figure 2: What information does your country need for the ASEAN Chemical Safety Database?

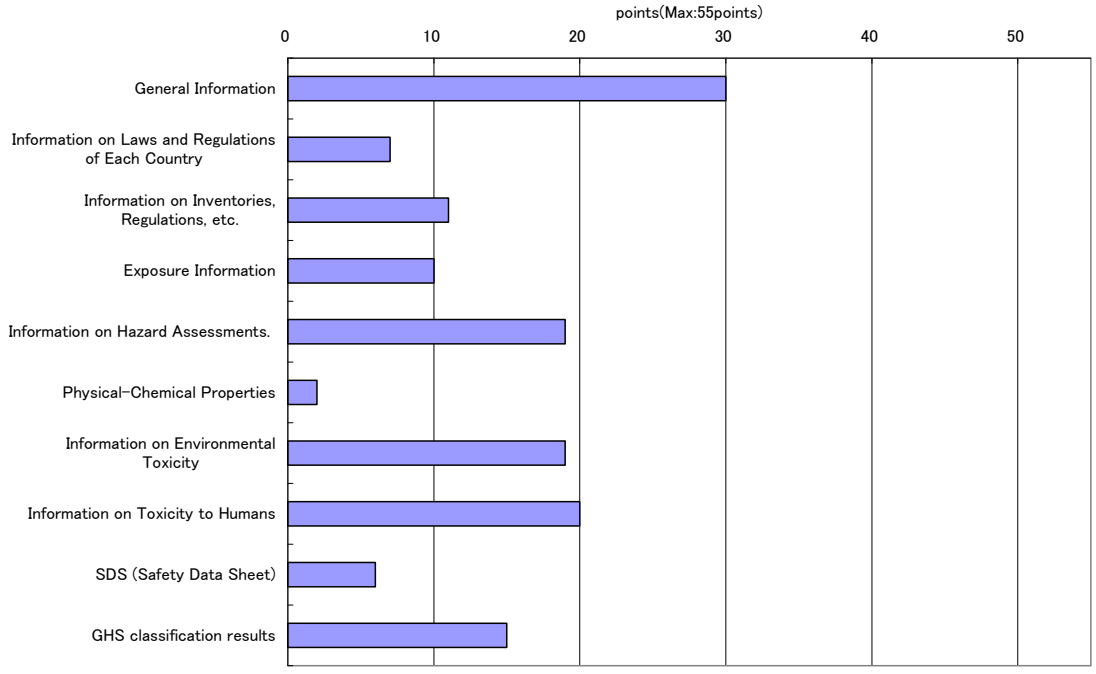


Figure 3: Please describe the possible usage of the output from ASEAN Chemical Safety Database.

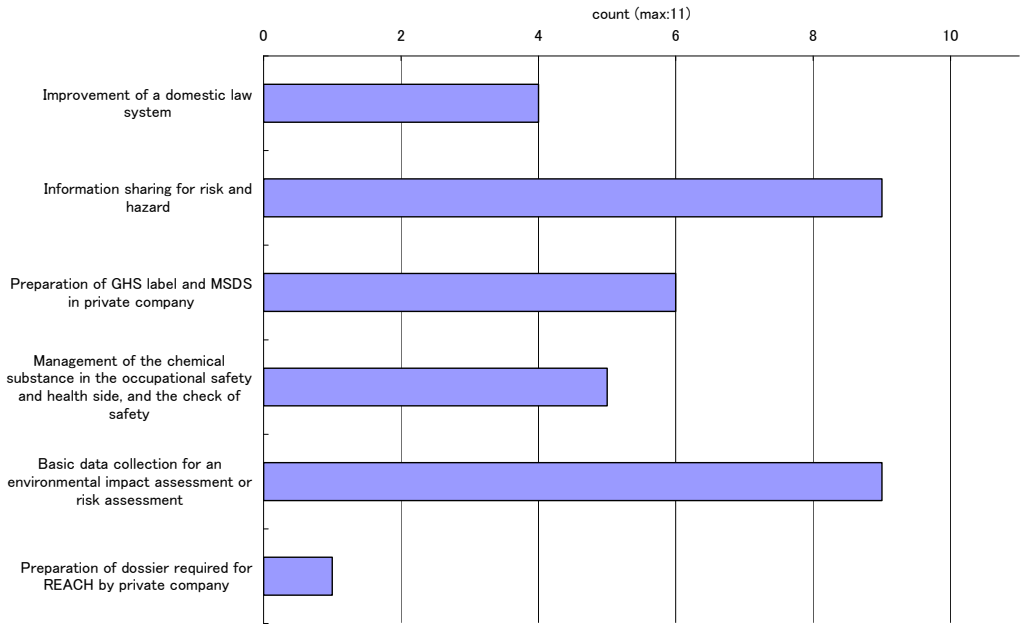


Figure 4: What does your country expect from the ASEAN Chemical Safety Database?

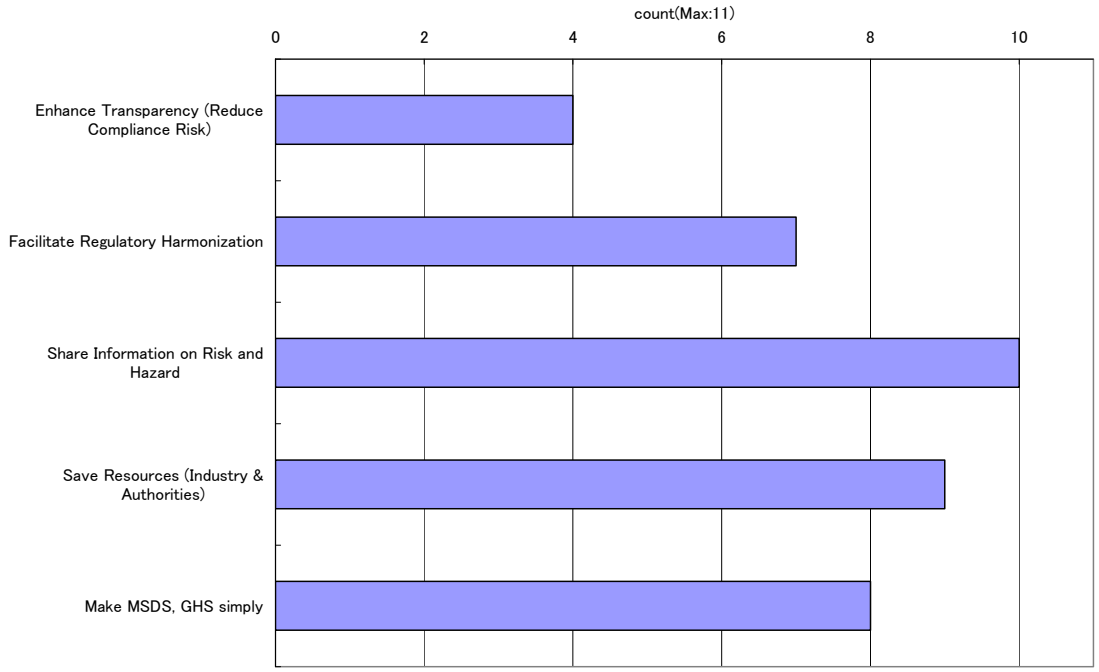
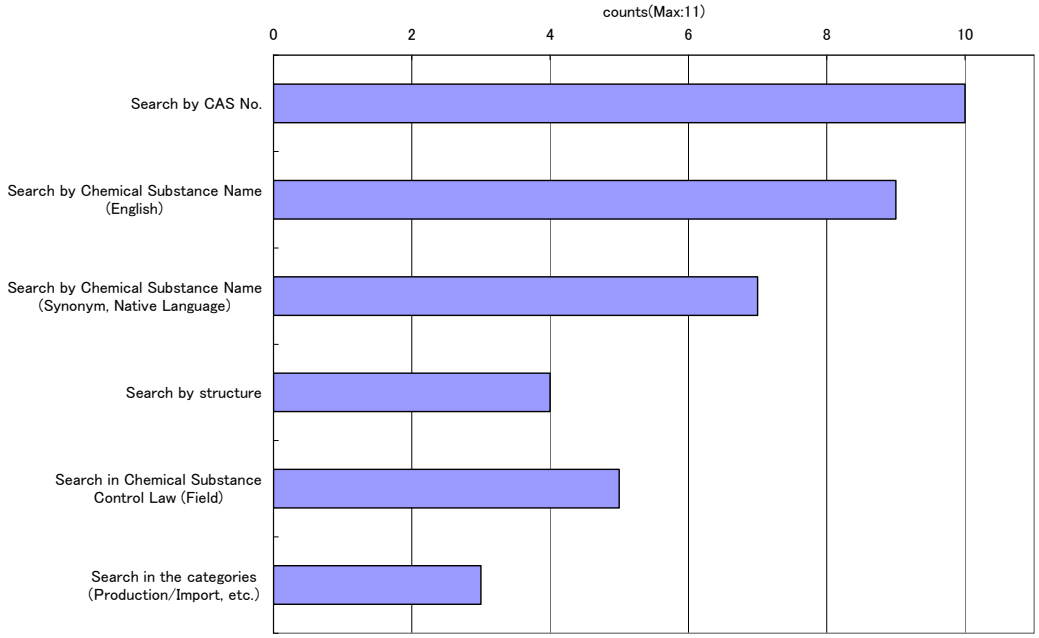


Figure 5: What functions should the ASEAN Chemical Safety Database have?



Looking at the results of the questionnaire survey, the chemical substance management information most highly needed by the WG members includes general information and information on toxicity to humans. Operations that use the information of the database most often are information sharing for risk and hazard assessment and basic data collection for an environmental impact assessment or risk assessment. The ASEAN Chemical Safety Database is highly expected to facilitate the sharing of information on risks and hazards and the centralization of information management.

Functions considered necessary for the Database to have included: Search by CAS No., and Chemical Substance Name (English).

The details of the items shown in Figure 2 are revealed in the following Table 1. A notation is included on the information provision of the SDS. As SDS is provided from many companies and the Database collects SDS information as a repository and discloses it with the notation of “not final.”

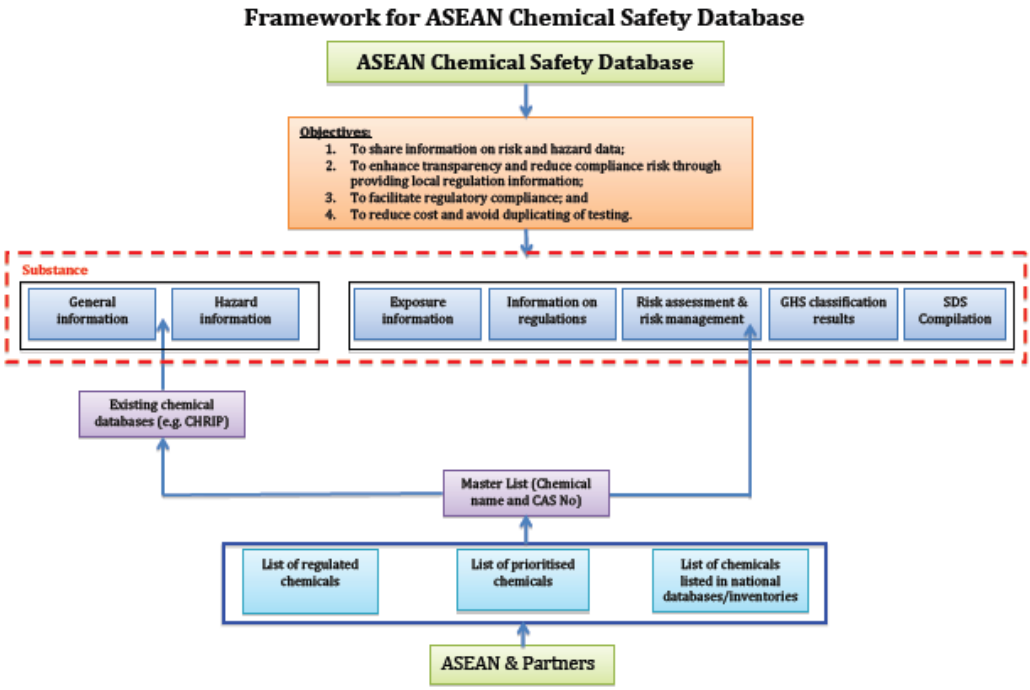
Table 1: Data Items

No.	Field	Specification
1	General Information	CAS No., Chemical Substance Name, Synonym, Structure, Total production amount
2	Information on Laws and Regulations of Each Country	Preventative information
3	Information on Inventories, Regulations, etc.	UN No. and Classification, ENICS, REACH Candidate List, etc.
4	Exposure Information	Produced and Imported amounts of chemical substances(each country), PRTR data, etc.
5	Physical-Chemical Properties	
6	Information on Hazard Assessments	
7	Information on Environmental Toxicity	
8	Information on Toxicity to Humans	American Conference of Governmental Industrial Hygienists (ACGIH), Carcinogenicity Assessment, etc.
9	GHS classification results	Pictogram, Signal word, Hazard statement, Precautionary statement
10	SDS (Safety Data Sheet)*	Examples of SDS

Note: *with note of "not final"

The framework of the ASEAN Chemical Safety Database was discussed by the WG for the purposes shown in Figure 1. The drafted framework of the ASEAN Chemical Safety Database, based on the discussion in the WG, is shown in Figure 6.

Figure 6: Framework for ASEAN Chemical Safety Database



The ASEAN Chemical Safety Database collects the lists of chemical substances from member countries in ASEAN and their partners. The possible information items to be collected are as follows:

- ✓ List of regulated chemicals
- ✓ List of prioritized chemicals
- ✓ List of chemicals listed in national databases/inventories

The ASEAN Chemical Safety Database integrates these three lists, and makes the list of a chemical substance name and CAS No. The ASEAN Chemical Safety Database indicates the data from Table 1, corresponding to the above list

B) Current Conditions of Chemical Substance Management Intelligence Infrastructure Surrounding ASEAN

We investigated several databases that provide chemical substance management information on the information stored, search keys, result display, and data location. The result of this investigation is shown in Table 2.

Table 2: Example of Other Chemical Databases

Database	Repository	Search Key	Results	Origin
eChemPortal	General/Hazardous	CAS/Property	Link Table	Other site
J-CHECK	General/Hazardous	CAS/Property	Data Table	This site
CHRIP	General/Regulation/Ha	CAS/Regulation/Pr	Data Table	Other site/
ECHA CHEM	General/Hazardous	CAS	Link Table	This site

Remark: Repository, Search Key and Results are representative values to compare databases.

Considerable differences for the database specification were seen in the method of result display and data location. As for result display method, if results are displayed as a list of links, as in eChemPortal, users must click the screen many times until the desired data is displayed. On the other hand, if data is displayed as a list, as in CHRIP, it is easier to grasp the perspective of data, and it is simpler for users to find the data they are looking for.

As for data location, if data is located on other sites, administrators need to perform operations to update/check data to be displayed in data lists, and acquire data, placing an extra burden on administrators. On the other hand, if data is placed on local sites, it can display a data list by updating data in databases, making it possible to suppress the labor

[1] Here the Search Key "Regulation" corresponds to a function that enables users to check whether the searched chemical is restricted under selected regulations or not.

of administrators in data list display, compared to cases where data is placed on other sites.

2) Examination of an Ideal Database

We deliberated how the ASEAN Chemical Safety Database should be based on the needs of the ERIA WG members, the current conditions of regulatory information in each country, and the conditions of chemical substance management databases surrounding ASEAN.

A) Viewpoints in Consideration

We considered how the Database should be organized, from the following three aspects of information: input/output to/from databases, operations of databases, and construction of databases. The result of our consideration is shown below.

- Information input/output to/from databases
  - ✓ It is possible to search through databases by CAS No. and chemical substance name.
  - ✓ Databases include inventory information of chemical substances compliant with regulations.
  - ✓ Databases include information on human toxicity of chemical substances in the inventory.
- Operations of databases
  - ✓ Databases are operated according to a schedule. This schedule determines the scope and period of gathering information registered in databases.
  - ✓ Data in databases shall be managed by the authorities in each country. Data management refers to data registration (addition of inventory information, information on human toxicity, etc.) and other tasks.

- ✓ Management of users and systems of databases shall be performed by the operator. User management refers to tasks of managing ID and passwords of users who register data etc. System management tasks include data backup, securing security, etc.

♦ Construction of databases

- ✓ It needs to be possible to construct databases within the ASEAN Chemical Safety Database in a way that means countries without existing databases can join the ASEAN Chemical Safety Database.
- ✓ It needs to be possible for countries with databases to use their own databases from the ASEAN Chemical Safety Database, so that they can easily join the ASEAN Chemical Safety Database.

B) Information Output from Databases

We deliberated over 4 display options for information output from databases. The screen images of the 4 options are shown in Table 3 to Table 6.

In all of these display options, results of searches by CAS No. or chemical substance names are shown, and the search results shall display the information on regulations and hazards in each country for each regulatory target area.

As with the regulatory information for each country, links to Web pages containing regulatory information of each country or links to regulatory pages within databases shall be displayed.

In terms of displaying information on hazards, each of these options is different from the others:

- ☐ Case 1

  Links to databases providing information on hazards are displayed. The links to be displayed shall be set manually.

☐ Case 2

Representative values in information on hazards are displayed. The representative values shall be set manually.

☐ Case 3

Displays representative values of databases providing information on hazards if data can be provided automatically. If data cannot be provided automatically, links to databases shall be displayed. The links to be displayed shall be set manually.

☐ Case 4

Representative values in information on hazards are displayed. The representative values shall be set either automatically or manually. If data cannot be provided automatically, and cannot be set manually, links to databases shall be displayed. Links to be displayed shall be set manually.

Table 3: To be system – case 1

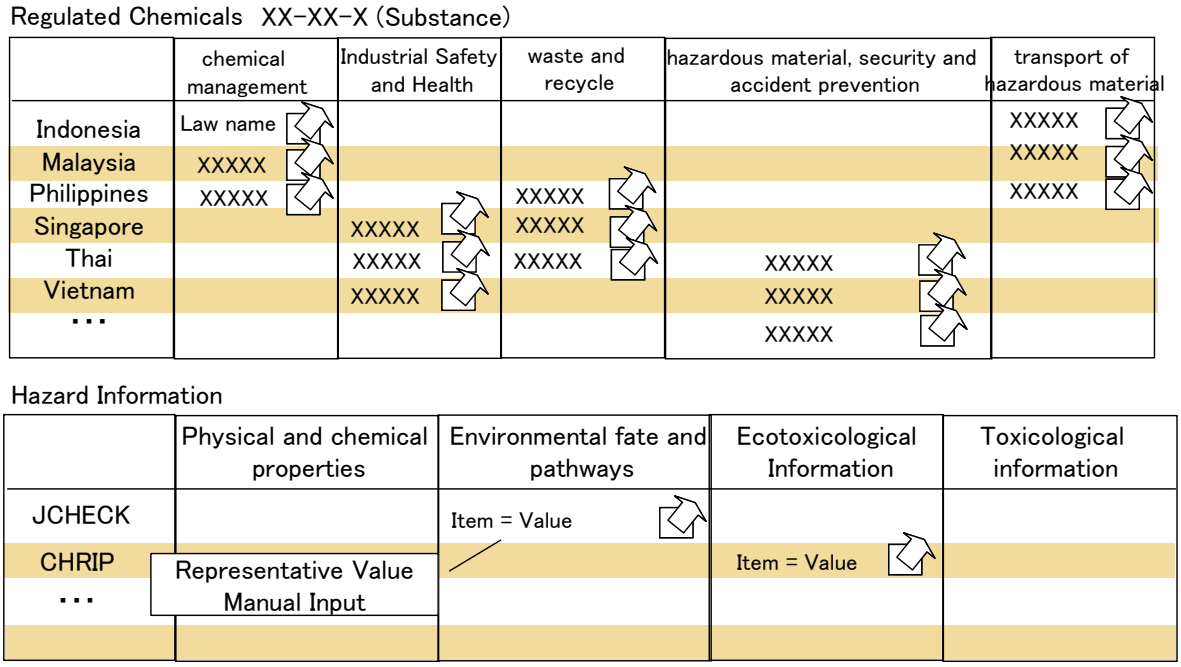


Table 4: to be system – case 2

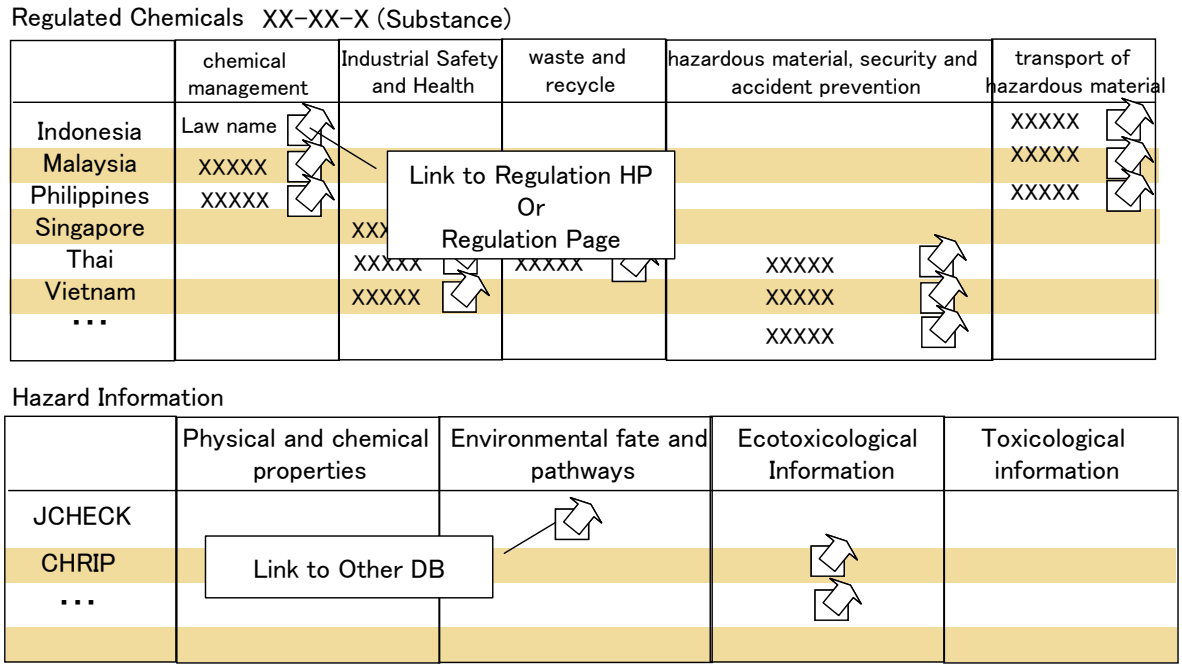


Table 5: to be system – case 3

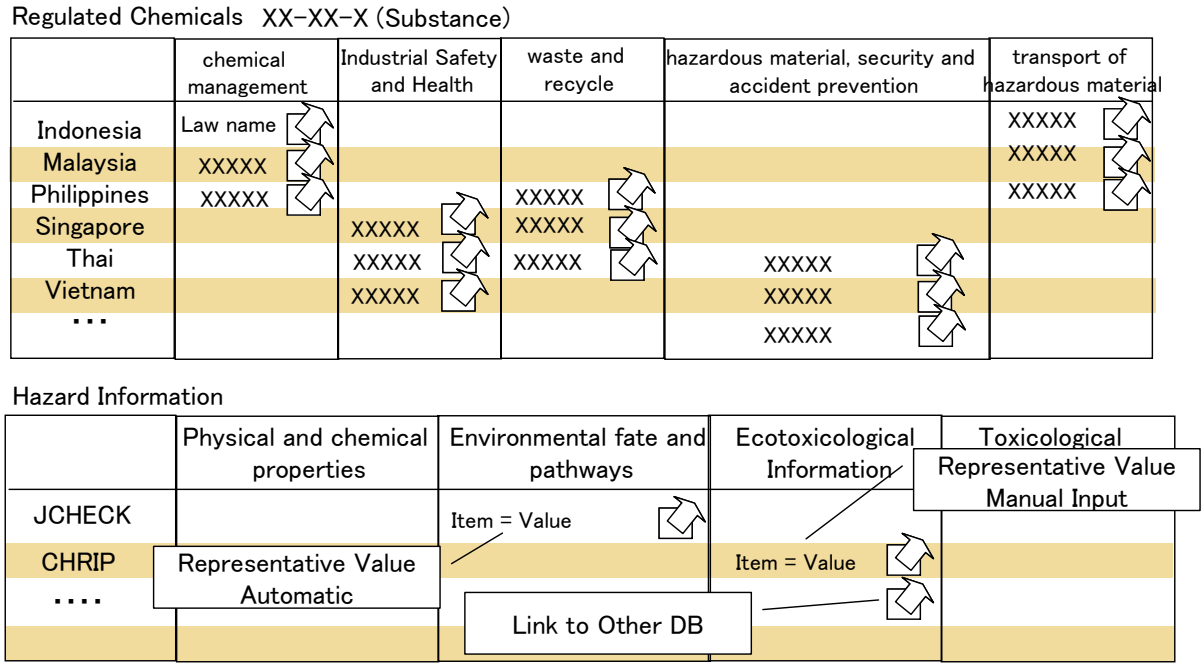


Table 6: to be system – case 4

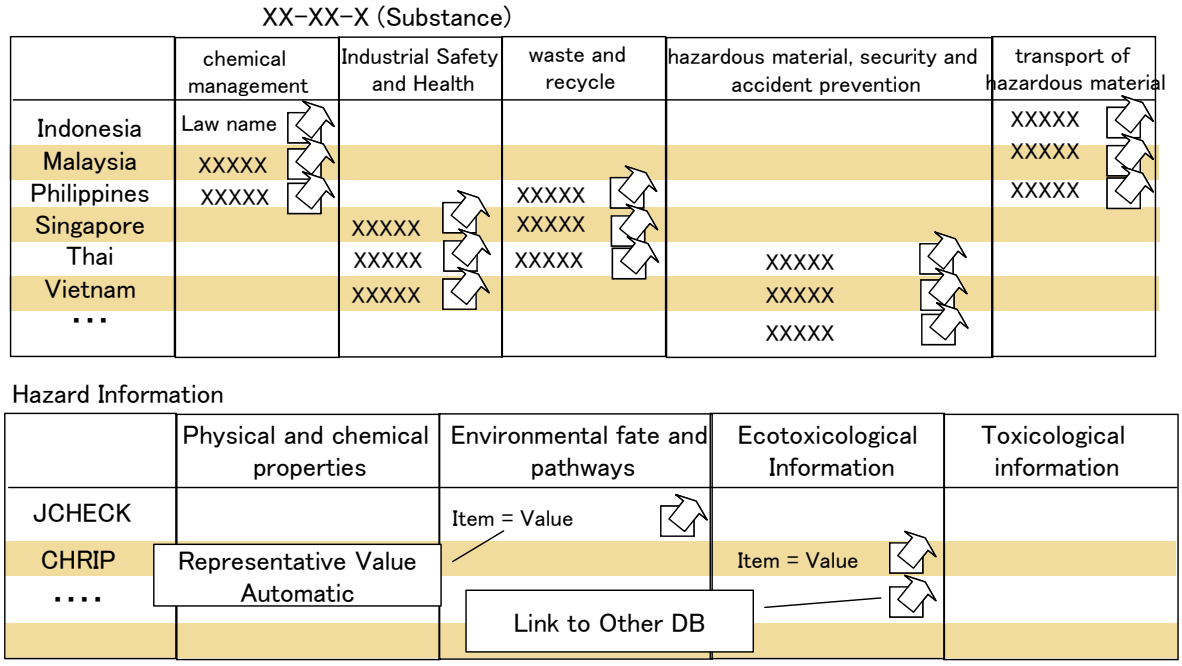


Table compares the display of cases 1 to 4, concerning information input/output to/from databases, database operations, and database construction.

The representative database of case 1 is eChemPortal. In case 1, both operation and construction are easier than in the other cases, but a list of data cannot be displayed; users must click links many times until the desired data is obtained.

CHRIP is a typical database of case 2. With case 2, users can find the desired data with ease compared to case 1. However, manual work is required to maintain data, placing more labor on administrators than in the other cases.

Case 3 combines advantages of cases 1 and 2. We were unable to find existing databases falling under case 3. In case 3, a data list displays values of databases whose data can automatically be obtained in order to reduce work required to maintain data. In this case, it is necessary to construct a function to automatically display data for databases that provide data.

In Case 3, a database which cannot perform automatic registration instead displays a link. It may be more useful to display data into these databases. With this in mind, we deliberated Case 4, which is a hybrid of Case 3 and Case 2. In Case 4, data which cannot perform the automatic registration of Case 3 is registered using the function of Case 2.

Table 7: Comparison of CASE 1 - CASE 4

	Case 1	**Case 2**	**Case 3**	**Case 4**
Representative Database	eChemPortal	CHRIP	N/A	N/A
Input / Output	Data is not shown in the results table. Cannot hold the global image of data. Should click many times until useful data is found.	Data is shown in the results table. Can hold the global image of data. Can obtain useful data by one click.	Data is shown in the results table. Can hold the global image of data. Can get useful data by one click.	Data is shown in the results table. Can hold the global image of data. Can get useful data by one click.
Operation	Not to register data.	Difficult to register data. Register data manually.	Easy to register data. Register data automatically.	Easy to register data. Register data automatically and manually.
Modification of national databases	Not required	Not required	Might be required*1	Not required*2

Note: *1 Modification of national database might be required if each country's data (not link) should be displayed and updated automatically.

*2 Modification of national database shall not be required as long as the automatically update is not required.

3) Application of the Database to Practical Operations

We examined how the Database can be utilized in chemical substance management operations, from both standpoints of regulating chemical substance and using chemical substance in industries.

- Regulatory standpoint
  - ✓ Review of chemical substance regulations of home country based on environmental impact assessment and risk assessment
    The Database allows corresponding regulatory information and environmental impact assessment and risk assessment for each chemical substance. It becomes possible to review regulations of chemicals with no regulatory information since environmental impact assessment and/or risk assessment are performed
  - ✓ Confirmation of information on risk and hazard of chemical substances
    The Database allows displaying environmental impact assessment and risk assessment of each country. The comparison of information on risk and hazard of relevant chemical substances not only at occurrence of accident but also as a precautionary purpose enables study of safer measures.

- Industrial standpoint
  - ✓ Checking regulations on chemical substance distribution in each country
    The Database allows viewing regulatory information of each country for each chemical substance. It is thus possible to check regulations of target country in distribution of chemical substances in East Asia with ease.

4) Concept

After the deliberations of 1)–3), further description of the concepts of ASEAN Chemical Safety Database is as follows.

- ✓ It is possible to search CAS No. and chemical substance name, inventory information of chemical substances compliant to regulations, and information

on toxicity to humans of chemical substances in the inventory from databases via Internet.

- ✓ Through the discussion in the WG, Case 4, which displays automatically and manually updated values of databases, were agreed as the most preferable option for mutual links.

- ✓ Exchange data of information on risk and hazard has an automatic method for suppressing operation costs.

2. Outline of the ASEAN Chemical Safety Database

2.1. Functions of the ASEAN Chemical Safety Database

The ASEAN Chemical Safety Database provides three functions for searching, registering, deleting, and editing data as well as logging change and usage histories, as listed below.

- ♦ Search
  - ✓ Display regulatory information and information on toxicity via a keyword search, in order to retrieve target information.
  - ✓ Keyword search shall allow the following search methods.
    - Search by CAS No.
    - Search by chemical substance name (English)
  - ✓ Regulatory information and information on toxicity shall be displayed in 2 steps, as is done in several other databases.
    - First step: collect and display information from each country as a list
    - Second step: display web pages published by individual countries

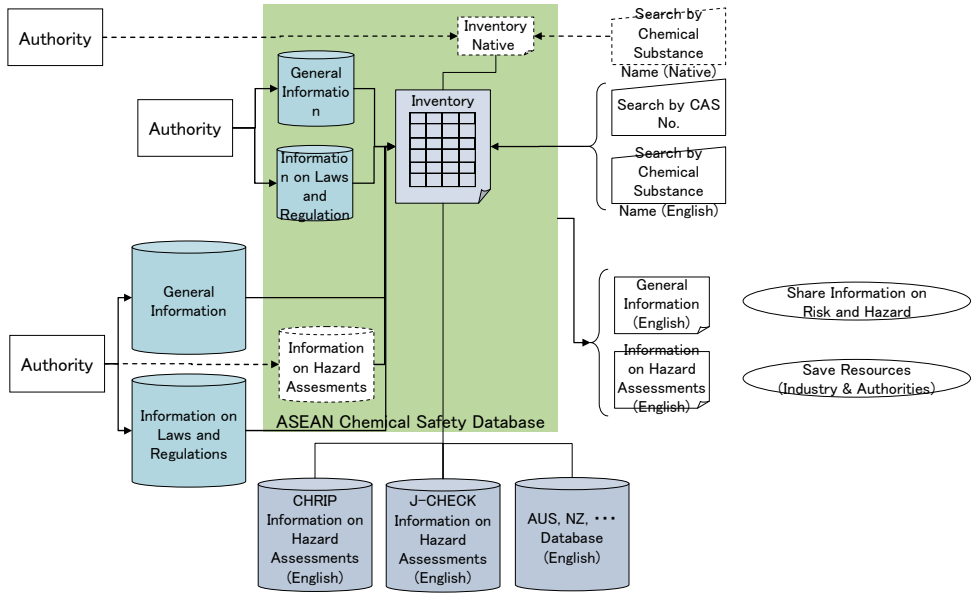
- Registration/deletion/editing
  - ✓ Register, delete, and/or edit regulatory information so that agencies in each country can maintain data
  - ✓ Provide the following functions according to the amount of information
    - Register, delete, and/or edit information directly in web pages
    - Register, delete, and/or edit data files such as CSV files (effective when there are large amounts of data)
- History
  - ✓ The following functions shall be provided in order to secure the reliability of information and allow analysis of usage conditions.
    - History of registration, deletion, and edition: which agency worked on which information
    - Usage performance: which country conducted searches using which keywords

2.2. Management of the ASEAN Chemical Safety Database

Figure 7 illustrates a general overview of the database management. The relevant authorities of each country shall manage the general information and information on laws and regulations related to the chemical substances stored in the databases.

Chemical substances and CAS No. are associated via general information management, while CAS No. and details of regulations are associated via the management of information on laws and regulations. In cases where individual ASEAN member countries have their own databases, links to these databases shall be entered in the inventory of the ASEAN Chemical Safety Database. If a country does not have its own database, the general information and information on laws and regulations shall be registered in the databases of the ASEAN Chemical Safety Database.

Figure 7: Management of ASEAN Chemical Safety Database



In the management of information on risks and hazards, agencies of each country register information on risk and hazards of chemical substances corresponding to each relevant CAS No. in the ASEAN Chemical Safety Database. In addition, the operators of the ASEAN Chemical Safety Database shall register links to data in databases on information on risk and hazard in Japan (CHRIP, J-CHECK), Australia, and New Zealand based on CAS No. in the inventory.

ASEAN member countries' authorities set up open limits of general information and information on risk and hazard to ASEAN Chemical Safety Database.

Table 8 and Table 9 show the operations and cost of administration. The operations of Authority relate to the data creation of Chemical substances, CAS No., and Regulations. The cost of each case is based on Case 1.

The operations and cost of administration differ, depending on whether the data itself is located inside or outside of the database. When data is inside the database, in every case, each administrator is required to prepare the data.

Table 8: Administration Operation (Data outside)

Operation	Case 1	Case 2	Case 3	Case 4
Chemical substances and CAS No.	Connecting	Connecting	Connecting	Connecting
Chemical substances and Regulations	Connecting	Creation	Connecting	Connecting Creation
Cost	C_A	2 C_A	C_A	C_A to 2 C_A

Note: * C_A: Authority Cost in Case 1 and Case 3

Table 9: Administration Operation (Data inside)

Operation	Case 1	Case 2	Case 3	Case 4
Chemical substances and CAS No.	Creation			
Chemical substances and Regulations	Creation			
Cost	4 C_A			

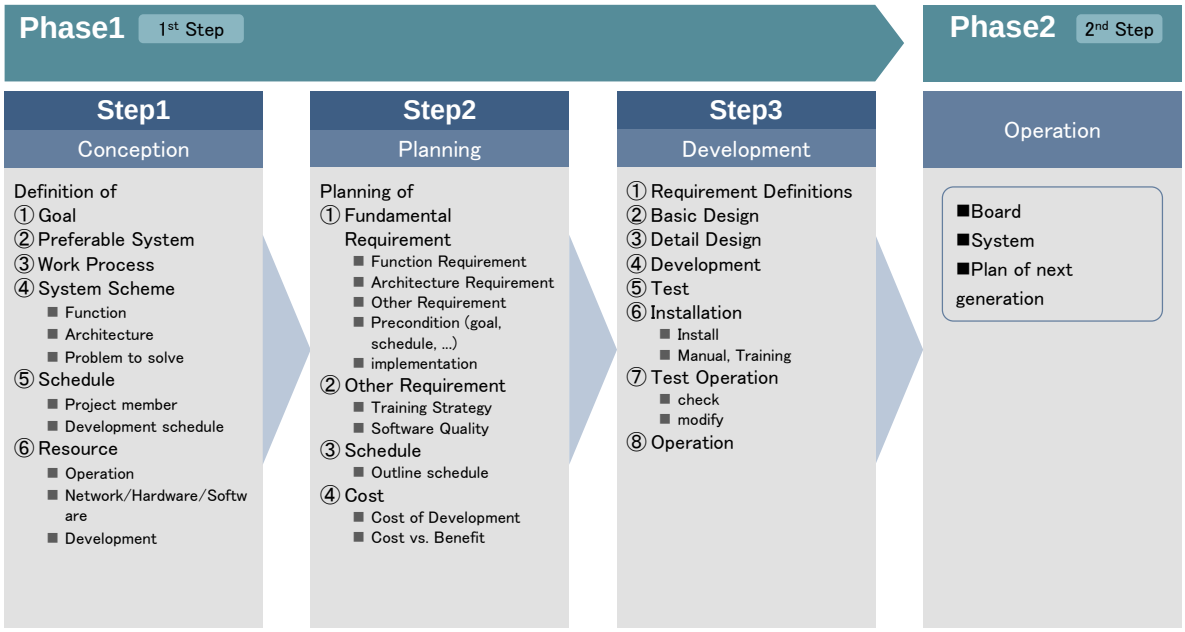
In Case 1, the administrator makes the connection between a chemical substance and regulations, connecting the CAS No. and a chemical substance. In Case 2, whenever any of the regulations are revised, the administrator prepares the data, as consistent with revised regulations. Therefore, the cost of administration in Case 2 is higher than in Case 1, and this difference is caused by the data creation. In Case 3, the administration operations are the same as in Case 1. However, in Case 3, the system could obtain data automatically when the regulation was revised. Therefore, the cost of Case 3 is basically same as that of Case 1. Lastly, the cost of Case 4 is between Cases 2 and 3, because the maximum cost Case is full manual registration (Case 2) and the minimum cost case is fully automated registration (Case 3).

3. System Architecture for the ASEAN Chemical Safety Database

3.1. Systemization Plan before the Basic Design Phase

Figure 8 shows the development schedule of the ASEAN Chemical Safety Database. The phase leading to the operation of the ASEAN Chemical Safety Database (1st Step) is divided into 3 steps: the conception of systemization, the planning of systemization, and lastly system development. This survey is part of Step 1, the conception of systemization.

Figure 8: Management of ASEAN Chemical Safety Database



In Step 2, the requirements, schedule and costs for the ASEAN Chemical Safety Database shall be planned. After the planning is completed, the requirement definitions, basic design, etc.. shall be developed in Step 3.

Formulation of Project Promotion Framework

In Step 2, it is necessary to plan requirements, schedule and costs for the ASEAN Chemical Safety Database. When developing this plan, it is necessary for members from each ASEAN member country to create a construction project in order to reflect each ASEAN country's specific requests.

The framework for the ASEAN Chemical Safety Database construction project shall be organized by the Management Board and Secretariat. The tasks of the Management Board and Secretariat are explained below.

- Management Board
  - ❖ Examination and definition of construction and operation plans
  - ❖ Examination and definition of database functions
  - ❖ Examination and definition of activities in the Management Board
  - ❖ Selection of developers
  - ❖ Investigation and definition of operational cost funding
- Secretariat
  - ❖ Drafts for construction and operation plans
  - ❖ Proposal of database functions
  - ❖ Proposal of activities in the Management Board
  - ❖ Invitation of developers
  - ❖ Calculation of operational cost

3.2. System Architecture

This section reviews the system methods of the ASEAN Chemical Safety Database considered in Section 3.1, from the aspects of network, hardware, and software.

- Network

The network architecture is comprised of a network on the management side, where regulatory bodies handle data management, and a network on the user side, which is accessed by general users. The network on the management side utilizes VPN technology for network security and to ensure the integrity of the data stored in the ASEAN Chemical Safety Database. VPN is a technology that allows the establishment of secure connections between different LANs etc., via public communication networks,

where bandwidth shared by large numbers of other subscribers, instead of fixed private communication lines (leased lines) of the communication partners.

- Hardware

For the hardware platform, at least a number of server machines, mainly comprised of CPU and HDD, are required. The specifications of CPU, HDD, and other computation resources shall be determined in Step 2. In the past, hardware was primarily procured, or leased, or rented, but currently, services providing hardware computation resources (CPU, HDD), such as data center hosting services and cloud services, are also available. In Step 2, the possibility of the utilization of such services shall also be investigated.

Data Center

- ✓ Hosting service
  Service that provides memory space and data processing functions of HDD of server machines for use
- ✓ Cloud service
- ✓ Software as a Service (SaaS)
  SaaS provides software that allows using required functions, in the required amounts, for a given job, such as services available via the Internet.
- ✓ Platform as a Service (PaaS)
  PaaS provides a platform that forms the foundation for constructing and operating software, as services available via the Internet.
- ✓ Infrastructure as a Service (Iaas)
  IaaS provides the basic components for constructing and operating computer systems (virtual machines, network and other infrastructure elements), as services available via the Internet.

- Software

The software consists of an OS for controlling hardware, and basic software (database software), and various application software for implementing the functions examined in Section 3.1.

Basic software refers to software that provides the foundation for the construction of the application software. The basic software includes database software and middleware. Since the ASEAN Chemical Safety Database will be operated in a sustainable manner, it is likely going to be necessary to replace hardware during the operation period. When selecting the basic software, it is thus necessary to select software that is not highly dependent on a specific choice of hardware.

4. Cost Estimation for the ASEAN Chemical Safety Database

4.1. Basis for the Cost Estimation

The costs of operating and constructing the ASEAN Chemical Safety Database will be estimated for different assumptions according to the economic level of the ASEAN member country in which the ASEAN Chemical Safety Database will be physically located. More specifically, when estimating the costs, it shall be assumed that the ASEAN Chemical Safety Database may be placed in one of four countries representing the various economic levels of ASEAN: Singapore, Thailand, Indonesia, and Vietnam. In order to be able to provide the services of the ASEAN Chemical Safety Database for extended periods of time, estimating the costs of database operations is of vital importance.

A) Operation of database

For database operation, the costs of the following items required to operate the framework described in Sections 3.2 and 3.3 shall be estimated.

- Operation of the Management Board:
  Estimate the cost of operating the Secretariat of the Management Board and holding meetings of the Management Board (twice a year)

- Operation of the database:
  Estimate the workload and labor costs etc. for operators (system engineers) required to operate databases

- Utilization of the database:
  Estimate the cost of housing services (location, power supply, and network) for each of the four potential host countries (Singapore, Thailand, Indonesia, and Vietnam)

- Maintenance cost of hardware and software:
  Estimate the cost of maintaining the hardware and software (basic software) procured to construct databases. Hardware maintenance tasks include replacement of parts when the hardware fails, while software maintenance tasks include updating of the basic software, etc.

B) Construction of databases

In terms of constructing the database, the costs of the following items required to construct the system described in Sections 3.2 and 3.3 shall be estimated.

- Procurement costs of hardware and software
  Estimate the costs of purchasing the hardware and software to be installed in the database.

- Cost of system construction and adjustment
  Estimate the cost of developing application software and adjusting the hardware and software to be installed in the database.

4.2. Cost Estimation Results

The table below shows the results of the estimations described in Section 4.1. The cost for database development could be divided into kinds: costs which do not differ in different cases, and costs which may differ in different cases. Table 10 shows a list of costs, and an estimated amount for the costs, which does not differ in each case, and Table 11 shows a list of costs, and an estimated amount for the costs, which differs in each case. In detail, the cost which differs in each case is only the operation cost, and this is because the difference of each cost only comes from the difference in the number of workers.

Table 10: Common Costs in Each Case (Estimation)

No	Item	Cost	Remarks
A) Operation of database			
1	Management Board	300,000 US$/year	
2	Operation	-	see Table 11
3	Data center rental		1Rack 4KVA
	Singapore	34,800 US$/year	Initial 1,900 US$
	Thailand	26,400 US$/year	Initial 800 US$
	Indonesia	21,120 US$/year	Initial 1,000 US$ *Convert 3KVA
	Vietnam	18,000 US$/year	Initial 800 US$
3	Hardware/Software maintenance	20,000 US$/year	[Buying expenses]×20%
B) Construction of databases			
1	Hardware/Software Buying expenses	100,000 US$	
2	Development	1,000,000 US$	

Table 11: Operation Cost in each Cases (Estimation)

Operation	Case 1	Case 2	Case 3	Case 4
Data Operation	Link (URL) Registration	Link (URL) Registration Update Data Check (Hazard) Data Registration	Link (URL) Registration	Link (URL) Registration Update Data Check (Hazard) Data Registration
System Operation	User Registration Security Update System Backup System Restore Data Backup Data Restore Operation Check	User Registration Security Update System Backup System Restore Data Backup Data Restore Operation Check	User Registration Security Update System Backup System Restore Data Backup Data Restore Operation Check	User Registration Security Update System Backup System Restore Data Backup Data Restore Operation Check
Workers required	1	3	1	1-3
Operation Costs				
Singapore	78,000 US$/year (6,500 US$/month)	234,000 US$/year (19,500 US$/month)	78,000 US$/year (6,500 US$/month)	78,000 - 234,000 US$/year
Thailand	30,000 US$/year (2,500 US$/month)	90,000US$/year (7,500 US$/month)	30,000US$/year (2,500 US$/month)	30,000 – 90,000 US$/year
Indonesia	18,000 US$/year (1,500 US$/month)	54,000 US$/year (4,500 US$/month)	18,000US$/year (1,500 US$/month)	18,000- 54,000 US$/year
Vietnam	12,000 US$/year (1,000 US$/month)	36,000 US$/year (3,000 US$/month)	12,000 US$/year (1,000 US$/month)	12,000- 36,000 US$/year
Authority Cost	C_A	2 C_A	C_A	C_A to 2 C_A

Note: * C_A: Authority Cost in Case 1 and Case 3

5. Comparison

Table 12 summarizes the results deliberated in this chapter. The WG agrees and highly recommends Case 4 as a preferable option for the ASEAN Chemical Safety Database. However, there is a risk of costs increasing with the data volume being registered manually.

Table 12: Comparison

	Case 1	**Case 2**	**Case 3**	**Case 4**
Result Table	✘ Link	✓	✓	✓
Method of Data Input	Link	Manual	Auto	Manual/Auto
Modification of Database	✘	✘	✓	✘
Link to Regulation Pages	✓	✓	✓	✓
Authority Cost	C_A	2 C_A	C_A	C_A to 2 C_A
Operation Cost	C_O	3 C_O	C_O	C_O to 3 C_O

Note: * C_A: Authority Cost in Case 1 and Case 3
* C_O: Operation Cost in Case 1 and Case 3