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TITLE PAGE

UNIVERSITI TEKNOLOGI PETRONAS

On-line At-Risk Behavior Analysis and Improvement System (e-BAI)

By

Tan Sew Keng

A DISSERTATION SUBMITTED TO THE POSTGRADUATE STUDIES PROGRAMME

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1) Discourse analysis
2) Social Psychology

DECLARATION

I hereby declare that the dissertation is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTP or other institutions.

Signature : _____

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ABSTRACT

Behaviour Based Safety (BBS) was a programme that implemented in many organizations to identify the at-risk behaviour and thus, reduce the injury rate in an organization. Many have proven the BBS was a very good process to reduce the injury rate. However, some limitations in BBS were discussed. This study was to establish an alternative to the BBS, termed as On-line At-risk Behaviour Analysis and Improvement System (e-BAI). The e-BAI utilizes technology to play a role to make the observation process more routine and create the habitual awareness by the cognitive psychology effect.

A database needs to be set up with the pre-programmed questions regarding at-risk behaviours in the organization. The employees then utilized the database to feedback their observation. The observations were done naturally to all the activities happening in the organization. From the collective feedback, it can easily identify the at-risk behaviours in the organization. The safety committee can thus, take appropriate action by reinforcing the safety regulations or safe practices.

A case study was conducted in Eastman Chemical (M) Sdn Bhd for one month. It was termed as "1-min Observation" programme. The case study was followed by a survey to understand the employees' thought about the e-BAI concept. Majority of the employees accepted the programme and liked the concept of e-BAI. Some recommendations were presented in the study to further improve the programme implementation. One of it was to have a professional and user-friendly database created by IT expert instead. Also, it was important to note that the clear communication was needed in order for the employees to understand and contribute to the programme. Data sharing and quick actions to rectify unsafe behaviours were important. Rewards should be considered to encourage the continuous participations. In long term, it ensured the programme was sustainable and the unsafe behaviours also reduced.

It was concluded that the e-BAI concept was workable and practical based on the positive feedback received from Eastman Chemical. It could be done with very small resources and it saved time and money. As long as the programme was implemented with a thorough plan and strong commitment from all level, it could be a very successful programme to reduce injury in the organization.

ABSTRAK

Kelakuan yang Selamat (Behavior-Based Safety -BBS) adalah satu programme yang digunakan di banyak organisasi untuk menentukan kelakuan yang membahayakan. Dengan programme tersebut, kadar kecederaan dapat dikurangkan. Banyak organisasi yang menggunakan konsep BBS sudah membuktikan bahawa BBS adalah suatu programme yang bagus dan telah dapat menurunkan kadar kecederaan. Walau bagaimanapun, terdapat juga permintaan untuk memperbanyakkan pilihan selain dari programme BBS. Kajian ini adalah untuk mengeluarkan idea baru yang dinamakan sebagai "On-line At-Risk Behaviour Analysis and Improvement System (e-BAI).

Satu pangkalan data perlu disediakan dengan soalan-soalan yang sudah di-programkan tentang kelakuan yang risiko di dalam suatu organisasi. Pekerja menggunakan pangkalan data untuk memaklum balas tentang pemerhatiannya. Pemerhatian adalah dilakukan secara "sukarela" tanpa fokus atas mana mana aktiviti. Dengan maklum balas ini, kelakuan yang merbahayakan dapat dikenali. Ia memudahkan kerja untuk mengetahui sama ada kerja-kerja dilakukan dengan kelakuan yang selamat. Jawatan kuasa keselamatan dapat membetulkan kelakuan risiko selepas mendapat kumpulan data dari pekerja pekerja melalui pangkalan data.

Satu kajian sudah dijalankan di Eastman Chemical (M) Sdn Bhd selama satu bulan. Program itu dinamakan sebagai "1-minit Permerhatian" ("1 Minute Observation"). Satu bancian juga dilakukan selepas programme itu untuk mengumpul pendapat daripada pekerja. Kebanyakan pekerja menerima programme ini dan menyukai konsep e-BAI.

Beberapa cadangan telah diberikan dalam kajian ini bagi menjayakan perlaksanaan programme ini. Salah satunya ialah memakai pangkalan data yang lebih canggih dan mudah digunakan. Selain itu, komunikasi yang jelas kepada pekerja adalah sangat penting untuk menjayakan programme ini. Perkongsian tentang data yang dikumpul dan tindakan segera untuk membetulkan kelakuan yang tidak selamat juga penting. Galakan seperti hadiah penghargaan boleh dipertimbangkan menggalakkan lagi

pekerja mengambil bahagian dalam programme ini. Dalam jangka masa yang panjang, programme ini masih dapat diteruskan dan kelakuan yang tidak selamat dapat dikurangkan.

Kesimpulannya, konsep e-BAI boleh dilaksanakan dan sangat pratikal berdasarkan reaksi positif yang diterima daripada Eastman Chemical. Ia boleh dilaksanakan dengan sumber terhad dan ia menjimat wang dan masa. Programme ini perlu dirancangkan dengan pelan yang menyeluruh dan penuh komitmen, ia boleh menjadi satu programme yang boleh mengurangkan kadar kecederaan dengan berjayanya.

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CHAPTER 1

INTRODUCTION

1.1 Background

Behaviour based safety (BBS) was first established by B. F. Skinner in the 30's (Skinner, 1938). He was a psychologist who developed a systematic approach called behaviour analysis to increase safe behaviours, reduce risky behaviours and prevent accidental injury at work and on the road. This approach was later known as applied behaviour analysis (Hayes, 2000).

A "workplace Attitude Study" conducted by Missouri Employers Mutual Insurance (MEM) which published in Occupational Hazards (September 2003) revealed that 64.1% of Americans thinks a workplace accident would never happen to them. 53.4% believes that the probability was very low for a work injury that could cause them to become permanently disabled (SCF, 2004). This showed that people generally perceived that there was a low risk of injury possibility in a workplace. On the other hand, H. W. Heinrich, a workplace safety pioneer, reported that out of 550,000 accidents, he found that only 10% was caused by unsafe working condition, another 88% was caused by worker's unsafe actions (SCF, 2004). This showed that accident could happen if the workers continue to work with at-risk behaviour and perceived it was safe to do so.

The human toll of unsafe behaviour was high: According to the U.S. Bureau of Labour Statistics, unintentional injury was the leading cause of death to people ages 44 and under. In 2001, private industry had more than 5.2 million non-fatal accidents and injuries, with more than 5,000 fatal injuries. Other costs were also high: it was estimated that every year U.S. employers pay approximately $200 billion in direct costs associated with injuries that occur both on and off the job. Occupational injuries account for three-quarters of this total. Behaviour-based safety programs that target and document behaviour changes indeed save lives, money and productivity (APA, 2003).

The effectiveness of BBS was proven over years. On average, one year after implementing BBS, the average recorded injury rate at such sites decreases by 29 percent. After five years, the reduction rate averages at 72 percent; after seven or more years, the average recorded injury rate has dropped by 79 percent (APA, 2003). Besides, as reported in the Occupational Hazards (2001), Kroger Manufacturing East, which previously had 1,200 recordable injuries annually from 26 plants, had reduced the number of recordable injuries by 59 percent for a total incident rate (TIR) of 7.7. In addition, in the two-year period of 1998-1999, workers' compensation costs were reduced by more than $3 million (OH, 2001).

Many organizations worldwide had implemented BBS in their organizations. They are Hewlett Packard, ExxonMobil Chemical, Estée Lauder, Pfizer Pharmaceuticals, L.L. Bean, and Johnson & Johnson. One of the company, Pool California Energy Services had shown a 52 percent drop in the number of injuries to hands, wrists, and fingers over a 12-month period (APA, 2003).

Behaviour is an "upstream" approach to safety. It focuses on the "at-risk behaviour" that might produce an accident or near miss rather than trying to correct a problem after an accident or occurrence. The behaviour-based aim then, is to change the mindset of an employee by hopefully making safety a priority in the employee's mind (Schatz, 2003).

However, it was noted to many that not all organizations had successful experience in implementing the BBS as the others did (Geller, 2002).

Over years, some safety professionals had started to develop alternatives to the BBS programme, i.e people-based safety, ProAct Safety and Value-based Safety.

It was desired to develop another alternative to the BBS programme via the help of technology.

1.2 Problem Statement

BBS process had delivered a very significant result in term of reducing the number of injuries (APA, 2003). However, the BBS process could be very labour intensive. It requires many observers to make the process effective. Very much effort was required to train the employees to become the observers. Many organizations which attempted to reap the benefits of BBS did not obtain or sustain comprehensive participation in BBS related activities (Geller, 2002). With this drawback, it calls for a simplified process that could achieve the same result as BBS.

1.3 Objectives

The objectives of this study were to establish an alternative to the BBS program that was able to

- overcome certain limitations of the current BBS process,
- simplify the process of observation, make observation done "naturally", and
- Inculcate the Total Safety Culture[1] in an organization that eventually practices safe behaviour in handling all kind of works.

1.4 Scope of Work

This study involved trying some new concepts derived from BBS to gauge the effectiveness so as to meet the objectives of this study.

A case study was conducted in Eastman Chemical (M) Sdn Bhd, Kuantan, Malaysia to assess the effectiveness of the e-BAI established.

This study included the following limitations:

i.) The case study was limited to Eastman Chemical (M) Sdn Bhd.

ii.) There was a time constraint of one month to complete the case study.

iii.) Long term effect cannot be measured.

---

[1] Total Safety Culture is explained in detail under "Theory" Section.

CHAPTER 2

LITERATURE REVIEW

2.1 Behaviour Based Safety (BBS) and It's Concept

As advertised in the Quality Safety Edge (2007) homepage, the Behaviour-Based Safety (BBS) was an adaptation of behavioural psychology to promote safety. The fundamental concept of BBS involves:

a. creating a systematic, ongoing process that defines a finite set of safety behaviours that reduce the risk of work-related injury,
b. collecting data on the frequency of critical safety practices, and then
c. Ensuring that feedback and reinforcement, encourages and support those critical safety practices.

On another hand, Spigener (2007) mentioned that there were four key elements in the BBS process. The four steps were

a. Identifying critical behaviour
b. Gathering data
c. Providing on-going feedback
d. Removing barriers

To implement the BBS process, employees conduct observations and provide feedback to associates within their work areas. These observations provide data for problem recognition, problem-solving, and continuous improvement.

Schatz (2003) mentioned that BBS basically involves three steps which were:

a. Turning an unconscious, risky habit into a conscious, self-directed, risky behaviour.
b. Changing a conscious, self-directed, risky behaviour into a conscious, safe, self-directed behaviour.

c. Changing a conscious, safe, self-directed behaviour into an unconscious safe habit.

From these steps, workers will change from having risky habit to a safe habit.

Many had misunderstood that BBS was a program that blame the workers and push the accountability of injury to the workers themselves (Geller, 2000). However, this was not the case. According to Gilmore, Perdue and Wu (2002), the National Safety Council had estimated that the vast majority of incidents and injuries underscore at-risk behaviour as a common denominator; in other words, the victims (or co-workers) performed an at-risk behaviour that led to the incidents/injuries. This finding was not intended to blame employees, but to focus the analysis of the incident. Organizations should be investigating what encouraged or allowed the employee to perform the at-risk behaviour. The answer to that question would lead to the real root causes and long-term solutions (Gilmore et al., 2002).

Krause (2000) on another hand explained BBS process as a performance management which workgroups could carry out for themselves. Krause stated that to manage the workgroups' own performance, they measure and track the rate at which they perform critical, identified at-risk behaviours. The at-risk behaviours were the task-related observable acts that expose the workforce to injury. By utilizing the performance data, the groups then perform problem solving and action planning to reduce their exposure levels.

2.2 The Consultants Businesses of BBS

A variety of consultants and companies market the behavioural safety programs to employers throughout the United States and around the world. The leading companies include DuPont (the DuPont STOP program), Behavioural Science Technologies, Aubrey Daniels (SafeR+ program), E. Scott Geller's Safety Performance Solutions (Total Safety Culture program), Topf Organization (SAFOR program) and Liberty

Mutual Insurance Company (Liberty's Managing Vital Performance - LMVP program). These programs generally cover the fundamental BBS steps which were to

a. identify the "critical worker behaviours",
b. train "observers" (workers and/or supervisors who observe worker behaviours) and
c. Use "critical behaviour check-lists" to document when a worker has engaged in a safe behaviour or committed an unsafe act (Frederick et. al, 2000).

2.3 The Recognition Program for BBS

Safety awards programs by themselves often provide very little motivation for working safely on the job. The typical safety awards program was based on working some period of time without injury. Based on the interviews with employees, it revealed that such awards did not motivate them to work safely (McSween, 2004). However, recognition and celebrations were important elements in supporting behaviour-based safety effort, particularly in maintaining long term participation. Celebrations for team success or improved participation, achieving goals should be arranged (McSween, 2004). Roberts (2000) thinks that it could be useful to add recognition or rewards to reinforce safety behaviour. Example given by Roberts was a "thank you card" could be given for using safety harness as opposed to a STOP card for not using one. Goodrum et al. (2004) mentioned that the incentive could be given based on participating in safety meetings and training; offering suggestions about how to improve jobsite safety; and other behaviour that can help prevent accidents. However, it was comparatively difficult to measure and monitor as it was a very subjective judgment. Geller (1999) stressed that giving incentive and recognition would help to shape the good behaviour by providing positive consequences. Geller (2000b) also highlighted that there should be proper strategies to give recognition to either individual or team. According to Geller (2000b), it was better to give team recognition in the public but private recognition to individual that go beyond the call of duty for the sake of their team.

2.4 The Opposition of BBS Program

A report by Frederick et al. (2000), quoted that when the United Auto Workers Health and Safety Department of a factory that had implemented a behavioural safety program, asked workers during shift meetings to raise their hands if they were afraid to report injuries, about half of 150 workers raised their hands. The union representative then asked a subsequent group to write "yes" on a piece of paper if they were afraid to report injuries. Seventy percent indicated they were afraid to report injuries. When asked about why they would not report injuries, workers said, "We know that we will face an inquisition," "we would be humiliated" and "we might be blamed for the injury." (Frederick et al., 2000).

While BBS theory was advocated by many proponents. It may not be true in all sense. Smith (1999) revealed that many researches had refuted the behaviourist ABC theory.

According to Smith (1999), the cornerstone of behaviour-based safety was the principle that the majority of work related accidents were caused by the unsafe actions of the workers. The traditional safety management theory was to focus on unsafe actions since they were believed to be the majority (85%-95%) of the reason accidents occurred. With that, people were convinced that to improve the safety, one must concentrate on changing the behaviour of the worker. However, the fact was that safety could only be improved if the system was well managed and designed. Merely changing the behaviour of the worker would not able to improve the safety.

Correspondingly, Frederick et al. (2000) shared the same thought about the weakness of BBS in improving the safety in one company. According to Frederick et al (2000), 2000 United Steelworkers of America health and safety resolution offers a similar perspective. The resolutions said they would oppose those behavioural safety' programs that assumed misbehaviour was the primary cause of workplace accidents. The resolutions also said they would oppose safety incentive programs that assume workers were too stupid to care about their own safety and must be bribed with

trinkets. They would insist on safety program that enlist the skill, knowledge and commitment of the workforce in finding and correcting the hazards.

2.5 The Common Mistakes/Lacking When Implementing BBS

Organizations often struggle with sustaining participation in observations. According to McSween (2004), the typical problems faced by many organizations when trying to implement the BBS process were lack of logistics planning and preparation, generic or irrelevant checklists, inadequate training, no systematic use of observation data for improvement planning, little or no reinforcement to support the process and poor leadership participation and support.

To briefly illustrate the idea stated above, McSween pointed that planning on the program was far more important than to simply train the employees without making the BBS as a "formal" process in the organization. Checklist used need to be specific or custom made instead of generic in order to improve the observation process. Training that covers all employees was more effective than just to cover a small group of people in the organization. It was common to realize that the data from the employees' observations were not used to do anything. In these cases, employees invariably stop participating, after which the process grows stale and eventually dies. Recognition may be used to encourage the participation of the employees in the program. BBS program that involves the management people in the observation was more effective as it showed to everyone in the organization that management was serious about safety (McSween, 2004).

Geller (1996) shared the similar thought on this. Geller pointed out that the failure to teach the principles of BBS could lead to the failure of the entire program. It was important to let every single employee in the organization understand the importance of BBS program to help reduce the injury rate and correct the at-risk behaviour. Besides, if the organization just purchase the BBS program from one of the consultant and implement it exactly as per the manual could lead to a failure as lack of ownership of the program by the employees.

Geller (1996) also touched about the importance of leadership and management role to make BBS program successful. He commented that the management needs to show the interpersonal support by verbalizing understanding and belief in the principles and recognizing individuals and work teams for accomplishing program objectives.

Similar to what was claimed by McSween about the lack of reinforcement is a root cause to the failure of BBS, Geller (1996) mentioned that a successful long term BBS requires leadership at all level, especially operator level. If the key individuals believe deeply in the principles and procedures, they will make sure program continues. Only if the leader believes the principles of this program, the reinforcement will always be there.

Geller (1996) listed seven pitfalls to avoid when implementing BBS. The seven pitfalls were:

a. failure to teach the principles to all potential participants,
b. lack of perceived ownership,
c. insufficient bottom-up involvement,
d. invisible top-down support,
e. insufficient champions of the process,
f. mixing goals with purpose or mission and,
g. Insufficient measures of program success.

Later in 1999, DePasquale and Geller (1999) published a survey result on the factors that determined the success/failures of the BBS program. From the survey, it showed that the employees' involvement was greatly influenced by

a. perceptions that BBS training was effective,
b. trust in management abilities,
c. accountability for BBS through performance appraisals,
d. whether or not one had received education in BBS, and
e. tenure with the organization.

Management involvement in the program would encourage greater percentage of employees to participate. Otherwise, the message was very clear, "Do as I say, not as I do" (McSween, 2004). Geller (1996) made a remark that if the plant CEO or key supervisory staff sat through his presentation, the program implementation was usually more effective and long term. This was due to visible management support.

Also, DePasquale et al. (1999) survey from 20 organizations revealed that organizations mandating employee participation in a BBS process reported significantly higher levels of

a. involvement,
b. trust in management,
c. trust in co-workers, and
d. satisfaction with BBS training than to voluntary employees.

In addition, employees in mandatory processes reported significantly greater frequency of giving and receiving positive behaviour-based feedback.

One of the defining features of behavioural safety was that decisions were based on data. Objective information was the basis for action. Two of the most important features of behavioural safety were employee observations and participation. Selecting these measures was relatively easy: how often were observations occurring (frequency of observations) and how many employees were doing observations (percentage of personnel conducting observations). Critical aspects of observations also include their quality, quantity, and accuracy (Matthews et al, 1998).

Another frequent mistake was to use the injury rate as the measure for the program (Geller, 1996). As Krause (2000) mentioned, injury rates were important descriptive statistics, but they were not of prescriptive value. Prescriptive measures were leading process indicators of performance, and that was precisely what managers need in any field of their endeavour, including safety. Using injury rate as the measure would discourage the reporting of incidents or manipulating the record so that the data "look

good". This would end up failing the whole program as the workers perceived that they were not able to control injury by using BBS (Geller, 1996).

2.6 The Latest Development of Behavioural Analysis

BBS is nearly 30 years old. The term "BBS" was first used by Dr. Scott Geller in 1979. Geller is the founder and senior partner in the consulting firm Safety Performance Solutions (SPS). He is also the Alumni Distinguished Profession at Virginia Tech. Geller has been working on BBS since 1970s. After many people have misperceptions on BBS, Geller has developed an evolution of the method, which is called people-based safety (PBS). According to Geller, PBS is the "improved version" of BBS. The people-based emphasize on the human dynamic more than the ordinary BBS. PBS emphasizes that those involved need to consider the feelings, attitudes, and perceptions of those on receiving end. The method is based on ACTS (acting, coaching, thinking and seeing). Geller wants those influenced by people-based safety to wear their seat belts or safety harnesses not because failure to do so will result in scolding or reduction in pay. Rather, he wants individuals to perceive themselves as safety-minded people who understand the consequences of their actions (BLR, 2007; Geller, 2006b). Geller (2006b) explained that the PBS approach adds to BBS by teaching ways to implement self-coaching and increase self-accountability for safety. Geller (2006b) also revealed that PBS principles and procedures stress on attitudes, perceptions and thoughts. PBS requires a very sincere and honest appreciation of other people. It requires an understanding and acceptance of the internal feelings, needs and perceptions of other people. The uniqueness of each person is appreciated and recognized (Geller, 2006b).

According to the OSHA Compliance report in Jan 2007, Terry Mathis has also altered the BBS process that his firm offered. Terry Mathis is a co-founder of the Houston based consultancy – ProAct Safety. The new process is known as "rapid cycle improvements". The alternatives involve smaller teams, shorter checklists, and an emphasis on "quick wins, not moving a while culture." These seek to achieve success in a particular area or in response to a particular problem, rather than to reshape the

entire workplace culture. Mathis generally focuses on the problematic group of people and able to significantly reduce the accident rate.

CHAPTER 3

METHODOLOGY

The methods used to complete the study were explained step by step as shown in the heading below.

3.1 Concept

This study identified the possibilities to develop an alternative to the BBS process by utilizing the technology, such as computer.

The e-BAI concept retained all the four important elements in the BBS concept. The four important elements were

a. Identifying critical behaviour
b. Gathering data
c. Providing on-going feedback
d. Removing barriers

3.2 Framework

To start the e-BAI programme, a database needed to be set up first. The database consisted of the pre-programmed questions that derived from the checklist or previous incident records.

Then there was the observations process where the employees were not told to observe any specific activities. Employees only needed to be more aware when they were doing work daily.

When they opened the database, they gave their feedback to the database whether they have observed any at-risk behaviour on the activities mentioned by the database. The database would calculate the analysis automatically and published the result based on feedback received. The employees were reminded on the safe behaviours from this

exercise could change their behaviour eventually when they realize that behaviour was not save. This is through the cognitive psychology effect.

With the analysis done by the database, the safety committee could used those data and discussed in the meeting directly. The team would apply the ABC analysis to understand the behaviours. Optionally, the safety committee could conduct some interviews to the employees to further understand why they took risk when performing their tasks.

With that, the action plan can be established to rectify the at-risk behaviours that were contributed by factors such as "hard-ware", "soft-ware" or "human-ware" mentioned above.

The framework of e-BAI is shown in Figure 1 below.

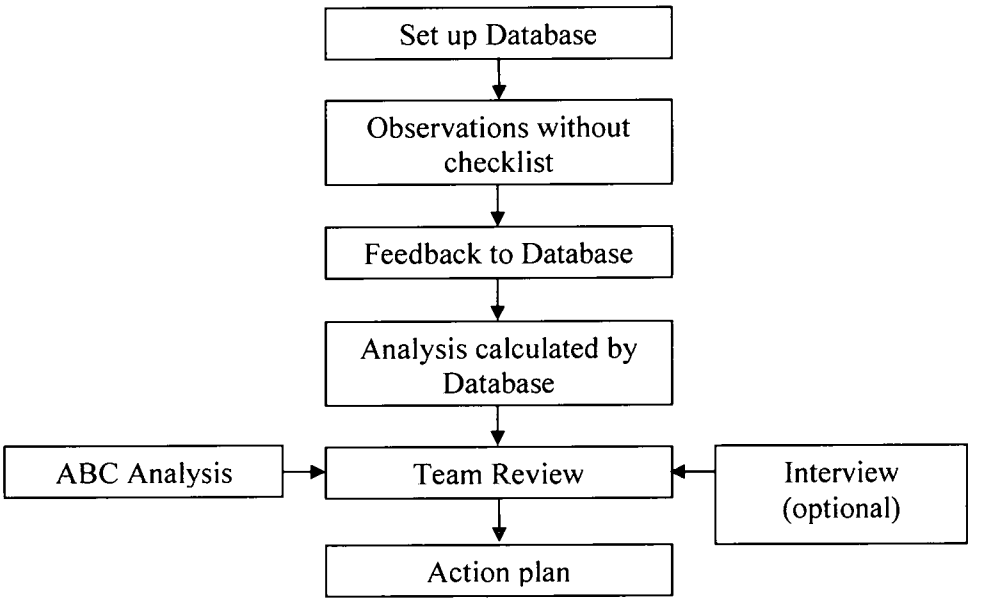

Figure 1. Framework of e-BAI

3.2.1 Overcoming Limitations

The e-BAI program was meant to overcome certain limitations of BBS as mentioned below.

a. Prevent Coyness In Direct Feedback With Computer Interface

Additionally, there was also problem faced by the employees where they dare not approach the peers to give feedback directly (Gilmore et al., 2002). The e-BAI established here attempted to rope in as many participants as possible to get involved in the program with the least training needed, using the shortest time spent and to overcome the coyness of directly feedback to peers.

b. Inculcate Safety Culture with e-BAI

The e-BAI utilizes computer software to prompt the employees if they observe any unsafe behaviour related to the topic asked. For instance, the e-BAI database could have a question like, "Did you see anybody drive faster than 20km/h today?" The employees were trained to observe things that occurred around them naturally without bringing the checklist. The questions that prompted up regularly would also serve as the checklist in the ordinary BBS process. However, instead of focusing on many items during one observation, the questions would require the employees to respond to only particular areas in a day. Different topics were asked everyday. This would eventually instil a psychological effect where people were "reminded" on the safety rules and regulations. The cultivating of habitual awareness was always the heart of designing the e-BAI. Only when it became habitual, the safety culture could be inculcated.

As employees perform observations, said McSween, they come to recognize any discrepancies between their own behaviour and what is considered safe, and they begin to adopt safe practices more consistently. "We have created a process where they raise their personal standards," he said (Minter, 2004). This is the objective of this whole e-BAI – to inculcate the safety culture in organizations.

c. Tackling Slow Data Collecting And Analysis With IT

Questions on observations were then being repeated randomly. All the feedback was collected in the database and would be analyzed by the steering committee on a regular basis. When the safety steering team analyzed the data, they would be able to identify the high risk issues faced by the employees. For example, if the speeding behaviour of the employees remained high in the statistic after a few times being asked through the software, it implied that many people were speeding in the plant and refuse to change their behaviour. From there, the safety committee could provide some recommendations such as building a few road humps in the plant, spot check and issue warning to those who sped. The data analyzed would highlight the areas in which the safety team was excelling and thus providing the greatest potential for improvement. This would also help the committee to identify if the unsafe behaviour was due to

- "Hard-ware" problem like inadequate structural safety design,
- "Soft-ware" problem like poor system implementation or obsolete operating procedure, and
- "Human-ware" problem like employees' risky behaviour.

d. Reduce Intensive Labour And High Cost With e-BAI 24 Hour Functionality.

The advantage of e-BAI was that the observation was taking place 24 hours a day and 7 days a week with minimum man-hour needed. Thus resulting in higher efficiency and cost saving.

Table 1. The Table showed the comparison of Ordinary BBS and e-BAI framework

Element	Ordinary BBS	e-BAI
Training	Training given to observers on how to define unsafe behaviour and how to provide feedback.	No training needed. All will participate in the observations. Only briefing about what is BBS and how it works need to take place.
Checklist	Checklist must be used to go through all items and see which is not complied.	No checklist is used. Only some preprogrammed questions asked on a daily basis covering all topics.
Observation frequency	Observers are required to make certain observations in a certain period, i.e. 1 observation a week.	Observation is done on daily basis or flexible adjustment to frequency can be made.
Cost	Additional cost for training and printing checklist.	No cost since no training and no checklist.
Feedback	Feedback is given directly when observation completed, whether it is positive or negative feedback. Result of observation also feedback to steering committee for further analysis.	Feedback not given directly to prevent "sick feeling" with peers. Feedback is displayed directly in the database. Steering committee uses the same set of data for further action.
Communi-cation	Feedback only given to those who are conducting the activity. Those who are doing same activity but at different shift not communicated. Need repeated communications in order to make everybody aware of certain unsafe behaviour.	Feedback recorded in database which everyone could access to see what the unsafe behaviour is observed.

Involvement	Only those who are trained will involve in the observations. To involve all, much training is required.	All will involve in the observation since the observation is done naturally without focusing on only one activity.
Manage-ment commitment	Management commitment determines if the process will be successful. Most BBS fail due to poor management commitment.	Software displays the management participation and thus motivates management to further commits and improves the program.

3.3 Theory

3.3.1 The ABC Model

Minshall (1997) explained that ABC analysis or ABC model stands for

- A for Activator (or antecedent)
- B for behaviour and
- C for consequence

An activator was what trigger a behaviour and consequence was what results from the behaviour. For example, when the phone rang (activator), someone picked up the phone (behaviour) to determine who was on the line (consequence).

Matthews (2006) provided some examples of ABC model (Table 1) for better understanding. The ABC's model showed that consequences played a more important role to affect the behaviour rather than antecedent.

Table 2. ABC Model Examples

ANTERCEDENT	BEHAVIOR	CONSEQUENCE
He saw it on TV & Mom has $20	Son asks for $20 to buy a new video game	Plays video game that night
Mom called her from work to remind her	Daughter does her homework before calling friends	Her friends are all doing their homework when she calls
Had to wear least favourite outfit that morning	Wife picks up dry cleaning on way home from long day at work	Has clothes to wear next morning .
Neighbour made comment about how fast grass grows	Husband mows grass and edges lawn	Is hot and sticky

ABC analysis was the common tools used to do the behaviour analysis during the team review. The analysis was able to identify why the at-risk behaviour was adopted based on the data collected.

3.3.2 Total Safety Culture

A total safety culture had been defined by Perdue (2000) as a culture in which people:

a. Hold safety as a value;

b. Feel a sense of responsibility for the safety of their co-workers as well as themselves;

c. Are willing and able to act on the sense of responsibility they feel. They were supported by the culture to go "beyond the call of duty" on safety matters.

Another list was compiled based on the feedback from supervisors and workers during workshop on their definition of total safety culture (Perdue, 2000). The list was shown below. It explained more specifically the criteria of total safety culture in an organization.

- All employees comply with safety rules and regulations at all times.
- Employees continuously search for safety hazards and take initiative themselves to correct hazards when found.
- Employees are eager to participate in safety-related activities.
- Participation in safety-related activities is promoted and encouraged through respect and positive recognition.
- All safety-related issues are openly communicated. Fear of reprimand or discipline does not inhibit discussions.
- Safety incidents are viewed as an opportunity to identify system failures and therefore improve the system. Individuals are not assumed to be, and are rarely found to be, at fault.
- Training systems result in all employees having the needed knowledge, skills, and abilities to perform their jobs safely.
- All employees fully understand and appreciate the potential hazards of the operations performed.
- Employees do not consider taking unnecessary risks.
- Management never (knowingly or otherwise) encourages employees to take unnecessary risks.
- Regular safety-related feedback is a way of life. Corrective feedback is constructive and appreciated.
- Peer pressure acts toward, rather than against safety.
- All business activities are managed with a constant focus on accident prevention and occupational health.

3.3.3 The Cognitive Psychology

Cognitive process, as explained by Kamp (2001), is the human thinking capability. The term is the terminology of psychologist.

Behaviour-based safety program was not a pure "safety" subject. It involved a lot of psychology subject in order to change the people behaviour. However, with the latest development on the research about BBS, more and more people thought that ABC model (see under 3.3.1 Theory) alone did not justify the behaviour change (Kamp, 2001).

Kamp (2001) brought up the question of why workers at the site with a successful behavioural safety process choose safe behaviour over at-risk behaviour when they were not observed. It makes sense as the safe behaviour normally takes more time and effort than at-risk behaviour. So what was the element in the BBS that motivates workers to work safely? Kamp provided many examples in his paper that consequences may not be the only reason to work safely. Kamp revealed that many workers when asked about why work safely, the answers were "increased of awareness", "more positive attitudes", "people caring more about safety". He concluded that the behaviour change was much due to the changing of perceptions, attitudes, and value than changing the external consequences of safe and at-risk behaviour. Kamp also pointed out that the meeting to get everyone "buy in" to the BBS, high participation of employees and training to all observers were actually attempted to create a favourable attitudes towards the BBS. Threat of injury was a weak consequence to many workers as they perceive the occurrence probability was low. Thus, the ABC model does not explain why BBS could be success as the consequences mostly favour at-risk" behaviour. Kamp urged the behaviourists to start looking outside the ordinary BBS theory and strives more on the cognitive psychology in order to further improve the success rate of BBS, to develop new BBS methods and to overcome implementation pitfalls etc.

Wagner (2007) explained that Cognitive psychology is the branch of psychology that studies mental processes including how people think, perceive, remember, and learn. As part of the larger field of cognitive science, this branch of psychology is related to other disciplines including neuroscience, philosophy, and

linguistics. The core focus of cognitive psychology is on how people acquire, process, and store information. There are numerous practical applications for cognitive research, such as ways to improve memory, how to increase decision-making accuracy, and how to structure educational curriculums to enhance learning.

Until the 1950s, behaviorism was the dominant school of thought in psychology. Between 1950 and 1970, the tide began to shift against behavioral psychology to focus on topics such as attention, memory, and problem solving. It is often referred to as the cognitive revolution, this period generated considerable research including processing models, cognitive research methods, and the first use of the term "cognitive psychology." (Wagner, 2007).

The different of cognitive as compared to behaviorism, it concerned with the internal mental states instead of only focuses on observable behaviors.

3.4 Tools and Software

Microsoft Excel was used to generate the database to prompt two questions automatically and to compile that information statistically. Percentage of unsafe behaviour was calculated based on the feedback received.

To generate the database, Microsoft excel was used with the visual basic programming tools to enhance features of the database.

3.5 Case Study Implementation

Eastman Chemical (M) Sdn Bhd (ECMAL) is one of the manufacturing sites of Eastman Chemical Company in Asia Pacific. In the year 2000, the plant had purchased the BBS training material from one of the renowned BBS consultant. The safety officer trained the selected employees in the company as per the training manual. Checklist was used to conduct observation. However, it was found that the program eventually slowed down and just failed to work out. The root cause of this problem was that the observation was very human intensive. Eastman Chemical was

in the effort in reducing resources to be more cost effective and thus, did not have resources that were able to conduct the observation. Additionally, the feedback was only shared to one person. This would mean that to correct ten unsafe behaviours, it required ten times of observation. This type of communication was later found ineffective to correct the unsafe behaviour. On top of that, no further study was done to understand why unsafe behaviour had taken place. Thus, eventually the program was terminated.

Learning from the previous experience, the e-BAI was devised to simplify the observation process whilst achieving the final result of correcting all the unsafe behaviours either by changing the design ("Hard-ware"), system ("Soft-ware") or training the employee ("Human-ware"). "Hard-ware" was referring to the existing design in the plant facility such as piping orientation, the position of equipment or instrumentations, signboard and equipment tagging,. The "soft-ware" was referring to the operating procedure and Log Out and Tag Out (LOTO) system. The "Human-ware" was generally referred to the human factor like behaviour, and employees' knowledge.

3.5.1 Procedure

The detail of the procedure to conduct this study was shown in the headings below.

3.5.1.1 Generate Database

One of the important tools of this study was to use IT (information technology) to help on the observations processes. One master list that consists of 16 questions was generated. It was intended to run the case study for a month and to repeat each questions four times to see if there were any trending observed. In the front page of the database, only two questions will be prompted. Two questions per day were designed in the database after consideration of the human factor. The program was intended to let people feel that it was so simple to participate and "why not take part?". Three questions would cause people feel irritated to read and one question was too

little. After much consideration, two questions were considered the most appropriate. With two questions a day, repeated for four times in a month, the database required a total of 16 questions. The questions were then stored in the database and would be prompted and repeated to the employees everyday.

The questions consist of area like PPE usage, ergonomics, safety rules, safe practice and housekeeping. A systematic approach can be established to develop the questions in the database. For instance, it can be based on the past incident records in the organization to focus on the problematic area, or it can be the near misses cases. It can also be the questions that purely derived from the checklist alone. Basically, to effectively use the e-BAI program, the questions must be custom designed for each organisation. The PPE coverage will generally include questions if there is anyone not using ear plug in high noise area or not using safety glasses while working. For ergonomics category, the question asked was if the employees experienced back pain after work. As for the safety rules, the questions asked were if anyone has seen people using hand phone in restricted areas and driving exceeding the speed limit. For safe practice, the question asked was anyone walking but eye not on path. Lastly, for the housekeeping, the questions asked if any area was prone to tripping hazard due to poor housekeeping of the employees, or any chemical/water leak area not barricaded.

The program was named as "1-min observation" to imply the program would only requires 1 min of the employees' time each day to participate in this program. Again, it was meant to let the employees felt "why not take part?" since it was so simple and did not require much time.

The participants were categorized according to their different departments. This was to encourage the participation of the employees by promoting the safety image of their department. No real identity would be revealed.

The master list of the questions was attached in Appendix I.

The questions were designed as such that the employees would answer either "yes" or "no" only. The answer of "yes" would represent unsafe behaviour whilst "no" would mean safe behaviour.

The database would calculate automatically the percentage of safe and unsafe behaviour observed on that day. This data was represented in charts shown in Appendix II, Figure AII-3.

The algorithm of the "1-min Observation" is shown in the Figure 2 below.

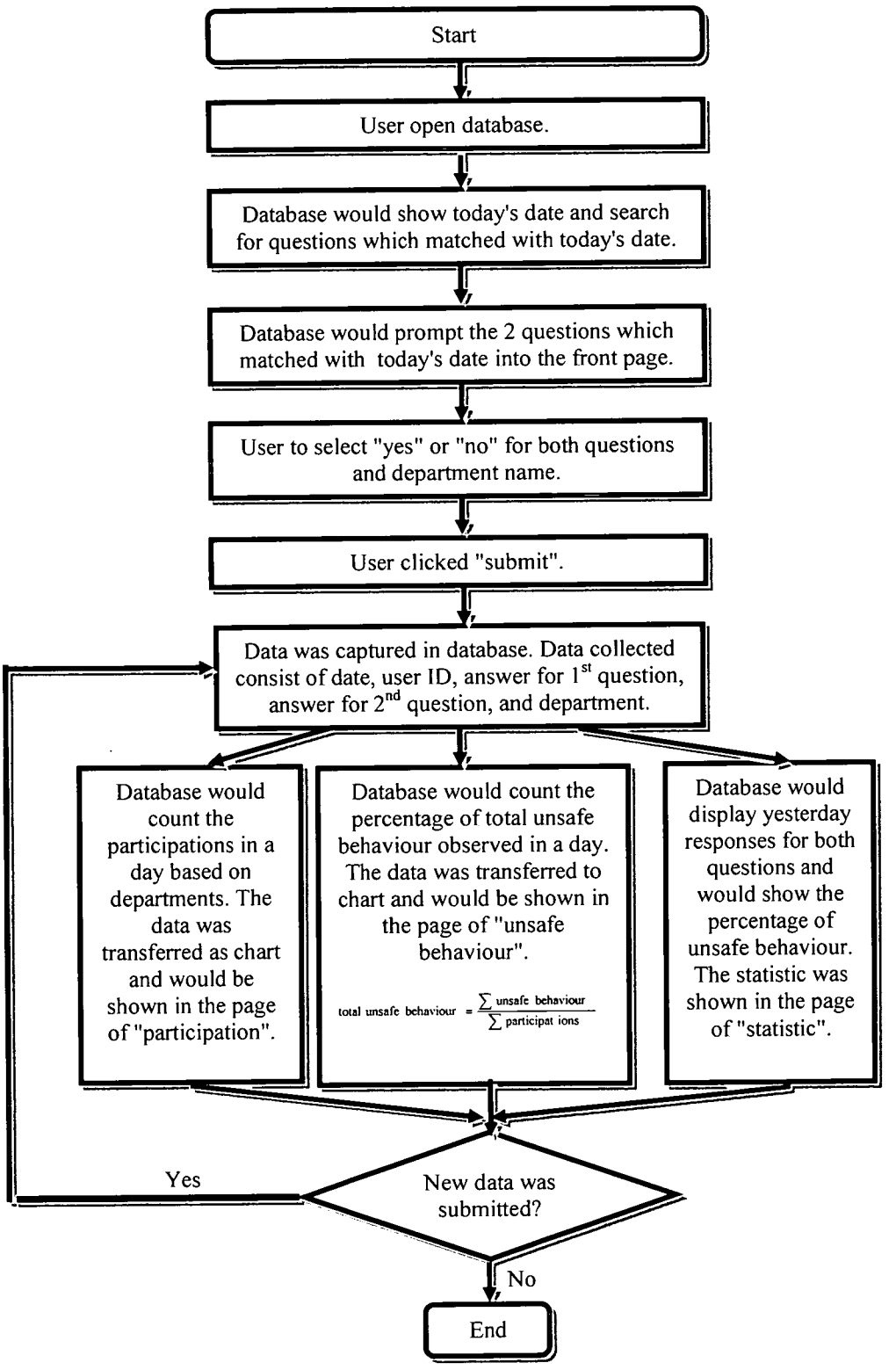

Figure 2. The algorithm for "1-min Observation" program

3.5.1.2 Discussion with Management Team

Prior to the implementation of the e-BAI program to Eastman Chemical, there were a few discussions with the safety manager to understand the feasibility of conducting the case study in Eastman Chemical. When the safety manager gave his agreement to implement the e-BAI program (termed as "1-min Observation" in Eastman Chemical), the management meeting was then scheduled.

The meeting with the management team involved the presentation of the fundamental idea of the e-BAI program as well as how the database worked.

It was great pleasure to get the management team approval to launch the "1-min Observation" in Eastman Chemical. The duration for the case study was one month.

3.5.1.3 Briefing to All Employees

The case study involved all the employees in Eastman Chemical from all different levels. The briefing about the program was given by the safety manager and the introduction on how to use the software was provided during the briefing.

3.5.1.4 Official Launching

Once the briefings were completed, the "1 min Observation" program was officially launched in Eastman Chemical for one month. The case study involved all the employees in Eastman Chemical from all different levels. However, the employees were not informed that the program was launched for a case study.

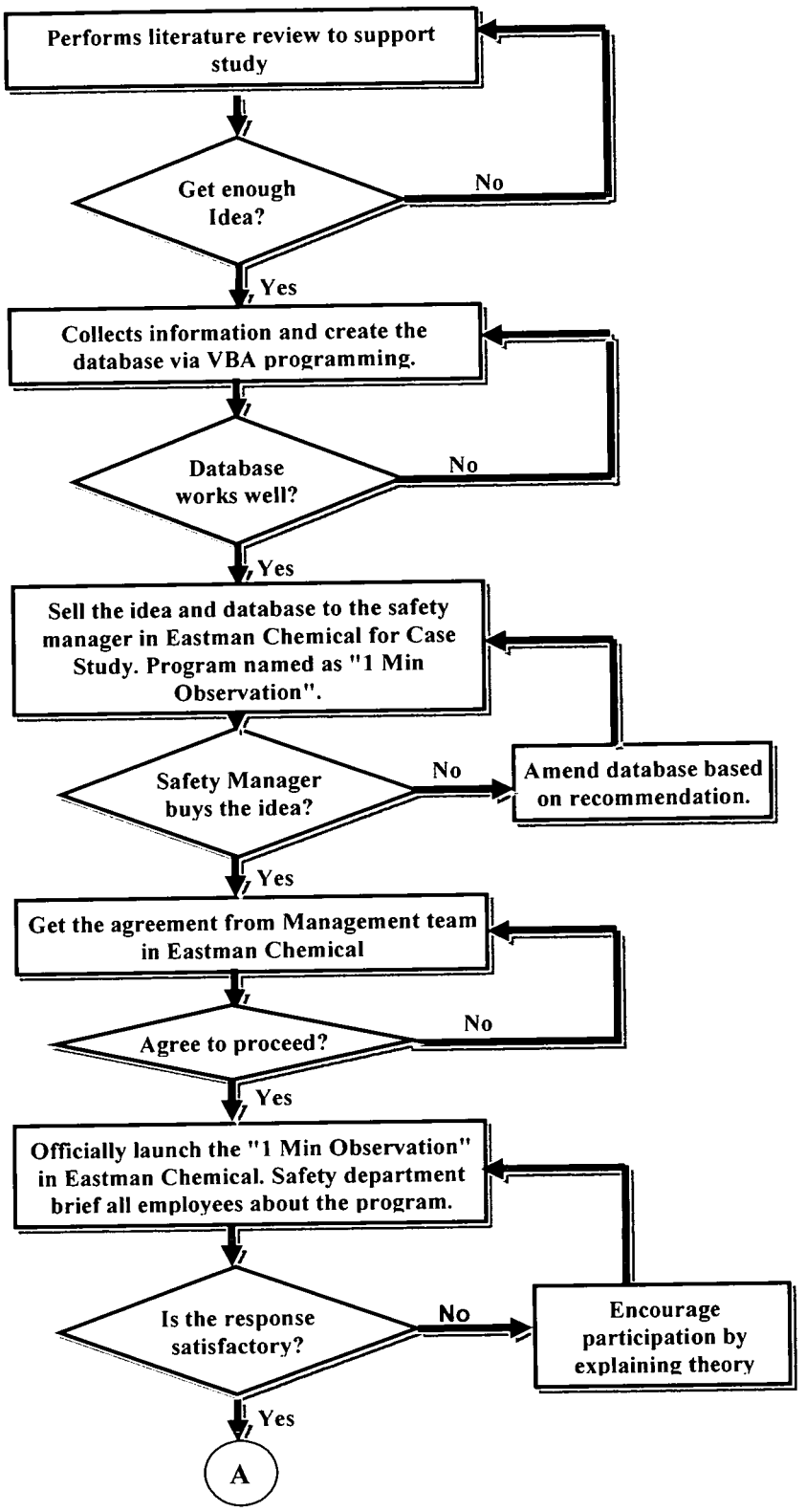

Figure 3. The process flow chart on how the case study was carried out.

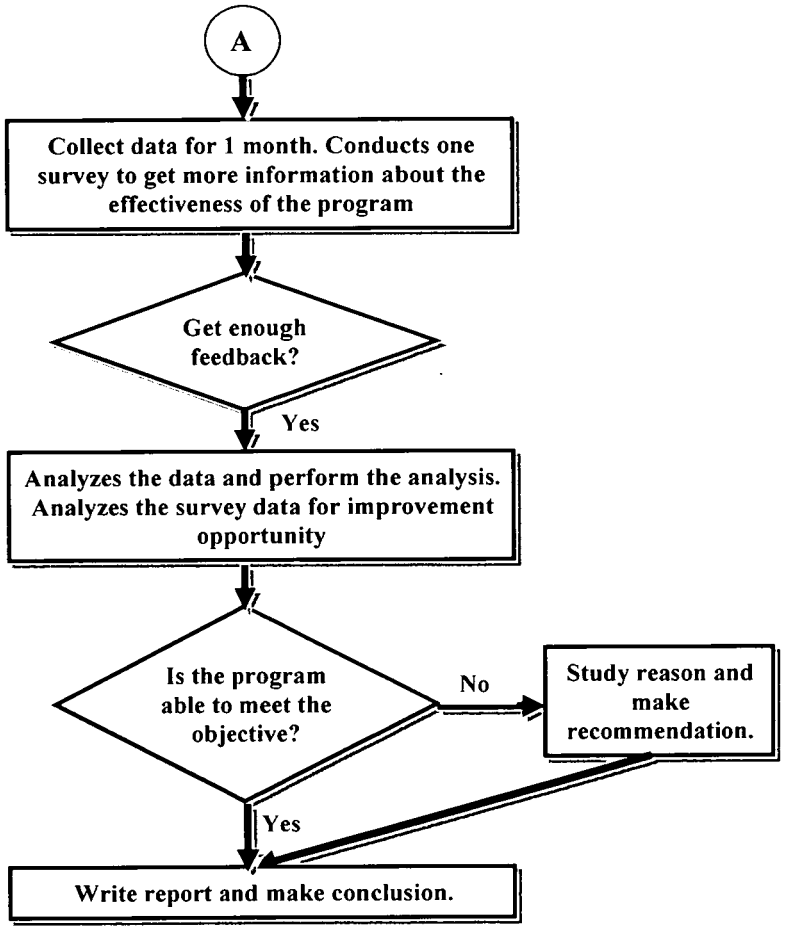

Figure 3. The process flow chart on how the case study was carried out (continue).

3.5.1.5 Questionnaire Survey

The questionnaire was given to the employees one month after the program was being launched. The objectives of the survey were to understand whether employees of Eastman Chemical think the "1-min Observation" was a good safety program for them and to deduce plans for further improvement.

The questions of the questionnaire were attached in the Appendix IV.

3.5.2 Analysis

Lastly, the data collected from the database was then compiled into a Microsoft Excel spreadsheet. All the data was analyzed as shown below:

- Overall percent safe behaviour observed,
- Overall percent unsafe behaviour observed,
- Top 5 unsafe behaviours that require steering committee's attention,
- Review of the unsafe behaviours categories, and
- Trend of the employees participation (improved or worsen),

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction of Case Study in Eastman Chemical - "1-min Observation"

The "1-min Observation" Program was officially launched in Eastman Chemical (M) Sdn Bhd (Eastman Chemical) on 16th Apr 2007. The program was launched without informing the employees that this was a case study. It was launched by the safety department so that employees would take the program more seriously. The Eastman Chemical homepage was replaced with the announcement of the "1-min Observation" program with the button to assess to the database (Figure AIII-1 in Appendix III).

The case study was conducted for 32 days in Eastman Chemical from 16th Apr to 17th May 2007. There were a total of 16 questions being asked. Each day, there were two questions being prompted to the employees. Each question was repeated 4 times during the period of case study.

Data collected was then analyzed and discussed below.

4.1.1 Participations

The participations from the employees at the early stage of launching were not good. This was primarily due to the unfamiliarity of the program and the routine of going into the web page for the "1-min Observation" file everyday. After much explanation and encouragement by the safety manager to the employees, the response started to increase.

Besides, there were also some feedbacks from Maintenance Department where accessing the "1-min Observation" file in the server via a hyperlink in the internal Eastman Chemical webpage was not convenient. Employees who spent most of the time in the plant, expressed that they could not access the file on daily basis even though they support the program. To resolve this problem, the questions for

each day were print on a piece of paper (shown in Appendix IV) and then passed to the Head of the Maintenance Dept. The Head of the Maintenance Dept then circulated the paper during their department morning meeting. The secretary of the department was in charge to key in the feedback collected to the master file in the server. The employees would then access the master file during their free time to look at the statistic data shared. From then onwards, the feedback from the employees had increased significantly. This was shown in Figure 4 below. The responses of the employees from respective departments were also shown in Figure 4.

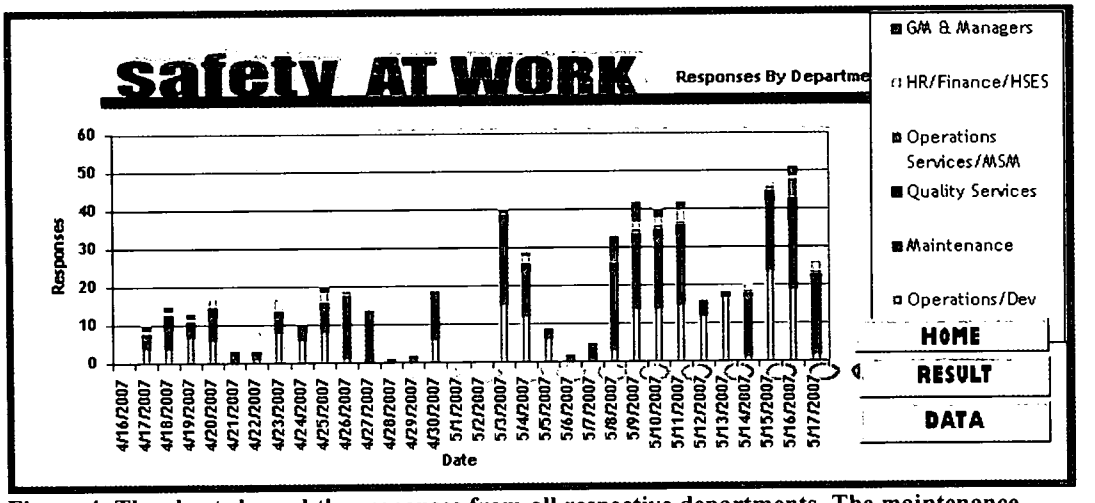

Figure 4. The chart showed the responses from all respective departments. The maintenance feedback had increased tremendously after 26th April.

The responses were expected to be low during weekends and public holidays. Figure 5 showed the responses received from all the employees and the responses were on lower side during weekends. The trend showed that there was improvement in the participations over time. However, there were some occasions when the feedbacks were lower due to some visitors' plant visit or corrupted master file. The master file which was compiled using Microsoft Excel was easily corrupted due to the multiple sharing with many people and the huge size of the file. The problem was then fixed by using standby master file, consistently back up and double password protection. Also, the file size was then reduced by removing some unnecessary decorative pictures in the file.

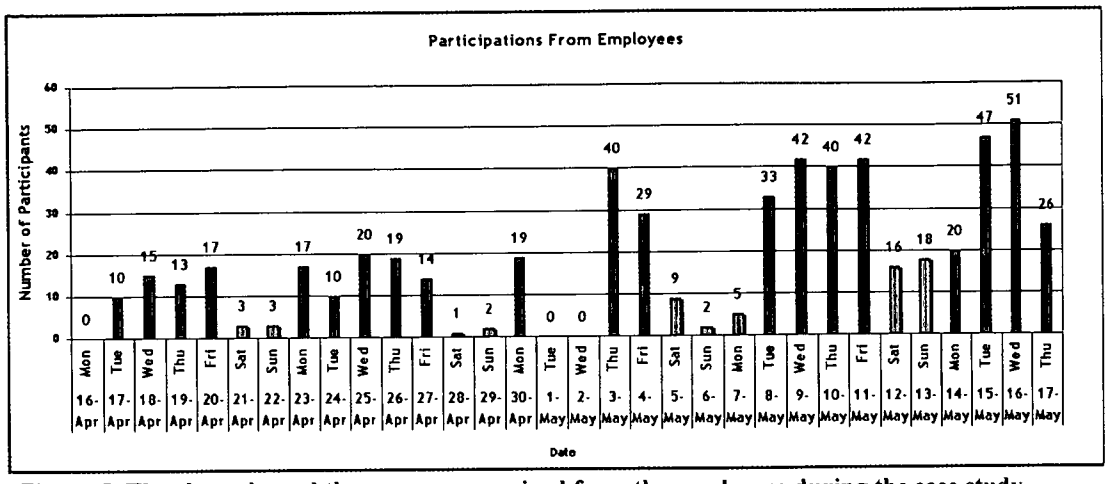

Figure 5. The chart showed the responses received from the employees during the case study.

Based on the record from Human Resource Department, the daily attendance of the employees was used to compare against the participations rate. Figure 6 showed the percent of participation relative to the attendance. The highest participation received was 86% whereas sometimes it went below 10%. This depended heavily on the plant activities. If the plant was experiencing some problems then the response would be lower as most of the employees were tied up on the rectification of plant problems.

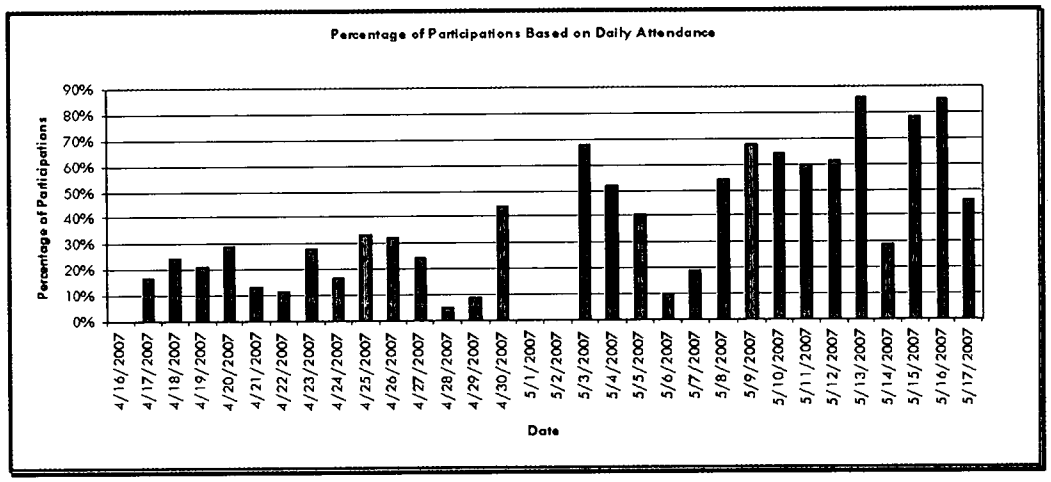

Figure 6. The chart showed the percentage of participation from the employees based on daily attendance

4.1.2 Feedback - Safe and Unsafe Behaviours Observed

The feedback from the employees was then analyzed. Each question was prompt four times. The calculation was shown below.

$$\text{Percent of Unsafe Behavior} = \frac{\text{Total Unsafe Behaviors Observed}}{\text{Total Response}} \times 100\%$$

Where

Total Unsafe Behaviors Observed = Unsafe Behaviors Observed Time 1 + Unsafe Behaviors Observed Time 2 +Unsafe Behaviors Observed Time 3 + Unsafe Behaviors Observed Time 4

Total Response = Number of response Time 1 +Number of response Time 2 +Number of response Time 3 + Number of response Time 4

From there, the percent of unsafe behaviours were sorted accordingly. However, it was noted that even the topmost unsafe behaviour is only 35% of the total response. Generally most of the employees observed were practicing the safe behaviours.

As shown in Figure 7, the list of the percentage of unsafe behaviours observed from the 16 questions posted. Figure 8 showed the top five unsafe behaviours.

From Figure 8, the highest unsafe behaviour observed was the usage of hand phone at restricted area, which contributed 35% of the response. The restricted area covered control room, manufacturing area, laboratory and maintenance workshop.

The second highest percent of unsafe behaviour was followed by "insufficient PPE at maintenance workshop" which was 32%. In the workshop, it was listed in a big signboard that the minimum PPE required was safety glasses, long sleeves shirt and safety boot. Even that, there were 32% feedback mentioning some people with insufficient PPE.

The third in the list was "exceeding driving limit". The driving limit in the plant area was 20km/h. Not everyone was permitted to drive into the plant area; the permit was only given to the executive level staffs. However, 27% of feedback showed that this group of people did not follow the regulations.

The fourth unsafe behaviour was "unclean area with tripping hazard". This contributed to 20% of the feedback. This was related to housekeeping attitudes. It was the operations department responsibility to keep the plant area in the tip top condition and they were accountable for introducing tripping hazard.

The fifth in the list was not wearing hand gloves at work and it consist of 18% of the response. It could be seen that of all the PPE, hand gloves were most frequently overlooked. It was not obvious that one was working without hand glove unless the peers have given the feedback. It was also interesting to note the there was not in a single occasion which observed anyone lifting goods with improper position.

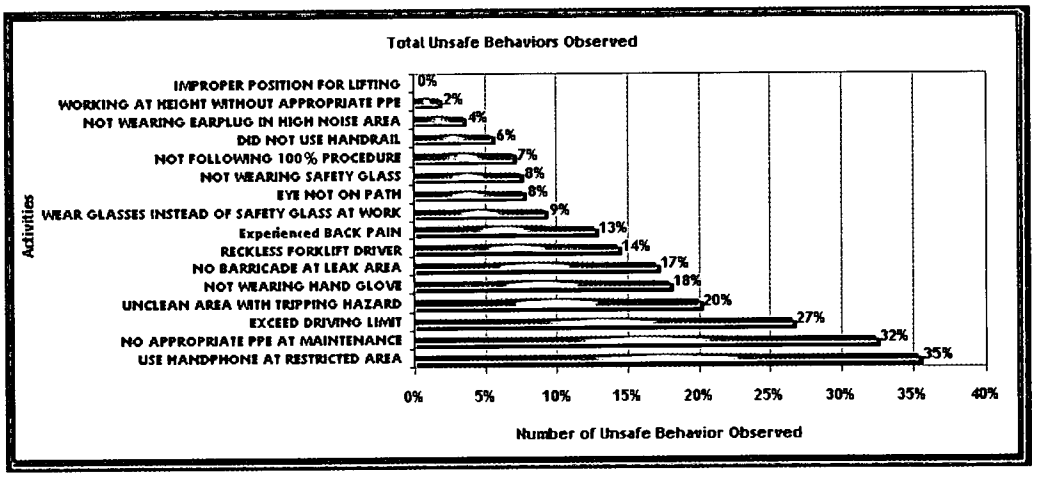

Figure 7. The Chart showed the percentage of unsafe behaviours observed based on the total feedback

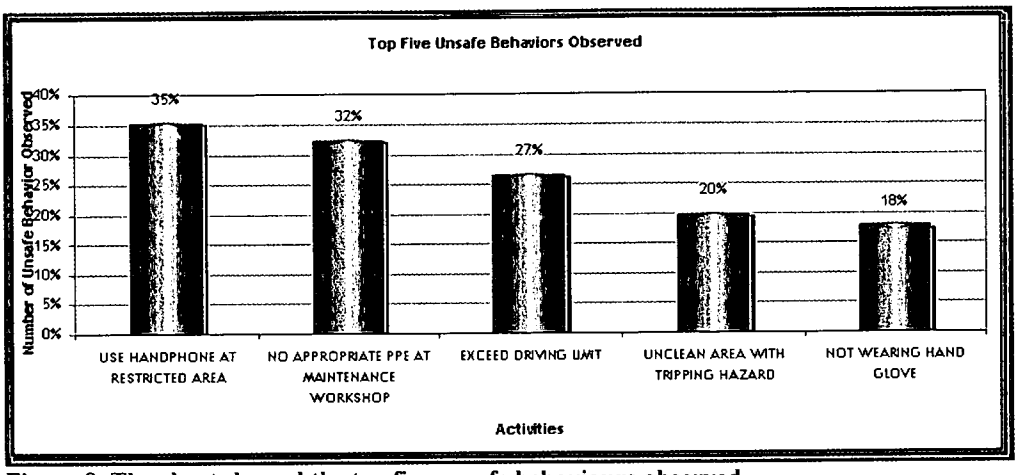

Figure 8. The chart showed the top five unsafe behaviours observed

4.1.3 Survey Analysis

A questionnaire was given to each employee in Eastman Chemical after one month implementing the case study. The objective of the survey was to understand how the employees thought about the "1-min Observation" program and how the program could be further improved.

The questionnaire consists of 13 questions which require rating to be given. There was an additional of three open ended questions which require the employees to write their feedback. Another three questions were "yes" or "no" questions. The questionnaire is shown in Appendix IV.

From the 78 surveys given, a total of 48 responses were received. From the response received, an analysis was done and discussed below.

4.1.3.1 Participation Frequency

From the survey received, 54% revealed that they participated every work day in the "1-min Observation". 19% said they participated 3 to 4 times a week and another 19% participated 1 to 2 times a week. There was 6% of the response said they participate less than once week and 2% has never participate the program. The response was shown in Figure 9. With majority

of the employee participated every day, it suggested wide acceptance and participation of the program.

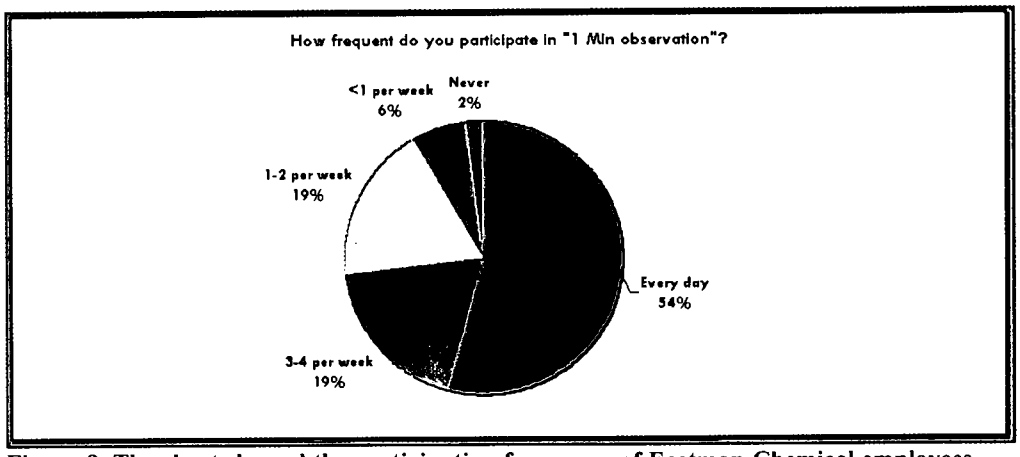

Figure 9. The chart showed the participation frequency of Eastman Chemical employees during the case study

4.1.3.2 Rating of the "1-Min Observation" Safety Program

When asked about how they rate the "1-min Observation" program, 19% said it was very good, and 66% said it was good, 15% rated fair and none rated neither poor nor very poor. Based on this, it seems that the majority of the employees (85%) accepted the concept of the "1-min Observation" program and thought the program was good for them. The chart was shown in Figure 10.

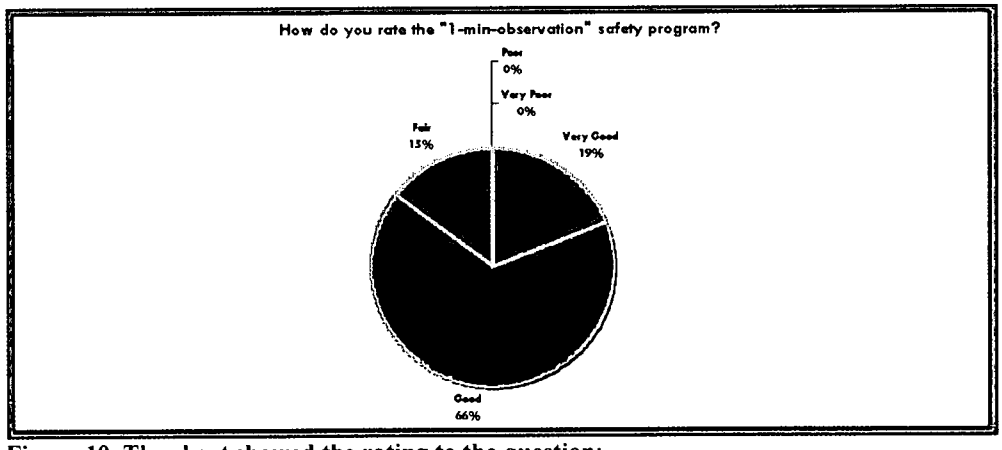

Figure 10. The chart showed the rating to the question:
"How do you rate the "1-min Observation" safety program?"

4.1.3.3 Safety Awareness and Safety Culture

There were 15% of the responses showing that the employees "very agree" that the "1-min Observation" program helped to improve their safety awareness. 66% of the response said they agreed and 17% rated fair. There were 2% did not agree that the safety awareness can be improved. None of them "very disagreed". A total of 81% of the response agreed that safety awareness could be improved via the exercise of this program. This showed very positive feedback from the responses and proved the acceptance of the program by the employees. The responses were plotted in the chart shown in Figure 11.

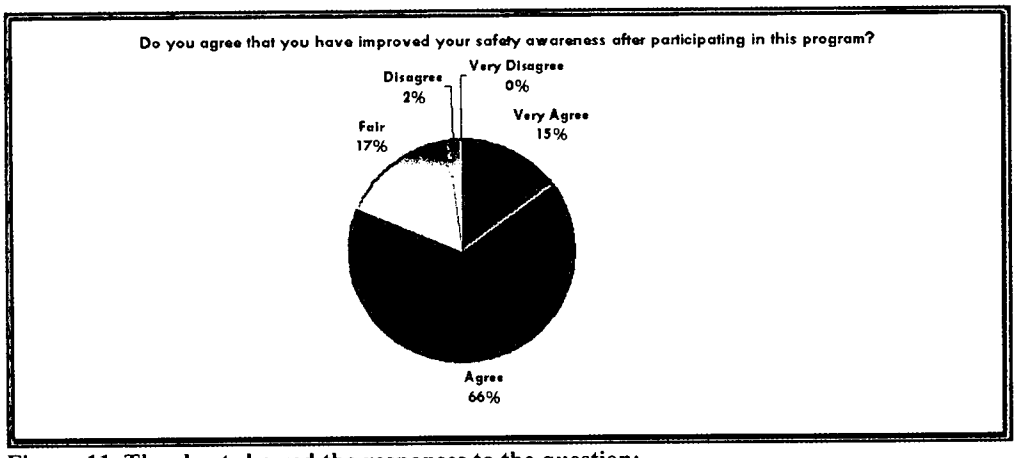

Figure 11. The chart showed the responses to the question:
"Do you agree that you have improved your safety awareness after participating in this program?"

Besides being asked if the safety awareness of individual can be improved via this program, the employees were also being asked if the program was able to improve the safety culture in the company. 17% responded that they very agreed that safety culture can be improved. 66% of the response said agreed and 17% rated fair. As much as 83% of the overall responses showed that this program was able to improve the safety culture in the organization. The chart was shown in Figure 12.

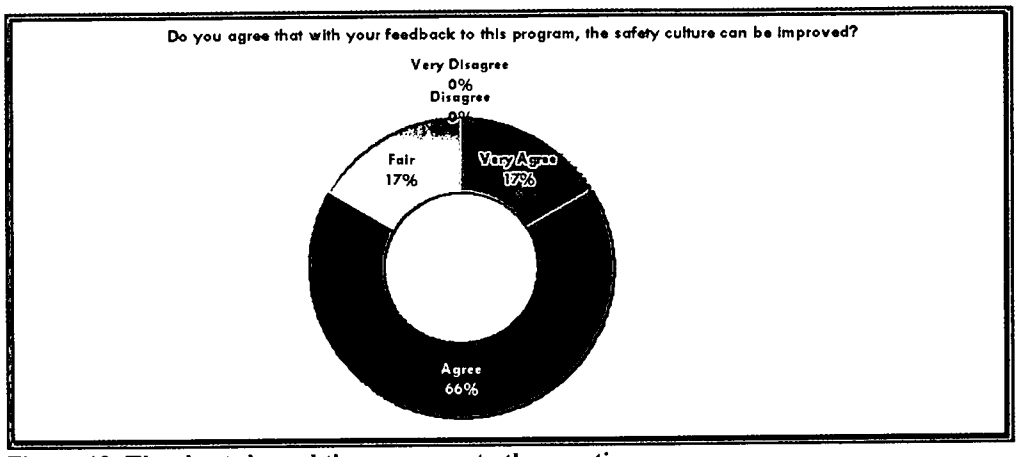

Figure 12. The chart showed the responses to the question:
"Do you agree that with your feedback to this program, the safety culture can be improved?"

4.1.3.4 Observation Activities

One of the survey question asked about if the employees feel people surrounding was observing when he was doing work and if this had made him more conscious of violating the safety rules. From the survey, it showed that 19% very agree and 47% agree on this. As much as 30% said fair which they did not think that people were observing him. 4% was disagreeing to this. With about 66% agreeing on being more conscious of violating the safety rules, we see the positive effect of the program in creating awareness in employees' safety behaviour. The responses were shown in Figure 13.

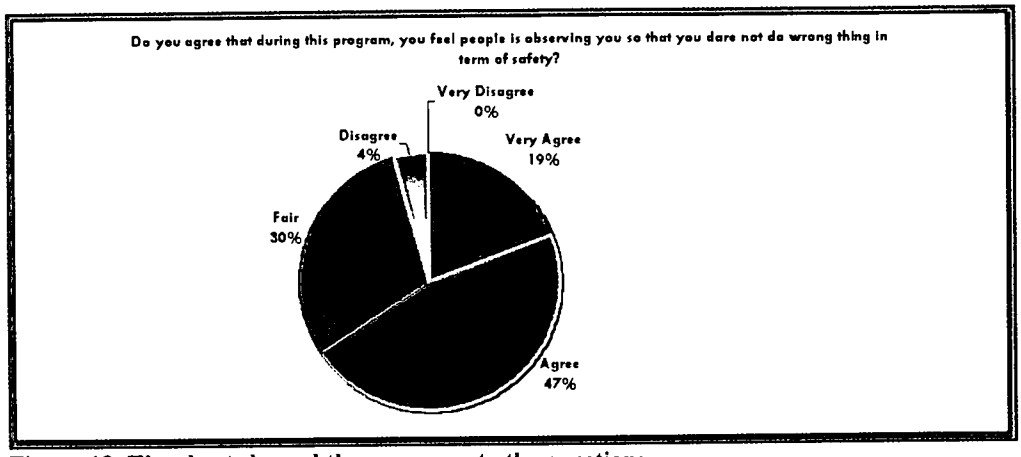

Figure 13. The chart showed the responses to the question:
"Do you agree that during this program, you feel people is observing you so that you dare not do wrong thing in term of safety?"

4.1.3.5 IT System Role in e-BAI

Figure 14 showed the responses from the survey to the question "Do you agree using IT (computer system) could help to cultivate safety behaviour, i.e. like "1-min Observation?". From Figure 14, it can be seen that 15% very agree, 39% agree, 38% fair and 6% disagree and 2% very disagree. Even that overall more than half agree to this, but there were a noticeable number either neutral or disagree.

One of possible explanation was because the program was written in a excel format with VBA program. When the file was shared with all the employees, it caused a few problems as listed below.

- File hang due to the huge file size
- File corrupted due to some attempts to view the hidden information, i.e. identity of the employees who submitted response (the problem was later resolved when the file was fully protected with double password.
- Could not be used at the same time. Would prompt "read only" if someone was opening the file at the same time.

All these problems could be resolved if the file was created by IT professional using Internet Explorer instead of Microsoft Excel.

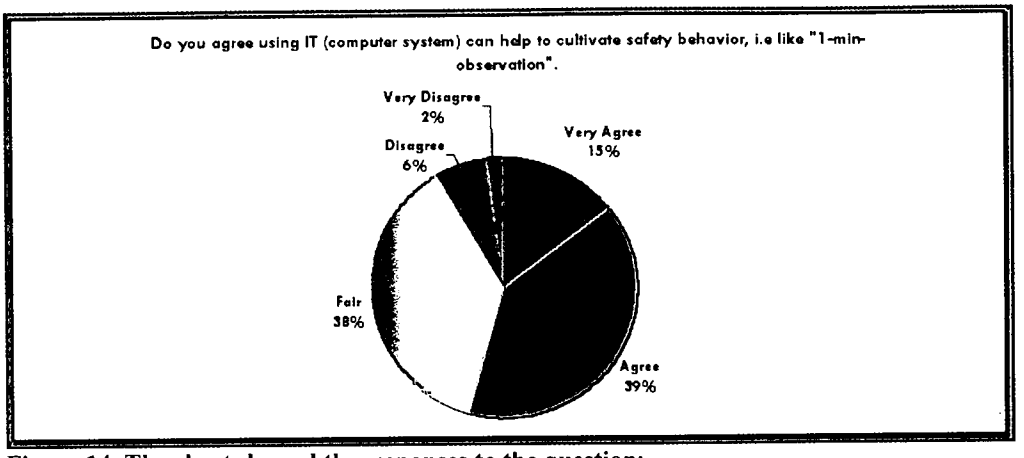

Figure 14. The chart showed the responses to the question:
"Do you agree using IT (computer system) can help cultivate safety behaviour, i.e. like "1 min Observation?"

4.1.3.6 Short Term & Long Term System

One of the survey questions asked about if the "1-min Observation" program should be continued so that everyone could be always be reminded on "good safety behaviour".

From Figure 15, 21% responded "very agree" to this; 52% agree; 23% said fair; 4% disagree.

Majority of the response (73%) agreed that this program should be continued to improve the safe behaviour practice.

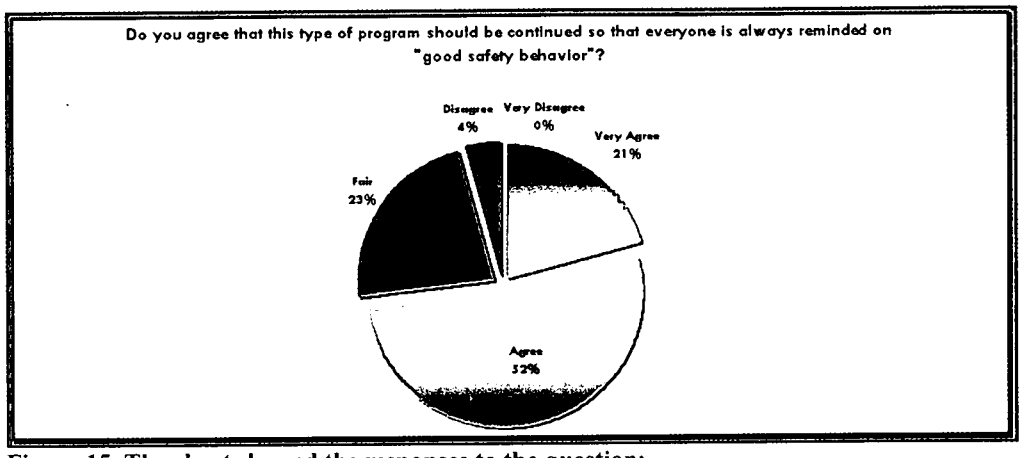

Figure 15. The chart showed the responses to the question:
"Do you agree that this type of program should be continued so that everyone is always reminded on "good safety behaviour?"

4.1.3.7 Reward and Recognition

In this survey, the question about whether those employees who were committed to participate should be rewarded revealed that 23% of them very agree, 36% agree, 27% fair, 4% disagree and 10% very disagree. Most of the people agreed that there should be rewards given to them to encourage more participation. There were still minority of them (14%) disagree to giving reward to encourage participation.

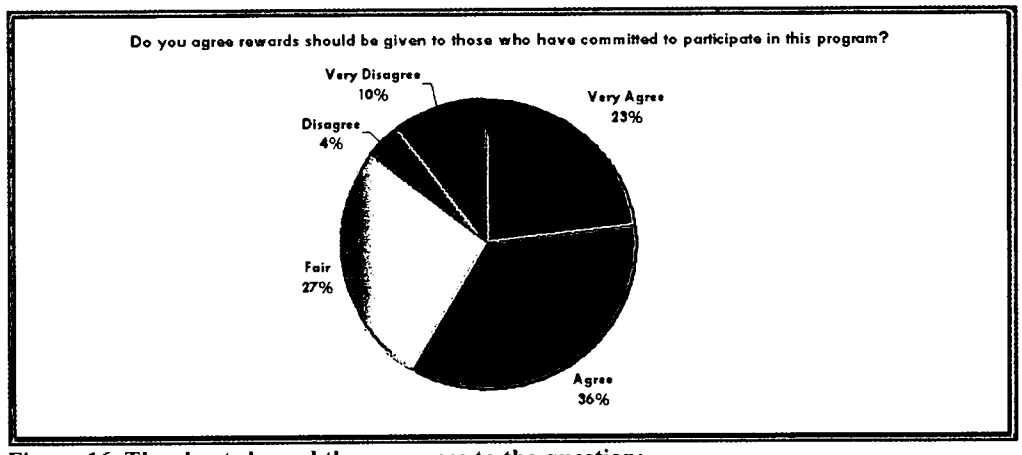

Figure 16. The chart showed the responses to the question:
"Do you agree rewards should be given to those who have committed to participate in this program?"

On another hand, the next question asked about if rewards could help to make the program more successful. Figure 17 below showed that 21% "very agree" that with rewards, the "1-min Observation" program can be more successful. 40% showed that they agreed, 27% was neutral about the rewards, 6% disagree and another 6% very disagree.

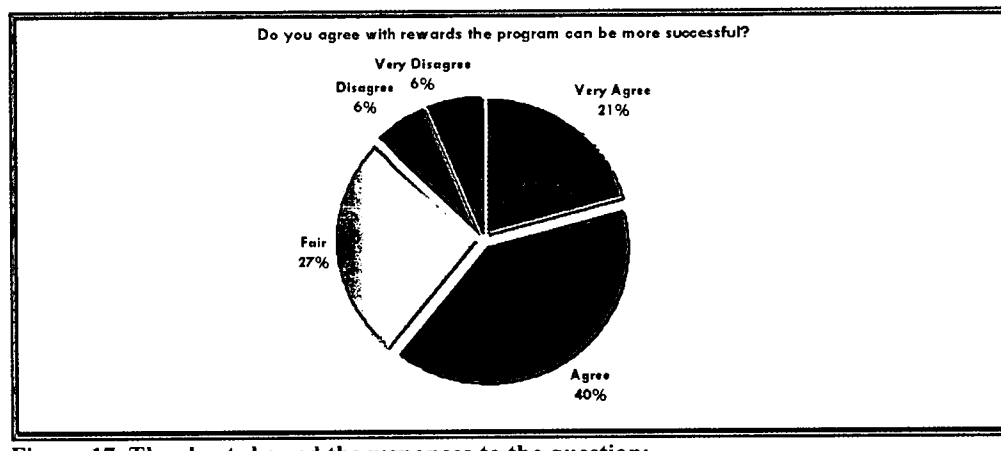

Figure 17. The chart showed the responses to the question:
"Do you agree that with reward given the program can be more successful?"

4.1.3.8 Feedback Column

As shown in figure 18 below, 19% of the responses showed that they were very agree that if there was a "feedback" column besides only prompting questions, it could more accurately feedback to safety department on the observation seen. 64% said they agree and 17% said fair. None said disagree or very disagree. With the feedback column, more unsafe behaviour could be captured and expand the questions pool.

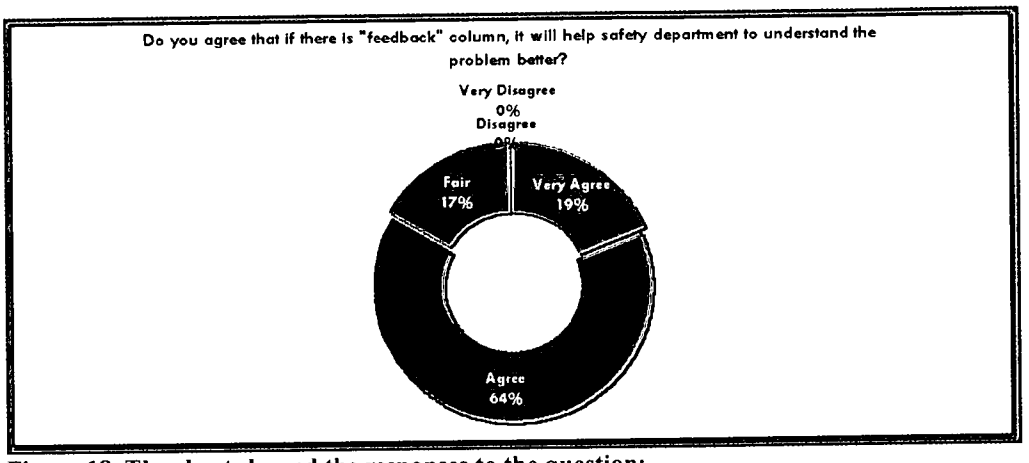

Figure 18. The chart showed the responses to the question:
"Do you agree that if there is "feedback" column, it will help safety department to understand the problem better?"

4.1.3.9 Data Sharing and Interactive Communication

There were two yes-or-no questions posted in the survey shown in Figure 19.

The first question was, whether the employees interested to know the most frequently observed unsafe based on the data collected. From the 48 responses, 45 or 94% said yes and only 3 or 6% said no.

The second question was asking about whether employees supported the idea to set up a forum in the intranet to share the safety issue/concern within the organization. The forum would allow them to use undisclosed identity and could openly share their thought on the safety issue. From the data, it showed that 40 or 85% supported the suggestion and only 7 or 15% disagree on the idea. It would be interesting if we could know why the 15% disagreed. It could be they might be the one who practiced the unsafe behaviour and afraid their name being disclosed in the webpage. Theoretically, it should not be detrimental as long as we did not violate safety regulation.

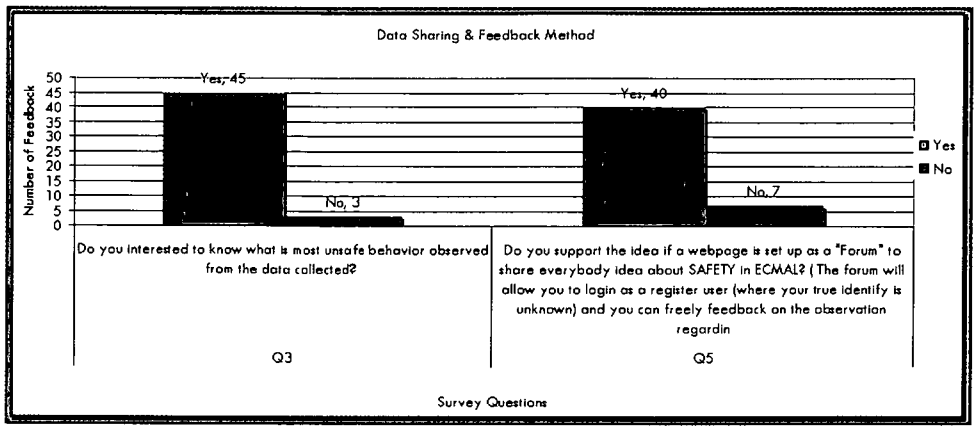

Figure 19. The chart showed the responses to the yes-or-no questions posted in the survey form.

4.1.3.10 Improvement Opportunity

One of the open ended questions asked about the employees' opinion on how the "1-min Observation" program could be further improved. The data collected was analyzed and group according to the category as shown in Figure 20.

19% of the feedback said that the participation could be improved if safety department had given them clearer explanation or briefing on the "1-min Observation" program. About 12% said the program would be more successful if there were more participation or commitment from all the employees. The highest category, which was 31% expressed that improvement could be made by sharing the result of the program and the remedial actions taken by the safety department. From the interview with the safety manager said the survey was launched too quickly (one month after the program launched) before safety can take any action. This was due to the time constraint for this study as it needs to be completed within one semester. The safety manager also said in the interview that they had gathered the data and would discussed on the appropriate action needed to reinforce certain safety rules or safety practices in the BBS steering committee meeting.

Since there were only 16 questions asked in a month period, 12% said that the program could be improved by having more questions prompted to them. This would help to covered more area of observations and thus more data to be collected. 8% of them said the program could be improved if there was a reminder through Microsoft Outlook so that the employee will not forget to open the file and respond to the questions posted everyday. The reminder was in fact being implemented by the safety manager. Everyday, one reminder would be prompted in the Microsoft Outlook at 1:30PM. The reminder might not be prominent enough to arouse attention. Therefore, more timely reminder should be studied to capture respondent attention. The remaining 19% fell under "others". These were mostly individual opinions such as giving reward and providing computer station to access to the "1-min observation".

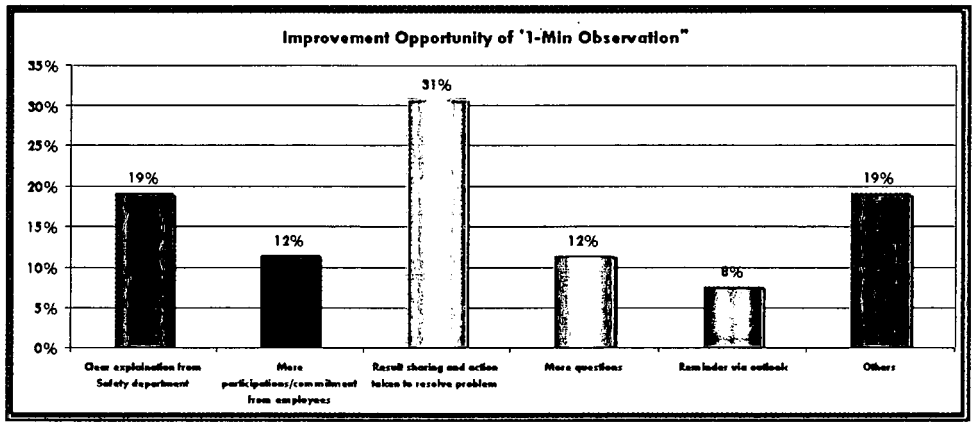

Figure 20. The chart showed the category based on the feedback received on how to improve the "1-min Observation" programme

4.1.3.11 The Weakness of "1-min Observation" Programme

Another open ended question was about the weakness of the "1-min Observation" program. 22% of them said the weakness of this program was that the file always hangs. 26% said that there was no feedback or data sharing from the safety department. Another 15% said there was not enough

participation from all the employees. 4% said the weakness of the program was the communication was not clear. The safety department did not give a thorough explanation on how the program should work and what was the benefit of participating. 19% said that the observation time was too short. Since the questions changed everyday, participants could miss it in one day and were not able to re-do it on the next day. Mix individual opinions make up the remaining 19%. The bar chart was shown in Figure 21.

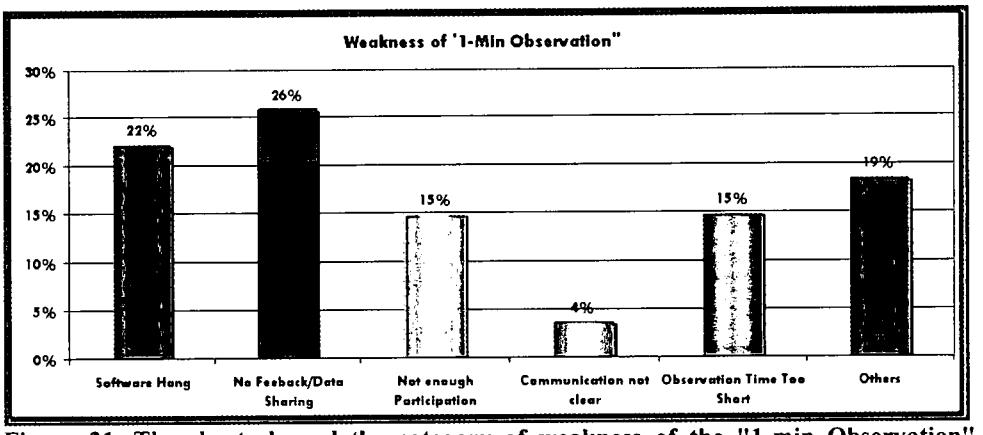

Figure 21. The chart showed the category of weakness of the "1-min Observation" program

4.1.3.12 The Reward Method

The last open ended questions asked about if one agreed to give rewards to those involve in the "1-min Observation" program and how the reward should be given. 39% said it should be given based on individual participation, 19% said it should be based on team participation and 42% said the reward should not be based on participation but based on the quality of feedback given. The data was shown in Figure 22 below.

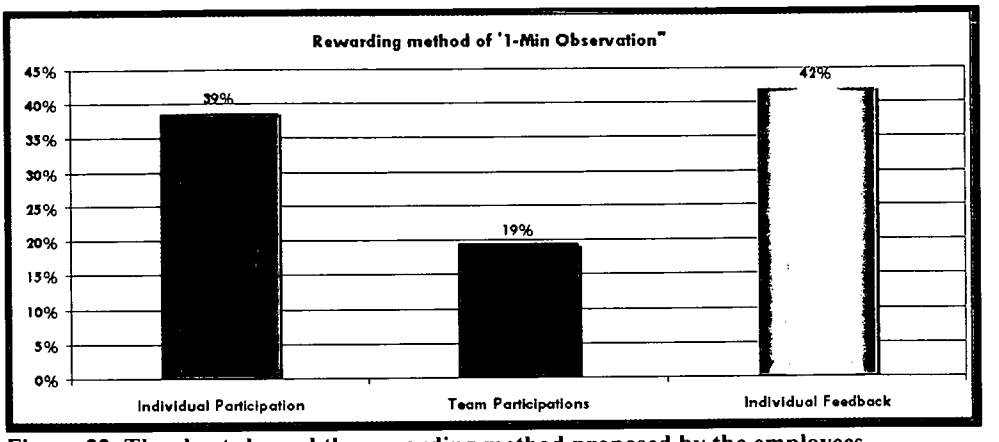

Figure 22. The chart showed the rewarding method proposed by the employees

4.2 Discussion

4.2.1 The e-BAI Theory and Case Study

The case study in Eastman Chemical showed the positive responses from the employees. The high participation rate of 86% showed that e-BAI was more beneficial as compared to the previous BBS which records a low participation rate.

Using the e-BAI, it was rather easy to identify area to focus as shown in Figure 7 and 8 above. It did not involve too many additional resources in order to gather the useful data.

Most of the responses in the survey revealed that the employees in the case study supported the program and welcomed the concept. Most of them would like to see the program being continued. If the program was handled and implemented carefully with more time and coordination, it would be a successful and rewarding program. Some challenges in implementation and limitations were shared below.

As the first trial, the program was considered quite successful. If given longer time, with the implementation improved, the e-BAI would definitely benefit the organization.

4.2.2 The Challenge to Implement the e-BAI in an Organization

4.2.2.1 Ensure Clear Communication

As e-BAI was a new concept, it was very important to be able to communicate clearly to the employees on the implementation. During the case study, feedback such as unclear communication and explanation from safety department were received from minority. As mentioned in the literature review, the success of either BBS or e-BAI depends heavily on how great is the commitment of the safety department to this program and the clarity in the implementation and monitoring of the program.

4.2.2.2 Ensure Management Commitment

On top of that, the commitment from management was also playing an important role. Involvement was encouraged when management keep stressing on participations. From the participation from department, it can be seen that some departments were much more active than another. The departments which participated more were mostly due to the commitment of the supervisor or the head of department.

4.2.2.3 Ensure Follow Up Action

The e-BAI could be exciting if it was handled appropriately. Employees who participated in the program would be eager to report their observation and wanted to see the changes. Thus, if the safety department was not able to produce concrete results to shows the changes, employees would start to feel disappointed to the management as there was no follow up action and the program would eventually cease. This was similar to the BBS program which nobody did anything on the data collected in the database. There was no motivation that could continue to thrill the employee to participate.

4.2.2.4 Honest Participation

The data collected would be very useful if everybody participate and answer honestly. However, there was potential that people was just trying to make fun of the committee by simply answering the question without doing the observations. This could not be prevented in the e-BAI. However, it would not affect the overall analysis as long as the majority answers honestly.

4.2.3 The Limitation of the e-BAI

As the case study was rather short, it was not able to measure if there was an improvement in the safety behaviour.

Also, the e-BAI was an IT based program. It was thus vital that the database worked appropriately. During the case study, the database was created using Microsoft Excel and was not stable with too many VBA programming. The file could be corrupted very easily. Additionally, the file was shared between 79 employees in Eastman Chemical and only one was allowed to access at a time. It had wasted lot of time when the participants need to wait. Some of them gave up when they could not open the file on a particular day.

CHAPTER 5

CONCLUSION

5.1 Conclusion

As a conclusion, the concept of e-BAI was viable. It served as another alternative to the current BBS program which required lesser resources and time. The case study of implementing e-BAI in Eastman Chemical (M) Sdn Bhd, which was named as "1-min Observation" had received many positive support and feedback.

The e-BAI was easy to implement, collect data and correct unsafe behaviour. The program was workable.

There were some constraints to fully implement the "1-min Observation" such as a well designed database, effectiveness of the safety department communicating to the employees, efficiency of the follow up action on the data analyzed, would all adds up to the successfulness of the case study.

Overall, the e-BAI concept was feasible and practical. It can be further fine tuned and used in any organization. Some recommendations were given below. The program could be more effective if the recommendations were considered and adopted.

5.2 Recommendations

5.2.1 Appropriate Planning for the e-BAI Program

Most of the employees would like to be informed about the analysis after their participation. They wanted to know more about the findings and what were the unsafe behaviours that were observed most frequently. Therefore, a more proper planning from safety department was required. The safety department should take expedite action once the employees had completed the feedback (between different implementation stage). The analysis must be shared to everybody in time before people start to forget what the questions were which they had responded.

Also, appropriate action must be taken to show to the employees that their feedback were valuable. No one would like to waste their time if they knew nothing was going to happen with their feedback. It was very important to note that the continuity of the program depends on if the employees were excited with the program.

The proper flow chart should be like showed below (Figure 23).

Figure 23. The flow chart of how the e-BAI program should be implemented

5.2.2 Improvement on Database and Feedback Column

As mentioned earlier, one of the weaknesses during the case study was the poor database used which was easily corrupted and hangs.

To overcome this problem, a more stable program should be used. The most user friendly program would be internet explorer. The database could be created in the intranet as a webpage and easily access by everyone without limitation of exclusive access.

This would require some professional IT personnel to be involved to establish the database prior to the implementation. For this study purposes, Microsoft excel had to be used as the timeline given to complete the database was pretty short (within 2 weeks).

Additionally, as shown in the survey analysis, it would be value enhancing if there were some feedback column on top of the questions posted so that the respondents could more accurately describe the problems and feedback to the safety department.

Also, majority of the employees had shown the interest of setting up a "forum" webpage in the intranet for them to highlight to the safety department or management about any safety issue in the organization. One of the limitations of BBS was that many people refrain from direct feedback to peers to correct their behaviour. The forum served as the channel for them to highlight to their peers that they were posing hazard to themselves and others by conducting unsafe act. There were many advantages of setting up the forum as everyone would be treated fairly. Everyone could feedback freely. For example, if an employee saw a manager was using hand phone in the plant area, most probably, she would keep quiet as they dare not correct the manager directly. However, they could feedback in the "forum" and highlight the issue. With that, safety department could be alerted with many safety issues in the organization without actually conducting audit or spot check.

5.2.3 The Program Sustainability

It was important to ensure that the program was sustainable. One of the recommendations was to provide rewards to the employees for their feedback given to the program. Based on the survey, majority of the employees agreed that reward was given in order to make the program more successful. Rewards helped to encourage participations and continuous feedback. In longer term, the safety

program will still sustain and the unsafe behaviour of the employees can be improved.

Geller, E. Scott (2006a). *From Good to Great in Safety*. Professional Safety, June 2006.

Geller, E. Scott (2006b). *The Human Dynamics of Injury Prevention*, Occupational Hazards, 7th Dec 2006.

Gilmore, Michael R., Perdue, Sherry R., Wu, Peter (2002). *Behaviour Based Safety: The Next Step in Injury Prevention.* SPE International on Conference on Health, Safety & Environment in Oil and Gas Exploration and Production, Kuala Lumpur, MAL, 20-22 Mar 2002.

Goodrum, Paul M. & Gangwar, Manish (2004). *Safety Incentive- a study of their effectiveness in construction*, Professional Safety, 2004

Hayes, Steven C. (2000). *The Greatest Dangers Facing Behaviour Analysis Today.* The Behaviour Analyst Today, Volume 2, Issue Number 2. Cambridge Center for Behavioural Studies.

Kamp, John. (2001). *It's time to drag behaviour safety to into the Cognitive Era.* Professional Safety, Oct 2001, pp 30.

Krause, Thomas R. (2000). *Behaviour-based Safety Pitfalls and Pointers*. Article of ISHN, May 23, 2000.

Matthews Grainne A (2006). *The ABC's: Critical Factors for Success*, Behavioural Safety Now Conference, 2006.

Matthews Grainne A, McSween, Terry E (1998), *Taking stock of behavioural safety – Here's how you can measure your Process*, Industrial Safety and Hygiene News, June 1998.

McSween, Terry E. (2004). *Keys to a Successful Behavioural Safety Process*, ASSE Region III Professional Development Conference and Exposition, San Antonio, TX, 4th Aug 2004.

Minshall, Steve (1997). *An Opportunity to get ahead of the Accident Curve*, Mine Safety and Health News, Vol 4, No. 9, 2nd May 1997.

Minter, Steven G (2004). *Love the Process, Hate the Name*, Occupational Hazards, 3rd June 2004.

Occupational Hazards Editorial Staff (2001), Kroger's Six Key Elements: Recipe for Safety Success, Occupational Hazards, 5th Mar 2001.

OSHA Business and Legal Report. *Compliance Report: Today's Behaviour-based Safety*, Issue 555, 7th Jan 2007.

Perdue, Sherry R. (2000). *Beyond Observation and Feedback: Integrating Behavioural Safety Principles into Other Safety Management Systems.* Proceedings of the 39th ASSE Annual Professional Development Conference and Exposition, Des Plaines, IL: ASSE, 2000.

Quality Safety Edge (2007), website: www.qualitysafetyedge.com.

Roberts, D. Steve (2000). *Employees Forgot their Hard Hats Again? Seven Lessons from Behaviour Based Safety for Increasing PPE Use*, Retrieved from Safety and Health, October 2000.

SCF Arizona Loss Control (2004). *Behavioural Safety: the Right Choice- Listen to Your Conscience and Eliminate Dangerous Behaviours*, SCF Arizona, 2nd July 2004, http://www.scfaz.com/publish/printer_549.shtml

Schatz, John R. (2003). *Behaviour-based Safety: An Introductory Look at Behaviour-based Safety*, Air Mobility Command's Magazine, Jan/Feb 2003.

Sherry Patrick (1992). *Peer Involvement and Behavioural Safety: A Case Study*, University of Denver, 1992.

Skinner, B. F. (1938). *The Behaviour of Organisms: An Experimental Analysis.* Acton, Mass.: Copley Publishing Group.

Smith, Thomas A. (1999). *What's Wrong with Behaviour-Based Safety?* Professional Safety, September 1999, 37-40.

Spigener, Fisher (2007). *The Behaviour-based Solution to Safety Improvement*, EC&M Magazine, February 2007, http://ecmweb.com.

The Hartford Loss Control Department (1999). *About Behaviour-Based Safety Management*, Technical Information Paper Series, 1999.

Wagner, Kendra V. (2007). *What is Cognitive Psychology?* Sources from http://psychology.about.com.

APPENDICES

Appendix I - The Questions in "1-min Observation"

1. Did you see people NOT using handrail when travelling up and down stairs?
2. Did you see employee driving faster than 20km/h in the plant area?
3. Did you experience back pain after work?
4. Did you see any reckless forklift driver?
5. Did you see people wearing glasses instead of safety glasses in the plant?
6. Did you see people lifting thing in improper position?
7. Did you see people NOT wearing ear plug in noisy area?
8. Did you see anyone working at height with falling hazard due to improper PPE/position?
9. Did you see people working (in the plant/lab/packaging) NOT wearing safety glass?
10. Did you see any leak in the plant but NOT barricaded?
11. Did you see any area (office or plant) unclean and expose to tripping hazard?
12. Did you see people using hand phone at restricted area?
13. Did you see people NOT looking in the direction that they are walking (eyes NOT on path)?
14. Did you see people NOT following 100% of the procedure when doing work?
15. Did you see people working without hand glove in the plant area?
16. Did you see people walking/working inside the maintenance workshop yellow line area without minimum PPE required?

Appendix II - Microsoft Excel files for the "1-min Observation"

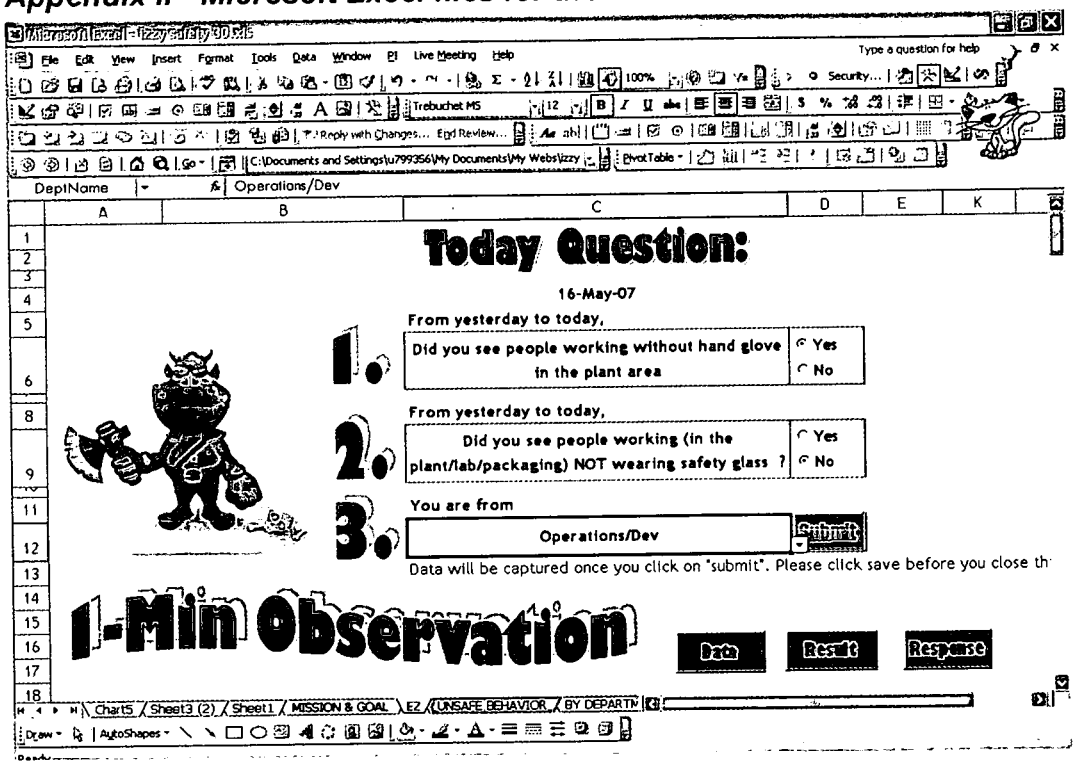

Figure AII-1. The main page of the "1-min Observation" file

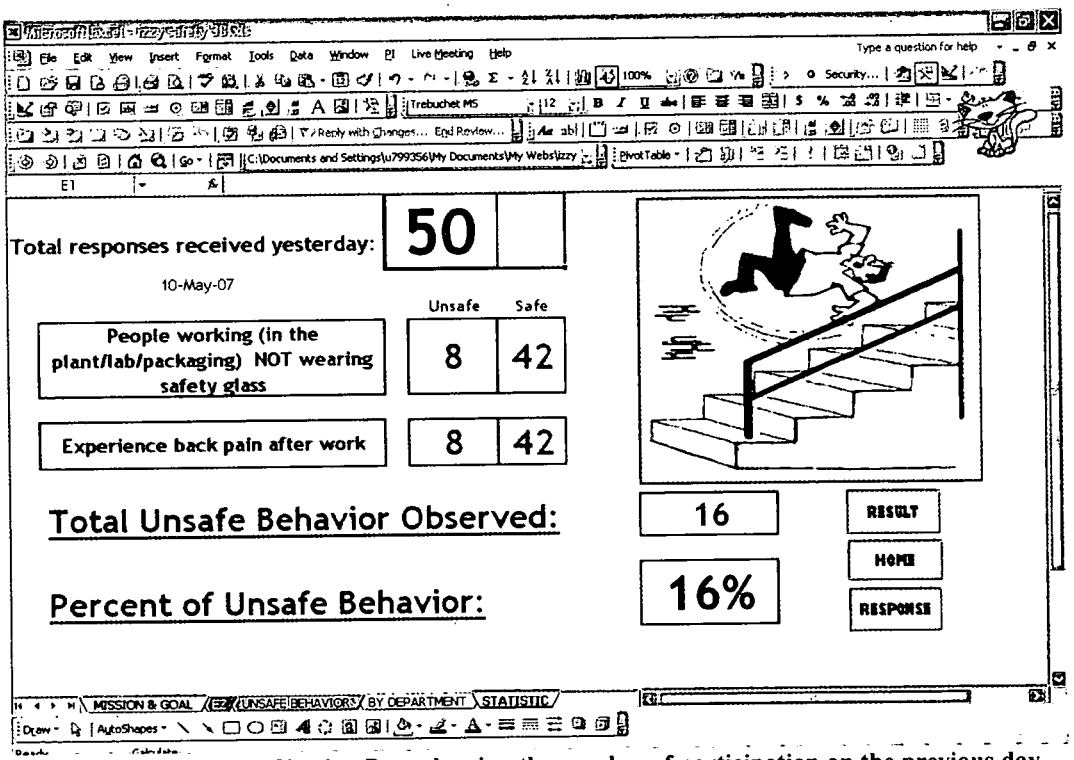

Figure AII-2. The Data Sharing Page showing the number of participation on the previous day.

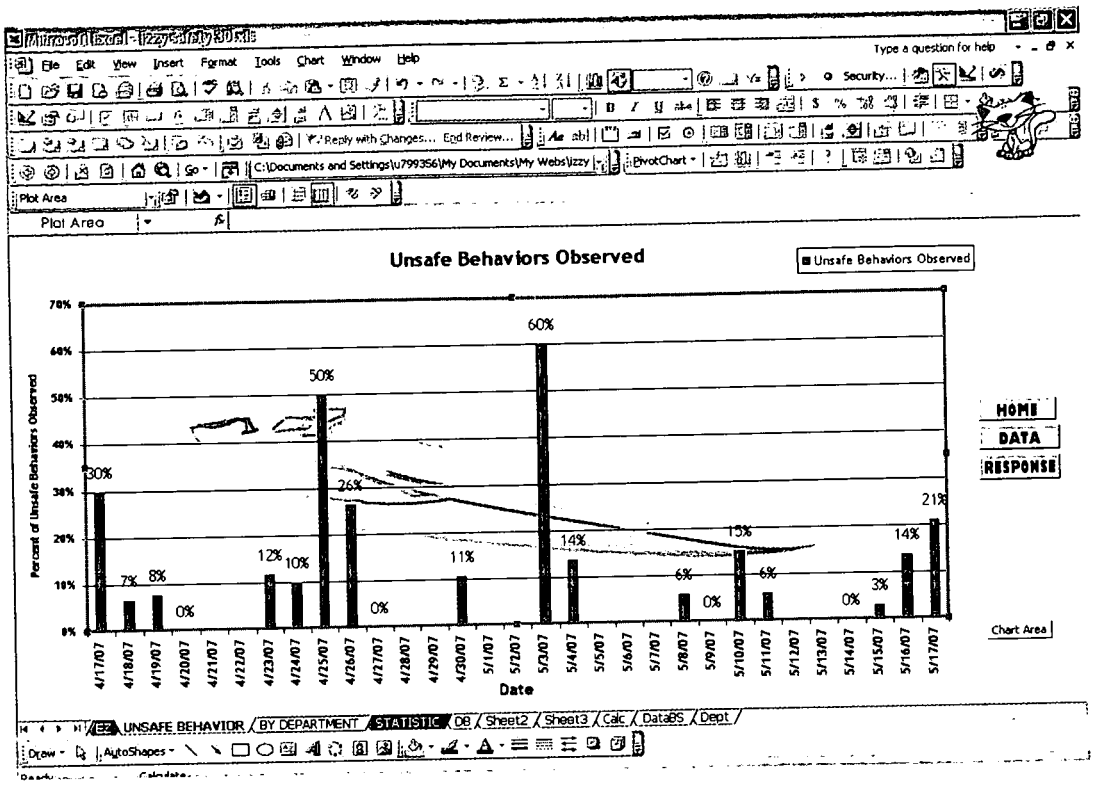

Figure AII-3. The page in the database showing the safe and unsafe act observed everyday.

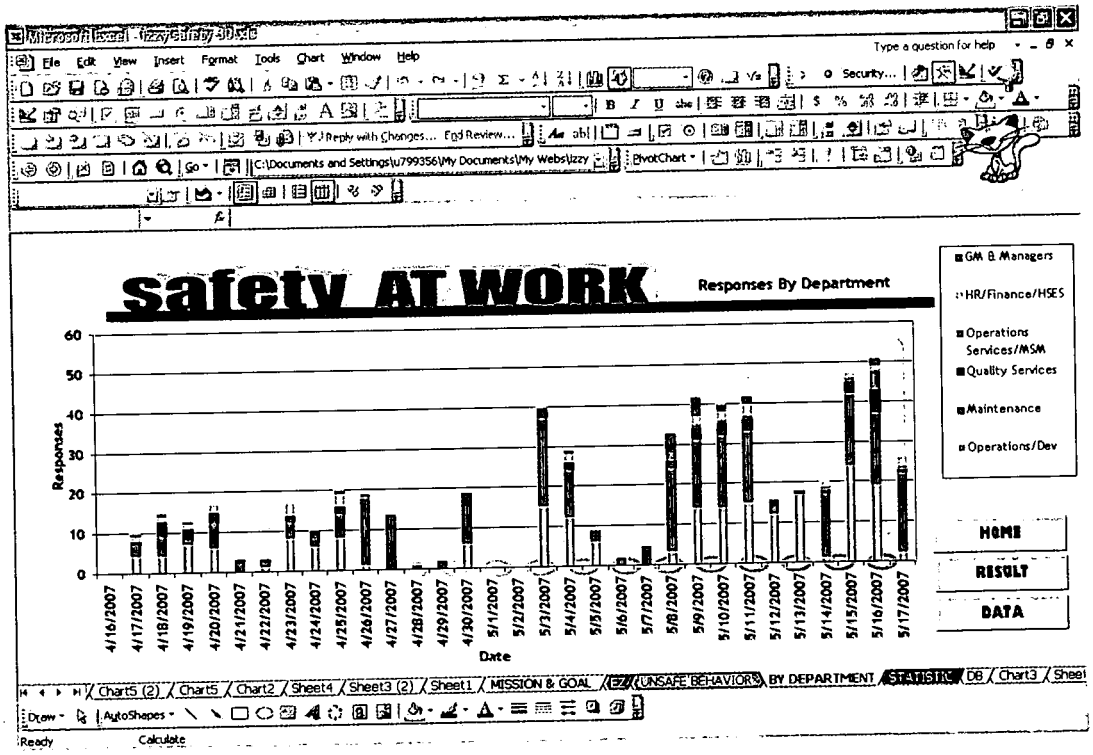

Figure AII-4. The page in database showed the participation everyday by department.

Appendix III – The Home Page of Eastman Chemical (M) Sdn Bhd

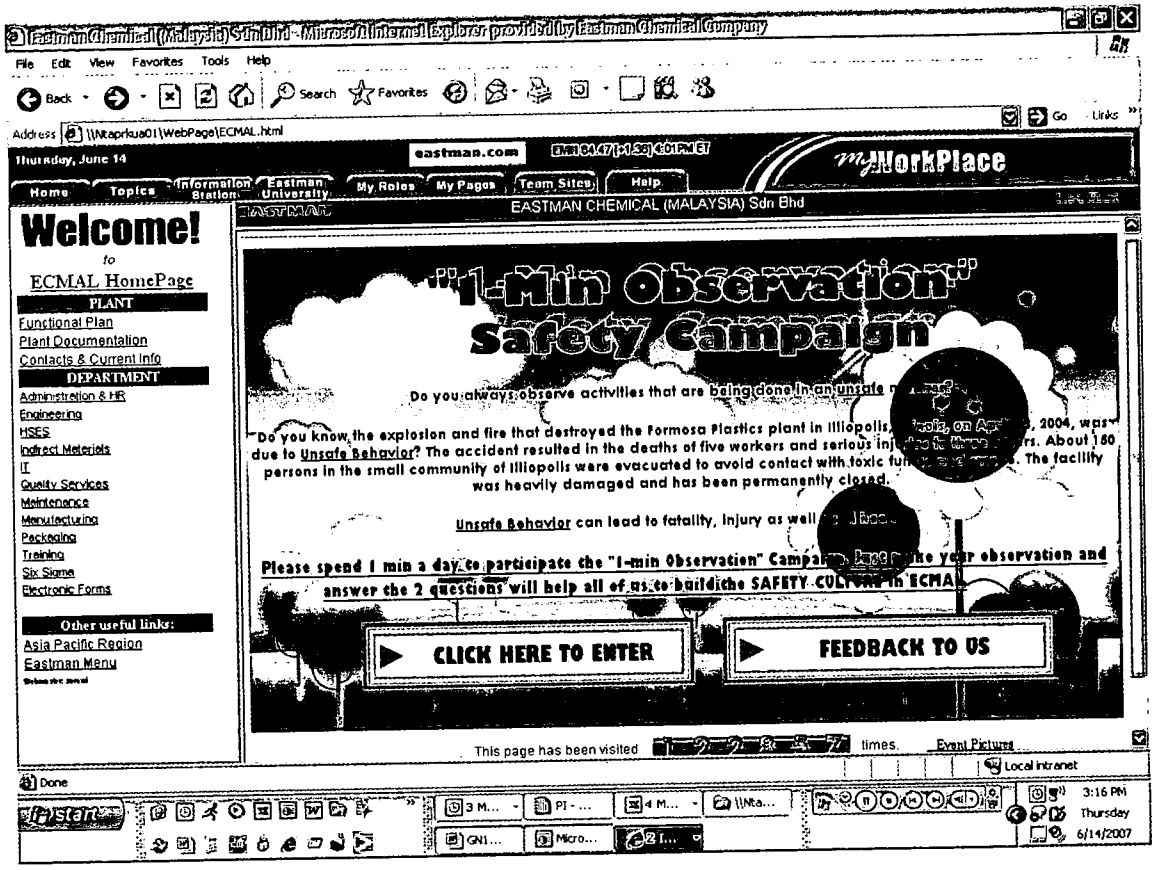

Figure AIII-1. The hyperlink to the database was displayed in the first page of the Eastman Chemical webpage.

Appendix IV - Quick Survey on 1-min Observation Program

	1- Every work day	**2- 3 to 4 times a week**	**3- 1 to 2 times a week**	**4- Less than 1 a week**	**5- Never**
1.) How frequent do you participate in "1-min observation"?	1	2	3	4	5
	1- very good	**2-good**	**3- fair**	**4- poor**	**5- very poor**
2.) How do you rate the "1-min-observation" safety program?	1	2	3	4	5
	1- very agree	**2- agree**	**3- fair**	**4- disagree**	**5- very disagree**
3.) Do you agree that you have improved your safety awareness after participating in this program?					
4.) Do you agree that with your feedback to this program, the safety culture can be improved?					
5.) Do you agree that during this program, you feel people is observing you so that you dare not do wrong thing in term of safety?					
6.) Do you agree this program has helped to reduce the unsafe behaviour by employees?					
7.) Do you agree safety department has given the clear explanations to you regarding this program?					
8.) Do you agree using IT (computer system) can help to cultivate safety behaviour, i.e. like "1-min-observation"?					
9.) Do you agree that you have seen improvement on people behaviour after this program?					
10.) Do you agree that this type of program should be continued so that everyone is always reminded on "good safety behaviour"?					
11.) Do you agree rewards should be given to those who have committed to participate in this program?					
12.) Do you agree with rewards the program can be more successful?					

13.) Do you agree that if there is "feedback" column, it will help safety department to understand the problem better?					

B.

1.) How do you think this program can be further improved?

_____

_____

_____

2.) If you agree to give rewards to make this program more successful, how do you think rewards program should be? I.e. based on individual participation? Based on team participation? Based on feedback?

_____

_____

_____

3.) What is the weakness of this program?

_____

_____

_____

4.) Are you interested to know what is most unsafe behaviour observed from the data collected?

Yes / No

5.) Do you want Safety Dept to share with you the final result analyzed on the unsafe behaviour observed?

Yes / No

6.) Do you support the idea if a webpage is set up as a "Forum" to share everybody idea about SAFETY in Eastman Chemical? (The forum will allow you to login as a register user (where your true identify is unknown) and you can freely feedback on the observation regarding safety. I.e. in the forum, you can say, "I saw Avanze CBQ8146 is speeding in the plant." Or "I saw X use hand phone in control room".

Yes / No

Thank you very much for your participation and valuable input. All the feedback will be studied with care and we look forward to serve you better!

- Safety Department

Appendix V - Paper version of "1-min Observation" questions.

17-May-07

From yesterday to today,
Did you see people walking/working inside the maintenance workshop yellow line area without minimum PPE required? Q1

From yesterday to today,
Did you see any leak in the plant but NOT barricaded ? Q2

User ID (optional)	Q1	Q2
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
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	Yes/No	Yes/No
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	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No
	Yes/No	Yes/No