RESEARCH ARTICLE

Engaging senior management to improve the safety culture of a chemical development organization thru the SPYDR (Safety as Part of Your Daily Routine) lab visit program

The SPYDR lab visit program is a key component in the Chemical and Synthetic Developments campaign on 'Safety as Part of Your Daily Routine' (SPYDR) at Bristol-Myers Squibb. This program was initiated in 2013, which has all the senior leaders in Chemical and Synthetic Development organization visiting laboratories to engage in a safety focused discussion with the laboratory occupants. These meetings are not laboratory inspections per se, but are conversations designed to meet with the laboratory scientists in their working environment, to solicit their safety concerns and to engage the scientists in personal discussions. The visits are scheduled on the calendar three times a year, with each senior leader visiting 4-6 laboratories per year. The participation rate is very high (>90%) and feedback from the staff is consistently positive. An innovative online survey system was set-up for the visitor to easily convey the concerns he/she receives, as well as provide an assessment of the laboratory's focus on safety. The Safety Culture Team meets monthly to review the survey results and take action on the concerns. The accomplishments from this initiative are beneficial to resolving many specific safety concerns, facilitating access to safety resources, and dramatically improving the safety culture of our organization.

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INTRODUCTION

The improvement and enrichment of an organization's safety culture are common goals throughout both industrial and academic research[1,2]. As a chemical process development organization that designs and develops safe, efficient, environmentally appropriate and economically viable chemical processes for the manufacture of small molecule drug substances, we continually strive to improve our safety culture[3]. Cultivating and energizing a rich safety culture is critical for an organization whose members are performing a multitude of processes at different scales using a broad spectrum of hazardous chemical reagents as its core activities. While we certainly place an emphasis on utilizing greener materials and safer reagents, the nature of our business requires us to work with all types of hazardous and reactive chemicals and the challenges we face are pertinent to any chemical research organization.

In our organization of approximately 200 organic and analytical chemists and chemical engineers, we have a Safety Culture Team (SCT) whose mission is to develop programs to enhance the organization's safety

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culture. To make this culture visible, the team developed a key concept, Safety is Part of Your Daily Routine, into a brand with its own logo SPYDR[4]. To build on this concept, we designed a program known as the SPYDR Lab Visits shown in Figure 1. The program engages our senior leadership by having them interact with our scientists directly at the bench in the laboratory to discuss safety concerns. This program, initiated in 2013, has visibly engaged our senior leaders directly in the organization's safety culture and brought to our attention a wide range of safety concerns that would not readily appear in a typical safety inspection. Furthermore, this program provides a mechanism for increased communication[5] between all levels of the organization by arranging meetings between personnel who may not normally interact with one another on a regular basis. The success of this program has led to similar programs across other functional areas in the company.

PROGRAM DESIGN OBJECTIVES

A key safety objective for all organizations is to ensure that the entire organization can trust that the leadership is engaged in and supportive of the safety culture[6,7,8]. Therefore this program was designed to (1) emphasize that safety is a top priority from the top of the organization to the bottom, (2) engage our senior leadership with a prominent role in the safety conversations in the organization, (3) build a closer relationship between our senior leaders and the laboratory occupants and (4) utilize the feedback obtained from the visits to make the working environment better for our scientists. The program is a supplement to and not a replacement for the long standing laboratory inspection program done by the scientists in the organization.

The program involves assigning the senior leaders to meet with 2–5 scientists in the scientists' laboratory. There are approximately 40 laboratories in the organization, and over the course of the year, each laboratory will meet with 2–3 senior leaders and each senior leader will visit 4–6 different laboratories. All of this is organized using calendar entries which informs the senior leaders and scientists of where and when to meet, and contains the survey link to collect the feedback.

As a result of this program, our senior leaders engage our bench scientists in conversations that are primarily driven to draw out the safety concerns of our scientists. However, these conversations can run the gamut of anything that is a concern to our team members. This can range from safety issues, laboratory operations, and current research work to organizational changes and personal concerns. The senior leadership regularly reminds and encourages the scientists to engage on any topic of their choosing; this creates a collegial atmosphere for laboratory occupants to voice their safety concerns and ideas.

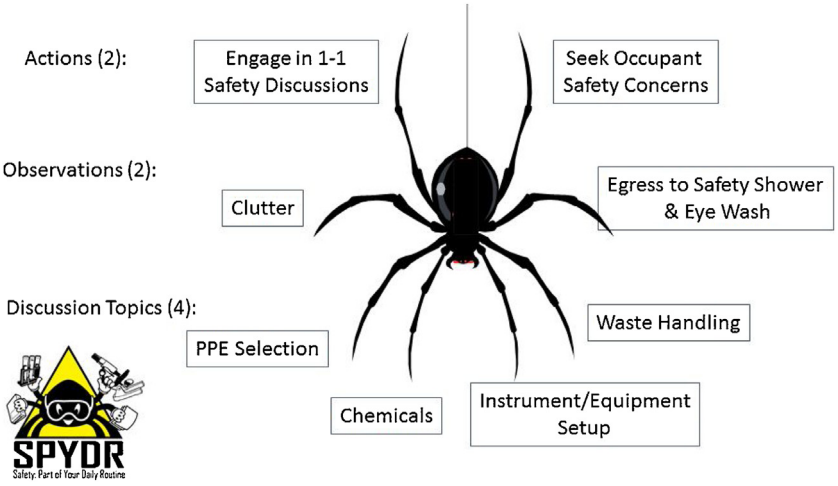

Figure 1. SPYDR senior lab visitor program overview.

STRUCTURE OF THE LABORATORY VISIT

The laboratory visit program was modeled around the Safety SPYDR and thus we designed the program to have 8 legs. The first two legs consist of the program's goals for the visit. We asked the senior leaders to ensure that they state the purpose of the program, that they are visiting the laboratory to find ways to improve lab safety. The second leg, which is the primary goal, is to ask "what are your safety concerns?". Often this is met with "we have no safety concerns", but using techniques common in the interviewing process, the leaders ask deeper probing questions to draw out what the scientists care about and with additional probing, root causes of the safety concerns will emerge. Once the scientists start talking about one safety concern, often multiple concerns will then surface, thus giving our safety teams an opportunity to deal with these concerns.

The next two legs of the SPYDR Lab visits consist of observations we ask our senior leaders to make on laboratory clutter and access to emergency equipment. If the clutter level of a laboratory is deemed unacceptable, the SCT will look to provide support to address root causes of the clutter. Typical solutions have been addition of storage capacity, removal of excess equipment from the work spaces, and alternative workflows. The second observation is to ensure clear paths from the work areas to emergency equipment exist, should an incident occur. We wanted to make sure a direct line existed to the eyewash station/shower such that the occupant would not be tripping over excessive carts, chillers, shelving or miscellaneous equipment. These observations led to active coaching of our laboratory occupants to ensure safe egress existed and modifications to the work environment. For example, the relocation of many chillers to compartments underneath the hood from being on a cart in front of the hood enabled improved egress for a number of laboratories.

For the final four legs of the SPYDR Visit, we ask the senior leaders to probe for understanding on various topics that range from personal protective equipment selection, waste handling, reactor setup and chemical hazards. The visitor is asked to rate these areas from needs improvements, to average, high, or very high. Figure 2 compares these ratings from the first year (2013) with the current year (2018). In the first year of the program, there were a few scattered "needs improvement" rating that resulted in communication with the line management of the laboratory. After the initial year, "needs improvement" ratings became very rare in all cases except clutter. In the current year, we shifted two topics to Laboratory Ergonomics and Electricity, which uncovered additional opportunities for improvement. We recommend changing the contents of these legs on a regular basis as it shifts the focus of the discussion and potentially uncovers new safety concerns.

FEEDBACK MECHANISM

The SPYDR lab visits are built around a feedback loop illustrated in Figure 3 that utilizes an online survey to both track completion of the visits as well as to communicate findings back to the SCT. The order of events around a laboratory visit consist of scheduling a half hour meeting between our senior leaders and the occupants in their laboratories. Once the visit is completed, the visitors will fill out the simple online survey (Figure 4) that details their findings for the visit. The SCT will meet regularly to review the surveys and take actions based on the occupants' safety concerns. This often involves following up with the team members in the laboratory to ensure they know their safety concerns were heard.

Two potential and significant detractors for this program exist. The first challenge is if the senior visitor does not show up for the visit, this results in a perception that senior management does not embrace safety as a top priority. The second pitfall is if the visitor uncovers a safety concern, but does not fill out the survey to report safety concerns, or if the SCT is unable to address a safety concern. In this case, there would be a perception that a safety concern was reported to a senior leader and "nothing happened". To minimize these risks, there is significant emphasis for the senior leaders to take ownership of the laboratory visits and for the SCT to take ownership of the action items and ensure the team members know their voices have been heard.

DISCUSSION OF SAFETY CONCERNS

A summary of safety concerns is illustrated in Table 1. By a wide margin,

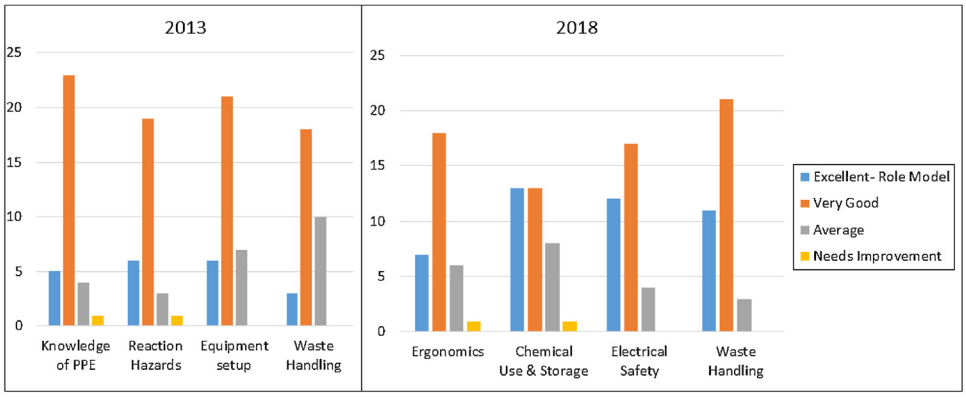

Figure 2. SPYDR lab visit feedback ratings from 2013 and 2018.

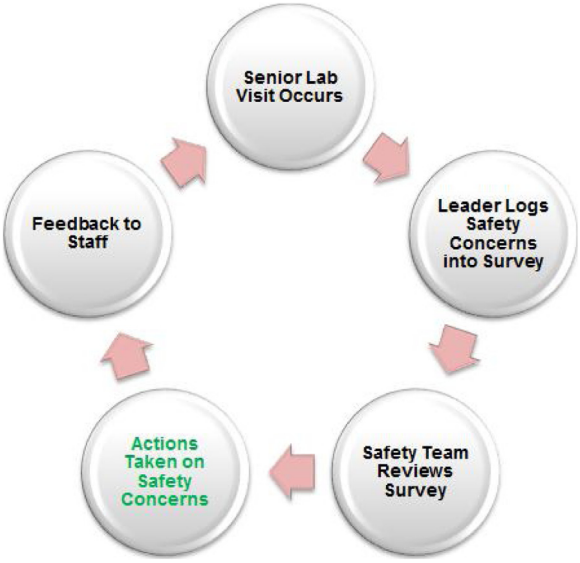

Figure 3. SPYDR lab visit feedback loop.

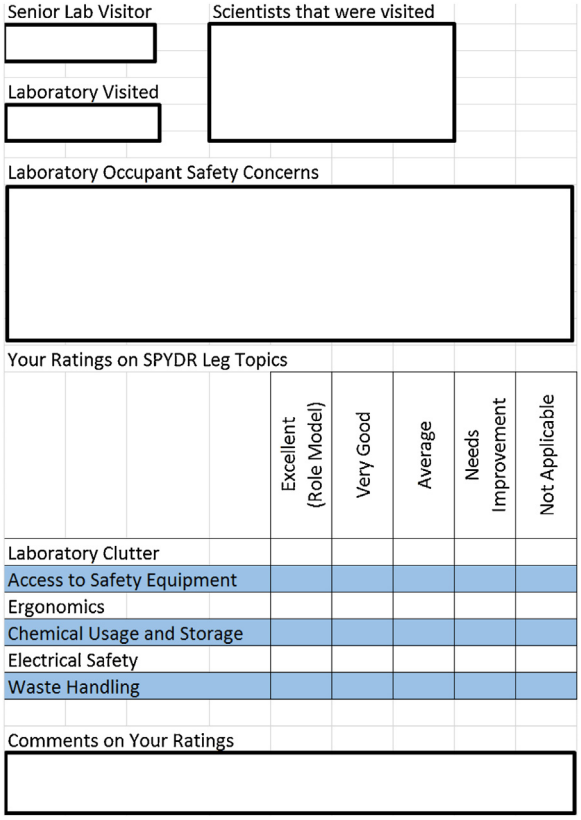

Figure 4. Online survey for SPYDR lab visit feedback.

clutter was the predominant safety concern in 2013 as it was noted in 50% of the laboratories visited. Three major safety programs within the department were inspired by early visits in order to reduce clutter in the laboratories. This included several rounds of organized general laboratory cleanouts to remove old equipment. A second program systematically purged old and/or duplicate chemicals throughout the department. Most recently, a third program created a systematic long term chemical inventory management system that was designed to reduce clutter caused by the large number of processing samples stored in the department. This program has returned over 900 sq. feet of storage space to our laboratories and has greatly reduced the amount of clutter in the labs. Although clutter remains a common theme in our visits, the focus is now often related to removal of old instruments and equipment rather than a gross shortage of storage space.

In the first year of the program, one aspect of the laboratory visit was to discuss hazards associated with chemical reactions (feedback rate of 28%) and equipment setup (32%). A common thread in these discussions were expectations of collaboration and behavior from "visiting scientists". These "visiting scientists" were colleagues and project team members from other laboratories coming to the specific laboratory in order to use its specialized equipment (examples: 20 liter reactors, automated reactor blocks). This caused certain friction between the visiting scientists and their hosts on safety expectations. The SCT addressed this by convening a meeting between hosts and visiting scientists to discuss root causes of friction to produce a list of "best practices" shown in Figure 5 to improve the work experience for both hosts and visitors that is still in use for specialty labs with shared equipment today.

The next major category of safety concerns for our laboratory visits was associated with facility repairs which was present in 24% of our first year visits. These included items such as leaking roofs, unsafe cabinet doors, or delays in re-energizing hoods after fire drills. These were addressed by connecting our scientists to the appropriate building managers who would be able to evaluate and address these safety concerns. After the initial year, most of the facility related concerns transitioned to the addition/removal of storage solutions within specific laboratories. Currently, when new laboratories are associated with the

Table 1. Statistics of Laboratory Visits and Safety Concerns with Percentage of Laboratories Reporting Safety Concerns in Each Category.

	2013	2018
Lab Visits	50	79
Safety Concerns	95	109
Clutter	50%	33%
Egress	10%	0%
PPE	18%	4%
Reactions	28%	–
Waste	12%	18%
Equipment Setup	32%	29%
Ergonomics	–	6%
General	16%	23%
Facility	24%	42%
No Safety Concerns	12%	10%

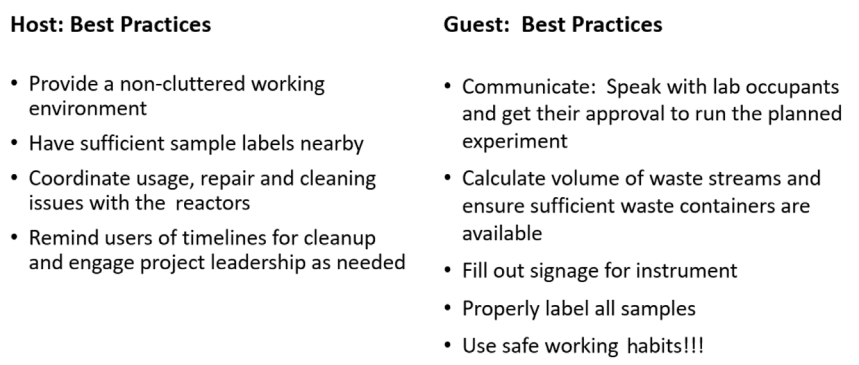

Figure 5. Best practices for visiting scientists and hosts.

SPYDR Lab Visit program, major facility concerns will quickly be reported.

These visits also brought to light a common problem occurring in the laboratories, that is, the loss of electrical power associated with circuit breakers being tripped when the electrical outlets associated with a laboratory hood were being used at capacity. This led to the identification of the need to increase the electrical capacity in the fume hoods and this has now being addressed by an ongoing capital project.

By the third year of the program, the nature of the safety concerns changed as many of the laboratory-based concerns had been addressed. Concerns raised now included site issues such as such as traffic patterns, pedestrian safety, walking in parking lots at night, and training. Among the items addressed for the site include on-site intersections being modified and movement of a fence line to enable safer crosswalks and improvements for the driver's line-of-sight. A simple questions raised about fire extinguisher training and who was permitted use an AED device led to the expansion of departmental fire extinguisher training to a broader group and the offering of AED/CPR training to the broader organization.

These safety concerns would not be typically detected by a laboratory safety inspection program and are only accessible by directly asking the occupants what their safety concerns are. Through theSCT, these issues were resolved over time as the team took accountability to move the issue through various channels (facilities, capital projects, ordering of equipment) to develop and implement the solutions.

CONCLUSION

Since 2013, this novel program has successfully engaged our leadership with laboratory personnel and has led to hundreds of concerns being addressed. The concerns have arisen from over 300 laboratory visits, and more than a thousand safety conversations with our scientists. Because this is not a safety inspection program, these visits routinely uncover new safety concerns that would not be expected to surface in our typical laboratory inspection program. The SPYDR visit program is a strong supplement to the laboratory inspection program, and has produced a measurable impact on the safety culture.

A collateral benefit from the program, is that it drives social interactions within the department where senior leaders who may not necessarily interact with certain parts of the organization have a chance to visit these team members in their workplace and learn firsthand what they do in the organization.

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