IMPLEMENTING SAFETY BEHAVIOURAL MANAGEMENT PROGRAMMES TO MAXIMISE THEIR POTENTIAL IN THE DEVELOPMENT OF A PROACTIVE SAFETY CULTURE

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Introduction

A relatively new phenomenon in the field of safety, behavioural safety initiatives are fast becoming the way forward in many industrial sectors because of the way they significantly improve personnel's safety behaviour, and the corresponding downward pressure they exert on accident rates. Applied properly, they are known to encourage and deliver real workgroup empowerment as the workforce help to take control of their own safety, with the management team providing ongoing support. A number of alternative behavioural safety initiative's are currently available which tend to be applied in different ways. The way that such an initiative is developed and implemented will impact on its effectiveness in reducing accidents and improving safety management systems. This paper outlines a case study using an approach originally developed in the UK construction and manufacturing industries that has consistently led to significant improvements in safety behaviour, reductions in accident rates and improved attitudes towards safety, in a matter of weeks rather than years. Typical results of this approach to behavioural safety include

- Rapid and consistent improvements in safety behaviour
- Rapid improvements in unsafe conditions
- A rapid downward pressure on accident rates and their associated costs
- Improved communications, involvement and co-operation between the workforce and management,
- Ongoing improvements to safety management systems;
- Improvements in attitudes towards, and perceptions about the importance of safety;
- Ownership of safety by the workforce;
- Enhanced acceptance of the responsibility for safety at all levels;
- Better understandings of the relationship between safety behaviour and accidents

In financial terms, cost-benefit analyses have demonstrated significant cost-savings, well in excess of the costs involved in setting up and maintaining a behavioural safety initiative. A study conducted in a West country Cellophane manufacturing plant, for example, saved the client an estimated £220K -£440K in Lost Time Accident (LTA) costs within the first 16 weeks, excluding the costs of minor accidents. Subsequently, this company applied the same techniques to quality, materials wastage and energy savings which resulted in further cost savings. According to the company concerned a further 30-40 percent increase in production capacity would be required to achieve this level of profit. Thus, behavioural safety initiatives can exert a significant influence on bottom-line profits, in accordance with loss-control models. Work conducted in the construction, chemicals and food industries provides further support for these findings.

The remainder of this paper presents a case study that focuses on the implementation steps that are required to implement a behavioural safety initiative. The initiative was named B-Safe (Short for Behavioural Safety), which has subsequently become the trade name for the award winning B-Safe Programme® developed by the principle author.

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Setting

This case study was undertaken in a Courtaulds Chemicals process plant in the Midlands, over the course of two years, beginning in May 1995. Because of the quality of the company's safety management systems, and the fact that they had worked over a million hours without a Lost Time Accident (LTA), the company had been presented with many safety awards by RoSPA, IOSH, British Safety Council, in addition to safety awards from the company's suppliers and customers. Thus, the company already had an excellent safety record, prior to implementing the B-Safe® .

Structuring the initiative

The initiative involved 46 people in six departments. The departments concerned were:-

- Process Control Room (4 X shifts)
- Light Oils
- Day crew / Drumpark
- Engineering
- Plant Offices
- Laboratory

These departments were spread across a large site, with Light Oils being about a mile away from the Process Control Room in an isolated area of the plant. The workgroups in the Process Control Room, Light Oils and the Laboratory comprised just three people each. Five people worked in the Drumpark, while seven people worked in the Engineering department. The remaining 16 were plant managers and clerical workers in the Plant offices. Thus, everybody in the organisation was involved in the initiative from the senior management team to process operatives. Indeed, it is always a good idea to involve everybody to minimise resistance. This resistance often shows itself when the selected few complain that they are being picked on, while those who are excluded tend to feel that they are missing out.

Procedure

The project began in May 1995, when a project team was set-up to implement B-Safe®. Due to severe time pressures experienced by the plant's managers, the plants safety advisor was designated as the B-Safe Champion, and an experienced laboratory technician was given the task of co-ordinating the project. The principle author acted as facilitator and guide to the project team. Because the safety advisor was not a part of the normal line-management function, the downside became apparent during the initial stages when the process operatives associated the initiative with the safety department, rather than as an initiative to be owned and directed by the workgroups themselves. Thus, it is a good idea to ensure that the project champion is a member of the senior management team, rather than the safety advisor, as it ensures that the initiative is seen as being firmly embedded within the production management function, not the safety department.

Personnel Briefings

During the first week, a letter introducing the project and a summary of a safety climate survey was sent to all personnel by the business director. This was followed-up with a letter from the B-Safe Champion that outlined the philosophy of B-Safe ® and the timetabling of subsequent events. In parallel, half-hour briefings were held with every workgroup to ensure that

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all personnel were explicitly aware of the project, the steps that would be taken, and what this meant for the workforce in terms of involvement. These briefings also provided an opportunity for personnel to discuss the project and ask any questions. During the briefings to line management, management were asked to demonstrate their commitment to the successful implementation of the project by fulfilling the following requests:-

1. Allow goal-setting sessions to be conducted with all members of their department / workgroup.
2. Allow personnel to conduct 10-15 minute observations every working day.
3. Line management to attend the B-Safe target setting sessions to provide visible support to the observers / session facilitators.
4. Management to praise workers when they see them working safely.
5. Line management to conduct weekly team briefings to discuss the previous weeks observation results and remind operatives to try and behave safely so as to reach the workgroups safety target.
6. Senior management to make a point of going around each department on a weekly basis to discuss and make comments to the workforce / line management on their progress to date.

Identifying Safe & Unsafe Behaviours

During the second week, the project team began examining the plants previous two years accident reports to identify the common behavioural causes of these accidents. Recent Near-miss reports and Risk Assessments were also examined. These efforts provided 'provisional' safety performance inventories for each departmental area, which were used as a basis for confidential semi-structured interviews with 12 members of the workforce to verify their practicality and utility. Each interview took approximately 30-45 minutes. Importantly, many other safety problems associated with production equipment were identified by the interviewee's that resulted in a list of possible remedial actions to enhance safety *per se*.

Recruiting observers

Approximately one month after initial implementation, volunteers were sought from all departments to act as safety observers for the first six months (phase 1) of B-Safe®. This was achieved via a letter issued by the project team that detailed an observer's duties, and by talking with personnel 'face to face'. In total, Nine observers were recruited with a mix of both supervisory and shop-floor level employees, representing one observer per shift, and one observer for each of the remaining locations.

Training observers

Eight weeks later, the nine volunteer safety observers took part in a series of two-day training courses, which consisted of the following elements. Day one was devoted to an introduction of the basic theory and practice of B-Safe® emphasising:

- the rewarding of desirable behaviours, rather than the punishment of undesirable behaviour
- the use of praise and feedback as positive reinforcement
- observational techniques and scoring the inventories, including practice observations in the various departments.

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The observers were also strongly encouraged to comment on their experiences. This resulted in further refinement and modifications to the safety performance inventories. Day two was devoted to the running of goal-setting sessions, and the importance of involvement and commitment. This included:

- exercises in team decision-making
- how to manage resistance from others
- how to provide individual feedback.

(Following comments from trainees, subsequent observer training sessions were condensed into a one day course).

Practice observations were again undertaken in the departments, leading to further refinements to the safety performance inventories. Observers continued to practice for a further two weeks, within their own departments, to ensure that were conversant with, and felt comfortable about their task. Moreover, observers were actively encouraged to further refine the inventories during this period.

Obtaining base-line data and displaying the safety performance inventories

Following the two-week practice period, a copy of the inventory for each department was enlarged and publicly displayed in the appropriate department to make it explicit which safety behaviours were being monitored. Four weeks of observation data were subsequently collected in each department to provide a 'baseline' from which any improvements could be compared. Observers completed the inventories at least once, at random times, during the period of their shift. The observations took on average, approximately 10 minutes to complete. Completed inventories were passed to the project team for the computation of results. This data was displayed on specially prepared 3' X 4' public feedback charts, in graphical form. This format presented the number of safe behaviours as a percentage of the total observed behaviours.

Introducing the intervention

The project went 'live' during the first week of September when the various work groups were asked to set their own safety improvement targets, at half hour meetings conducted specifically for the purpose. Personnel from all departments and shifts attended the meetings, at which the purpose and the philosophy of B-Safe ® was again explained. Particular emphasis was placed on the fact that no individual employee could be identified as a result of the observations, and that no disciplinary action would be taken against individuals who did not follow the procedures advocated on the inventories.

The resulting average baseline safety scores were then presented to each group. In addition, those behavioural items that had impacted adversely on the group's safety performance were highlighted. Subsequently, each group were asked to agree upon a safety target that was 'difficult, but achievable'. Within each department, the agreed safety performance goals for each group were marked by a 'target level' tape on the feedback chart. In total, nine goal-setting meetings were held, over a period of eight days; 90 percent were conducted by the project team rather than observers, as intended. The baseline averages and the goals set by each department are recorded in Table 1 below.

Because the baseline averages found in three of the departments (Light Oils, Day crew & Engineers) tended to be very high, many of the goals that were set, tended to be lower than the

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baseline averages. Nonetheless, each of these groups stated that they would try to maintain their current safety levels, rather than actually reducing their levels of safety performance.

Table 1: Safety Behaviour Baseline Averages and Target Levels, by Department

Department	Baseline Average	Goal Level	Difference
Process Control shifts	70.6%	78%	7.4%
Day crew	100%	98.5%	-1.5%
Engineers	98.5%	95%	-3.5%
Plant Offices	42.5%	92%	49.5%
Laboratory	24.2%	60%	35.8%
Light Oils	98%	85%	-13%

Starting the intervention

Following the goal-setting meetings the feedback charts were posted in the appropriate departments. Observations continued at the same rate as that during the baseline period. The results of weekly observations (Monday 6 a.m. - Monday 6 a.m.) were computed by the project co-ordinator and posted on the departmental feedback charts every Monday. In addition, detailed information was provided to highlight the best and worst scoring safety behaviours. These were posted next to the public feedback charts, as well as the text given to observers / team leaders. This information was provided with the specific intention of stimulating discussions at the weekly team briefings. During the remainder of the intervention phase progress was monitored and assistance given to observers when necessary.

Planning during the maintenance phase

Eight weeks after the goal-setting sessions, the project team began to develop the new safety performance inventories, and undertake observer recruitment and training in preparation for Phase 2. New departmental safety performance inventories were generated based upon items the first group of observers felt should be included, and the results from the first few weeks observations. A further Nine employees (both supervisory levels and shop-floor employees) undertook a one day observer training course, conducted solely by the company's personnel. Subsequently, after two weeks of practice observations in their own departments, this second generation of B-Safe observers established baseline averages over four weeks, which were used as the basis for phase 2 goal-setting. In addition, phase 2 was also expanded to include each individual shift in the control room rather than treating them all as one group, as had been done in phase 1. The whole process was repeated again some three to four months later to develop and implement Phase 3. The idea of changing phases is threefold: First, it helps to ensure that everybody in the organisation becomes an observer at some stage; Second, because new safety performance inventories are developed for each phase, it helps to keep the initiative fresh; and Third, it helps to maintain a 'continuous improvement' momentum.

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RESULTS

This section is presented in three parts:

1. An examination of the phase 1 safety performance.
2. An examination of phase 2 safety performance.
3. An examination of phase 3 safety performance.

Safe Behaviour Performance Levels

Each week, the results of the observer record sheets (records of observed safe and unsafe behaviours, recorded daily, for each work-shift) were used to produce a weekly safe performance level. This was expressed as a percentage (i.e. the number of safe behaviours observed, as a percentage of the total number of unsafe and safe behaviours recorded), for each department. The information was posted on feedback charts located in the engineering workshop, plant office, the control room, the laboratory and the day crew's office.

Figure 1: Presents the average safety performance results for the company as a whole and shows that within eight weeks of the start of the initiative, the plant had reached their average goal of 84% from a baseline of almost 71%. They continued to maintain and improve this level of performance right up to the end of phase 1, ending at an average site level of almost 92%, an overall improvement of some 21%. These are very positive results that reflect well upon all those involved.

Figure 1: Site average safety performance results (phase 1)

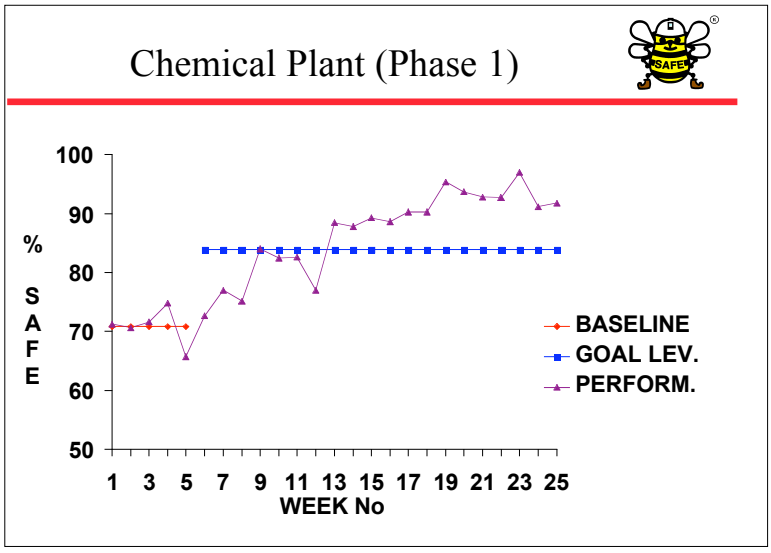

Table 1.1. provides a record of this data, divided into 5 periods of four weeks each, by department and globally. Period 6 consists of two weeks data only, as phase 1 ended during this period. The greatest improvements in safety performance were obtained by the plant offices and the laboratory. Compared to their baselines, by the end of phase 1, these two groups had achieved overall improvements of approximately 50% & 53% respectively. Importantly, these two departments were the only departments to hold regular weekly B-Safe briefings, which almost certainly helped people to focus on the poorer areas of their safety performance.

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Table 1.1.: Goal levels & mean average safety performance results for each period (Phase 1)

Location	Goal %	Baseline	Period 1	Period 2	Period 3	Period 4	Period 5
ProcessControl Room	78	69.67	73.00	75.75	80.25	83.33	82.00
Daycrew	98.5	100	99.5	96.0	100	100	100
Engineers	90	90.00	91.75	82.75	96.25	100	96.00
Plant Offices	92	43.56	68.00	88.00	92.00	94.43	93.73
Laboratory	60	24.34	34.5	55.50	66.50	77.5	77.30
Light Oils	85	97.18	96.5	98.00	99.25	100	100
Grand Total	84.75	70.79	77.21	82.67	89.10	92.54	91.51

Despite the lack of B-Safe briefings, the shift teams achieved a 12% improvement by the end of phase 1. The Daycrew and Light Oils were not expected to improve, just maintain their baseline levels of performance. The results for these latter groups showed a slight drop compared to their baseline levels at the early stages, but recovered to their former levels by the end of the phase. Some problems were experienced with the engineering observer, resulting in a false baseline score of 98.5%, which is why the baseline figure and goal are the same. This was rectified with extra observer training and double monitoring. This produced a genuine 6% improvement by the end of the phase.

Table 1.2 shows the number of weeks that the departmental / shift goals were reached or exceeded (i.e. on target), in actual terms and as a percentage of the time they were on target. By comparing the goal level set and the progress made towards that goal, it becomes evident that those departments/shifts which set relatively easy targets achieved and maintained their levels of performance more often than those who set themselves more difficult targets. However, those with very difficult goals managed to achieve and maintain them for 50% of the time.

Table 1.2.: Actual number of weeks & Percentage of time on target (Phase 1)

Department	**B/Line Level**	**Goal Level**	**Difference**	**Actual No of weeks on target**	**Percentage of time on target**
Process Control Room	69.6	78%	7.4%	11	55%
Day crew	100%	98.5%	-1.5%	15	75%
Engineers	90%	90%	0%	15	75%
Plant Offices	43.6%	92%	48.4%	10	50%
Laboratory	24.3	60%	35.7%	10	50%
Light Oils	98%	85	-13%	20	100%

To ensure the safety performance improvements were genuine, the safety performance percentage scores for each department/shift were subjected to an independent groups One-way Analysis of Variance (ANOVA). The baseline and the twenty week intervention period (divided into 5 X 4 weeks) were treated as levels of the factor. However, because this analyses requires large mean differences between the time periods for significant differences to emerge, the results are considered to be conservative. Notwithstanding this caveat, significant F values were obtained for three of the six departments. Table 1.3 shows the F values and their associated significance levels for each department.

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Table 1.3.: One way ANOVA results (Phase 1)

Department	df	F	p<
Process Control Room	5,19	7.88	.001
Day Crew	5,19	2.71	n.s
Engineers	5,19	0.76	n.s
Plant Office	5,19	22.55	.0001
Lab	5,19	84.42	.0001
Light Oils	5,19	0.92	n.s
Grand Sum	5,19	33.31	.0001

Phase 2

At the end of October 1995, the B-Safe co-ordinator began to prepare for phase 2. The completed data from phase 1 were examined for items that had consistently been addressed and always scored safely, as well as items that were always scored as 'not seen'. Based upon this analysis, new embryonic safety performance inventories were developed. These were developed further by referring to comments previous observers had made, and talking with plant personnel. In addition, plant personnel were asked to identify other potential behavioural items, discuss them with their workgroups at the weekly B-Safe briefings, and pass them to the co-ordinator. By the end of November the co-ordinator was in a position to ask for volunteer observers. It had also been decided to include the Process Control Room shift supervisors as observers, as a way of demonstrating visible management commitment. Other changes included, separating out each of the Process shifts and treating them as separate groups, as well as devising a 'Visible Ongoing Support' checklist with which to monitor the effectiveness of the projects administration, and the quantity and quality of the weekly B-Safe briefings. In addition, the B-Safe champion, handed over his duties to the Engineering manager, so that line management were seen to be more deeply involved.

By the middle of December, sufficient personnel had volunteered to be phase 2 observers. They attended one of two, one-day observer training courses which were held at the beginning of January. These training courses were run solely by the B-Safe project team with the principal author in attendance to monitor the proceedings. Subsequent to the one-day training courses, the phase 2 observers conducted two weeks practice observations on site, to ensure they were comfortable and conversant with their task. During this period the phase 2 safety performance inventories were further refined, as well as a comments section being added.

The observers obtained phase 2 baseline scores for a period of four weeks, commencing in mid January 1996, in parallel with the phase one observers who continued to monitor their colleagues until the completion of Phase one at the end of January. Phase 2 goal-setting took place during the first week of February. The procedures were exactly the same as those for phase 1, with the B-Safe co-ordinator conducting the majority of the goal-setting sessions. Table 2 presents the phase 2 baseline averages and goals for each workgroup.

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Table 2: Phase 2 Baseline Averages and Target Levels, by Department

Department	Baseline Average %	Goal Level %	Difference %
Process Control Room			
A shift	46.7	75	28.3
B shift	86.23	90	3.77
C Shift	63.03	78	14.97
D shift	67.30	70	2.70
Day crew	100	100	00.0
Engineers	71.23	84	12.77
Plant Offices	26.95	90	63.05
Laboratory	41.70	73	31.30
Light Oils	90.03	90	00.0

Phase 2 - Safety Performance Levels

In exactly the same way as phase 1, the results of the observer record sheets (records of observed safe and unsafe behaviours, recorded daily, for each work-shift) were used to produce a weekly safe performance level. This was expressed as a percentage (i.e. the number of safe behaviours observed, as a percentage of the total number of unsafe and safe behaviours recorded), for each department. The information was posted on feedback charts located in the engineering workshop, plant office, the process control room for the shifts, the laboratory and the day crew's office.

As shown in Figure 2, the site average goal of 83.3% was reached within twelve-sixteen weeks, from an average baseline of 65.91% representing an overall increase in safety performance of approximately 17.4%. By the end of phase 2, this had increased to an overall average improvement of 25%. Again, these are very positive results that reflect well upon all concerned.

Figure 2: Site average safety performance results (phase 2)

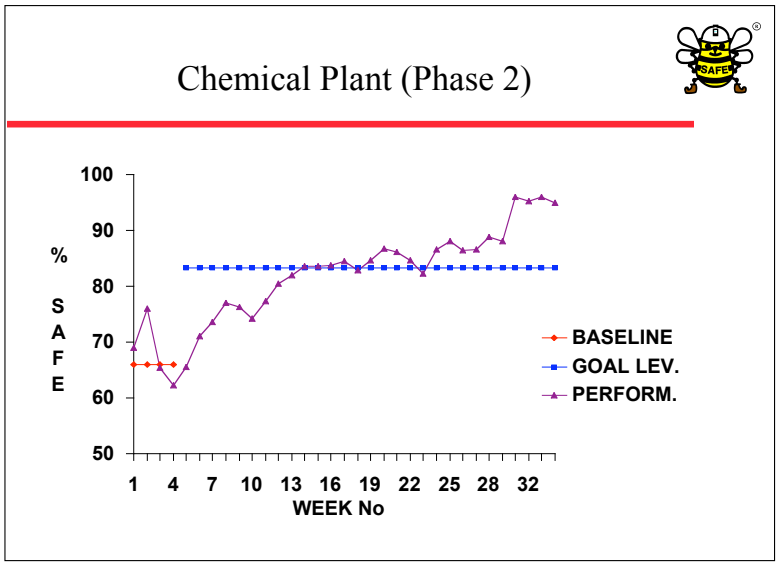

Table 2.1 provides a record of the available data, divided into seven X four week periods, by department and globally. Once again, the greatest improvements in this phase are to be found for those with the most difficult goals. The plant offices improved by an average of 68.5% to 95.5% from a baseline average of 27%, while the laboratory improved by 42.5% from an

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average baseline of 42% to 84.25% in period seven. Similarly, 'A' shift improved by 31%, from a baseline average of 47% to 78% in period seven. C & D shifts and Engineering also showed improvements in their safety performance of between 22-26%. Light Oils improved by 4%, while B shift achieved an overall improvement of 7%. It was not expected to find improvements for the Daycrew, just an expectation for them to maintain their baseline level of 100, which in the main they achieved. Overall, these results were very impressive.

Table 2.1.: Phase 2 Goal levels and average safety performance results by workgroup

Location	Goal %	Baseline	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7
Process Control Shiftsm									
A shift	75	46.70	60.00	61.25	77.23	74.25	78.25	81.25	78.00
B Shift	90	86.23	72.00	75.50	88.00	83.75	85.00	87.50	93.50
C Shift	78	63.03	81.00	82.00	77.78	76.50	79.00	77.75	86.85
D Shift	70	67.30	54.50	70.25	80.83	86.50	84.75	87.25	93.50
Daycrew	100	100	100	98.50	100	99.50	99.50	98.50	99.25
Engineers	84	71.23	77.75	86.25	87.25	89.00	86.00	87.00	93.50
Plant Offices	90	26.95	63.25	73.00	72.45	87.25	92.75	91.25	95.50
Laboratory	73	41.70	39.00	52.75	69.78	73.00	69.25	82.25	84.25
Light Oils	90	90.03	93.00	92.25	94.23	92.75	89.00	93.75	94.25
Grand Total	83.3	65.91	71.17	76.86	83.06	84.72	84.83	87.39	90.96

Table 2.2 provides an overview of the number of weeks that the departmental / shift goals were reached or exceeded (i.e. on target), in actual terms and as a percentage of the time the department / shift has been on target during the current phase. All the departments / shifts reached their goals at one time or other, albeit some more than others.

Table 2.2.: Phase 2: Actual number of weeks & Percentage of time on target

Department	**Baseline Average %**	**Goal Level %**	**Difference %**	**Weeks on target**	**% of time on target**
Process Control shifts					
A shift	47	75	28	14	50
B shift	86	90	4	5	18
C Shift	63	78	15	21	75
D shift	67	70	3	23	82
Day crew	100	100	0	20	71
Engineers	71	84	13	24	86
Plant Offices	27	90	63	14	50
Laboratory	42	73	31	13	46
Light Oils	90	90	-1	20	71

Ensuring that the improvements for phase 2 were not the result of chance variation was, again, ascertained by subjecting the safety performance scores to an independent groups One-way Analysis of Variance (ANOVA). The baseline and the twenty-eight week intervention period (divided into seven X four week blocks) were treated as levels of the factor. Significant F values were obtained for seven of the nine departments / shifts. Table 2.3. shows the F values and their associated significance levels for each department or shift, and for the plant as a whole. The F values obtained in phase two were greater than those found for phase 1, suggesting that behavioural safety initiatives exert a much greater influence on people's safety behaviour as time goes by.

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Table 2.3. One way ANOVA results (Phase 2)

Department	df	F	p<
245 shifts			
A shift	8,24	15.46	.0000
B shift	8,24	14.85	.0000
C shift	8,24	4.25	.01
D shift	8,24	9.59	.0000
Day Crew	8,24	1.81	n.s.
Engineers	8,24	10.59	.0000
Plant Office	8,24	33.17	.0000
Lab	8,24	52.43	.0000
Light Oils	8,24	0.82	n.s
Grand Sum	8,24	48.54	.0000

Phase 3

At the end of June 1996, the B-Safe co-ordinator prepared for phase 3. The completed data from phase 2 were examined for items that had consistently been addressed and always scored safely, as well as items that were always scored as 'not seen' , from this, new embryonic safety performance inventories were developed. In conjunction with plant personnel, further refinements were made, until such time as every workgroup was satisfied with the new safety performance inventories. During this process, the co-ordinator sought and obtained nine new volunteer observers. The phase 2 B-Safe champion continued in his role during phase 3.

The observers again attended a one-day observer training course, run solely by the project champion and co-ordinator, at the end of July. The day after the training, the phase 3 observers began their two-week practice observations on site. During this period the safety performance inventories were further refined. The goal-setting sessions took place during the first week of Sept 1996. The procedures were exactly the same as those for phase 1& 2, with the B-Safe co-ordinator conducting the majority of the goal-setting sessions. Table 3 presents the phase 3 baseline averages and goals for each workgroup.

Table 3: Phase 3 Baseline Averages and Target Levels, by Department

Department	Baseline Average %	Goal Level %	Difference %
Process Control Room			
A shift	81.5	85	3.5
B shift	75.33	85	9.67
C Shift	63.65	75	11.35
D shift	83.50	85	1.50
Day crew	94.00	94	00.0
Engineers	54.50	85	30.50
Plant Offices	70.25	96	25.75
Laboratory	41.25	80	38.75
Light Oils	88.00	90	2.0

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Phase 3 - Safety Performance Levels

As in phases 1 & 2, the results of the observations were used to produce a weekly safe performance level. This was expressed as a percentage (i.e. the number of safe behaviours observed, as a percentage of the total number of unsafe and safe behaviours recorded), for each department. This information was again posted on feedback charts located in the engineering workshop, plant office, the process control room for the shifts, the laboratory and the day crew's office. As shown by figure 3, during phase 3 the site average goal was set at 86.1%, slightly lower than that of phase 2, but slightly higher than that for phase 1. This site goal was first reached at week 17 from an average baseline of 72.4% representing an overall increase in safety performance of approximately 14%. Again, this is a very positive result. Although the safety performance goal set was not consistently maintained throughout phase 3, it continued to be above the site average goal of 86.1% for eight of the remaining twelve weeks, suggesting that B-Safe continued to exert a positive influence within most departments, some 18 months after it had first been implemented.

Figure 3: Site average safety performance results (phase 3)

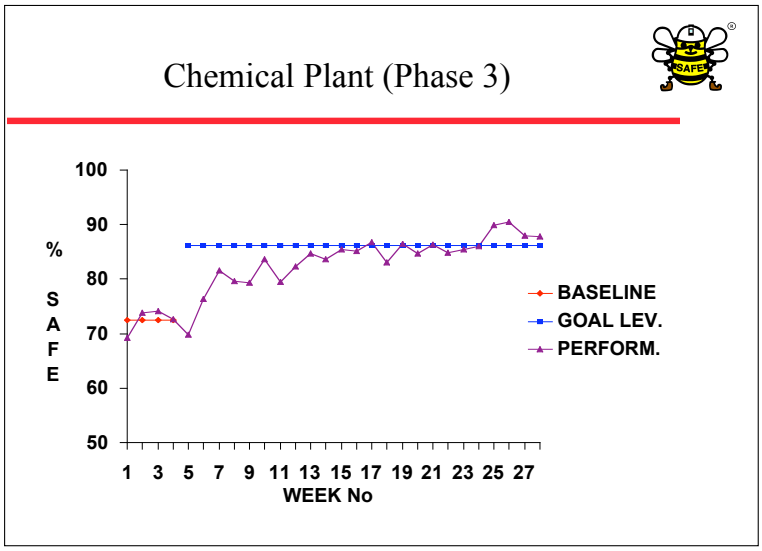

Table 3.1 provides a record of the data, divided into six X four week periods by department and globally. Once again, the greatest improvements in this phase are to be found for those with the most difficult goals. The plant offices improved by an average of 26.25%, reaching 96.5% from a baseline average of 70.25%. The laboratory improved by 48.5% from an average baseline of 41.25%, reaching 89.75% in period six, while the engineers degree of improvement was 29.5%, reaching an average of 84% from a baseline of 54.5%. Both 'A' & 'C' shifts achieved 20% improvements during the phase, whereas 'B' & 'D' shifts achieved about 7% improvements, reaching 100% by period 5, but dropping back to 89% in period six. Indeed C & D shifts and Engineering also showed improvements in their safety performance of some 22-26%. Light Oils was the most disappointing, as their performance declined during the phase, but returned to the baseline levels at the end of the phase. Nonetheless, the overall results were impressive, once again.

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Table 3.1: Phase 3 Goal levels and average safety performance results by workgroup

Location	Goal %	Baseline	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
Process Control Room								
A shift	85	81.50	93.25	94.00	97.50	90.50	100	89.00
B Shift	85	75.33	75.50	78.50	76.25	73.50	69.50	81.75
C Shift	75	63.65	71.50	67.50	75.65	79.00	85.75	85.10
D Shift	85	83.50	79.00	84.00	88.58	85.33	88.00	87.00
Daycrew	94	94.00	97.00	97.00	97.63	96.25	96.65	98.75
Engineers	85	54.50	74.67	78.68	82.00	85.00	83.00	84.00
Plant Offices	96	70.25	81.00	87.00	92.95	93.00	95.00	96.50
Laboratory	80	41.25	48.25	63.50	68.03	79.50	66.50	89.75
Light Oils	90	88.00	89.75	80.25	83.75	85.00	86.50	89.50
Grand Total	86.1	72.44	76.81	81.16	84.70	85.23	85.66	89.04

Table 3.2 provides an overview of the number of weeks that the departmental / shift goal's were reached or exceeded (i.e. on target), in actual terms and as a percentage of the time the department / shift has been on target during the current phase. At one time or another, every department reached their goal. Those with the hardest goals achieved them about a quarter to a third of the time, while most of those with easy goals achieved them about two-thirds of the time.

Table 3.2: Phase 3: Actual number of weeks & Percentage of time on target

Department	**Baseline Average %**	**Goal Level %**	**Difference %**	**Weeks on target**	**% of time on target**
Process Control shifts					
A shift	81.5	85	3.5	15	62.50
B shift	75.33	85	9.67	16	66.7
C Shift	63.65	75	11.35	2	8.3
D shift	83.5	85	1.5	16	66.7
Day crew	94	94	0	22	91.7
Engineers	54.5	85	30.50	9	37.50
Plant Offices	70.25	96	25.75	6	25
Laboratory	41.25	80	38.75	7	29.17
Light Oils	88.	90	2.0	3	12.5

Independent groups One-way Analysis of Variance (ANOVA), were again employed to ensure that the improvements for phase 3 were not the result of chance variation. In the same way as phases 1 & 2, the baseline and the twenty-eight week intervention period (divided into seven X four week blocks) were treated as levels of the factor. Significant F values were obtained for eight of the nine departments / shifts. Table 3.3. shows the F values and their associated significance levels for each department or shift, and for the plant as a whole. Although the F values obtained in phase 3 were generally smaller than those found for phase 1 & 2, they do reinforce the view that the B-Safe initiative continued to exert its influence on people's safety behaviour.

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Table 3.3 One way ANOVA results (Phase 3)

Department	df	F	p<
Process Control shifts			
A shift	6,21	7.49	.001
B shift	6,21	3.68	.05
C shift	6,21	7.97	.0001
D shift	6,21	2.26	n.s.
Day Crew	6,21	3.02	.05
Engineers	6,21	34.78	.0000
Plant Office	6,21	18.88	.0000
Lab	6,21	28.72	.0000
Light Oils	6,21	10.34	.0000
Grand Sum	6,21	21.97	.0000

Discussion

Overall, B-Safe ® produced significant improvements in peoples on-going safety behaviour in the majority of departments during all three phases. These are typical results of this particular approach to behavioural safety. These are in contrast to other type of approaches that make use of steering committees, and only monitor one or two individuals per week, which tends to take two - three years to impact on peoples safety behaviour and accident rates.

This plant already had a very good level of safety performance that had been recognised by official safety bodies. Nonetheless, these results show that on a day to day basis, there was still great room for improvement in peoples on-going safety behaviour. For example, in phase 1 the average baseline was recorded as 71%. This means that as a site, people were behaving unsafely 30% of the time, thereby putting themselves 'at risk'. Similarly, safety performance inventories containing new sets of safety behaviours, used during phases 2 & 3 also indicated that the site as a whole was behaving unsafely 30-35% of the time. To the sites credit, they met their safety performance targets during each phase, thereby minimising 'at risk' behaviours to approximately 10%. Because this plant had not experienced any lost time accidents for a number of years, the behavioural safety initiative was not expected to exert any great influence on accident incident rates. Nonetheless, minor injuries were reduced from eleven in 1994, seven in 1995 and three in 1996. Thus, behavioural safety initiatives exert downward pressures on the number of minor injuries, even where the existing levels of safety performance are already quite exceptional.

It is thought that B-Safe® exerts an influence in a number of important ways. In this study, for example, twenty-seven of the forty-six employees had been trained to observe their colleagues safety behaviour, representing some 58% of the workforce. Thus, a critical mass of trained observers was reached within 12-18 months. Perhaps for the first time in their lives, the trained observers treated safety seriously, on a day to day basis, for a period of approximately six months each. During their observation phases, each of them also memorised particular sets of safety behaviours that will stay with them throughout their working lives. Indeed, the positive impact the initiative had on people's attitudes towards, and perceptions about, safety was revealed in a follow up safety climate survey (A safety climate survey had been distributed

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prior to the initiative, with which the second survey was compared),which showed statistically significant improvements on most of the thirteen dimensions measured.

Some problems were encountered throughout the different phases. Initial recruitment difficulties became apparent as people thought that management had a 'hidden agenda'. Although some people volunteered, many had to be designated by their respective managers. This caused some difficulties during the phase 1 observer training and subsequent observations. However, these problems were overcome by the B-Safe team spending a lot of time with the people concerned and guiding them in their task. Some interpretation difficulties were also found with regards to engineering debris left on the plant. This caused some friction between the engineers and plant operatives, because the plant operatives felt the engineers were adversely affecting their scores. This was addressed by using an information board in the plants control room, where messages could be passed between the parties indicating whose debris was who's.

Other problems were related to a lack of 'visible management commitment'. One shift observer resigned half-way through phase 1,as safety issues he was identifying were not addressed. Despite many attempts, it proved impossible to get him to change his mind, and a new shift observer had to be trained. Thus, it is important that senior management address any safety issues that arise, else people will believe that the company is not seriously committed to safety, and will divorce themselves from the improvement process. A related problem was the general lack of B-Safe weekly briefings. During phase 1 the only departments to conduct regular briefings were the plant offices and the laboratory, the two groups who showed the most improvements. Fortunately, the state of play altered somewhat during phase 2. More people became willingly involved, although there were still some small pockets of resistance. Despite some coercion, all the shift supervisors were trained as B-Safe observers, so that their understanding of the project increased, which also had the desired knock-on effect of increasing the level of regular briefings. For example, although shift personnel did not conduct 'formal' B-Safe briefings, they did have informal chats about their safety performance. Moreover, the Day crew, Engineers, Plant offices and Laboratory all held formal B-Safe briefings on a weekly basis. Indeed, the B-Safe briefings subsequently provided a mechanism for transmitting other forms of safety information. Thus, regular weekly briefings not only demonstrate senior management commitment, but they also provide a forum for improving communications *per se*.

Summary

In summary, although some problems will be encountered, they are not insurmountable, provided that senior management are willing to visibly demonstrate their commitment, and follow through with issues identified by the workgroup observers. The effectiveness of the B-Safe approach to behavioural safety is testified to by the rapid improvements in safety behaviour experienced throughout each phase; the influence it exerted on the minor injury rate; and its positive impact on people's safety related attitudes and perceptions.

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