

A Revised Model for Operational Discipline¹

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The purpose of this paper is to review the development and implementation of a next generation approach to improving operational discipline programs at DuPont, in order to help sustain high levels of process safety management performance. DuPont defines operational discipline as a deeply rooted dedication and commitment by each member of the organization to carry out each task, the right way, each time. Eleven organizational characteristics have been used to help evaluate and drive continuous improvement of operational discipline, which have now been simplified to four primary characteristics. Ultimately, though, it is individuals who do the day-to-day work required by PSM systems, and it is these actions that help determine if the organization is able to operate with high levels of operational discipline. With this in mind, DuPont's program has been revised to include a new emphasis on individual characteristics of operational discipline, based on knowledge, commitment, and awareness. Discussion will include why operational discipline is important, how operational discipline can be characterized for both organizations and individuals, and how the revised program has been implemented.

1. Introduction

Operational discipline (OD) is defined by DuPont as the deeply rooted dedication and commitment by every member of an organization to carry out each task, the right way, each time [1]. OD reflects the strength of an organization's safety culture in making Safety, Health, and Environmental (SHE) systems effective and in providing tangible results for preventing injuries and incidents. In addition, a high level of OD typically contributes to improved operational and business performance through higher productivity, higher quality, reduced waste, and lower costs. "Discipline" in this context does not refer to punishment, but to doing things in a way that results in positive benefits.

The OD program at DuPont has been revised to introduce a new focus on individual OD as well as to simplify the existing organizational OD effort. This recognizes that, while organizational factors are essential for achieving high levels of OD, tasks are ultimately completed by individuals who have the knowledge, commitment, and

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awareness to complete their tasks correctly and safely every time. Aspects of the OD program that have been developed include: new training, new guidance on evaluating and improving OD, and trained resources to assist implementation at sites. The OD program is meant to be flexible, providing a toolbox of methods for evaluating and improving OD, based on individual site needs.

1.1 Operational Discipline at DuPont

The emphasis on OD at DuPont is found in the early development of safety culture in the company, where the manufacture of gunpowder was the first hazardous process. In 1808, the founder, E. I. du Pont, wrote:

The safety of our family, the safety of the farmers who live in our neighborhood, has imposed upon us the absolute duty of making choice of steady, sober men and of establishing the most rigid discipline among our workmen [2].

Nearly 200 years later, OD is viewed as essential to all SHE programs, but is most associated with Process Safety Management (PSM) systems, designed to identify, evaluate, and control a variety of potentially hazardous processes. OD is recognized as essential to the development and implementation of effective PSM systems as one of four required steps [3, 4]:

- **Step 1 – Establishing the Safety Culture:** A PSM program will only be as effective as the underlying safety culture permits. If an organization has a weak safety culture, PSM efforts may be harmed by conflicting priorities, such as production needs or lowering costs. A strong safety culture, based on a commitment to SHE as a core value, and as evidenced by organizational policies, goals, metrics, and day-to-day decision-making, supports establishing safety systems. Safety priorities are recognized, not as conflicting with other priorities, but rather as inherently necessary for completing any task the right way.
- **Step 2 – Providing Management Leadership and Commitment:** Management leadership and commitment which is visible throughout the organization is required for continued excellence in PSM. Beginning with the formation and fostering of a strong safety culture, continuing with policies that set high expectations for excellent safety performance, and implemented in day-to-day decisions that provide resources and establish high priority for safety-related activities, the actions of all levels of management must support and reinforce strong PSM programs and accountability.
- **Step 3 – Implementing a Comprehensive PSRM Program:** A comprehensive PSM program includes integrated managing systems for various elements of process safety [3-5], such as Process Hazards Analysis, Incident Investigation, and Mechanical Integrity. Regulations should generally be considered the starting point only, representing minimum essential levels of practice. Additional

requirements should be considered that go beyond regulations and better meet corporate needs for process safety, based on a review of process risks [6].

- **Step 4 – Achieving Operating Excellence through Operational Discipline:** Operational discipline is the deeply rooted dedication and commitment by every member of an organization to carry out each task, the right way, each time. No matter how comprehensive and well-designed PSM programs may be, it is the day-to-day ability of everyone to practice operational discipline that successfully changes safety systems from concept to reality. Operational discipline not only helps prevent serious injuries and incidents, but also contributes to excellent business performance through increased operating excellence, including higher productivity, higher quality, reduced waste, and lower costs.

The principles and essential features of DuPont’s PSM program are described by 14 elements grouped by Technology, Personnel, and Facilities, as shown in Figure 1. This figure is typically called the “PSM Wheel,” with each of the 14 elements, such as Process Hazards Analysis, Operating Procedures and Safe Work Practices, and Personnel Training and Performance, arranged around the spokes of the wheel. Management leadership and commitment, necessary for implementing and maintaining strong PSM programs, is shown at the center of the PSM Wheel. Operational discipline is shown as the rim of the PSM Wheel, connecting all of the elements and translating the required managing systems into real results for preventing injuries and incidents. In addition, the DuPont PSM Standard [7] includes the following requirement:

Sites shall implement and maintain programs and systems to achieve and maintain a high degree of operational discipline for all PSM elements in a manner that supports business and operating objectives.

Process Safety and Risk Management Model



Figure 1 – DuPont PSM Wheel

1.2 Importance of Operational Discipline

OD is fundamental to achieving strong SHE performance, based on successfully translating well-designed safety systems from concept to consistent day-to-day results. This can perhaps best be shown through the “Safety Triangle,” as shown in Figure 2, where the base of the triangle represents potentially numerous OD problems that ultimately lead to poor performance in terms of near-miss incidents and potentially serious injuries. By attacking the base of the Safety Triangle to improve OD, incidents and injuries can be prevented and SHE performance can be improved. Similar figures could also be constructed that show similar behavior for environmental releases, fire safety, electrical safety, etc., including other top events such as environmental harm or business loss.

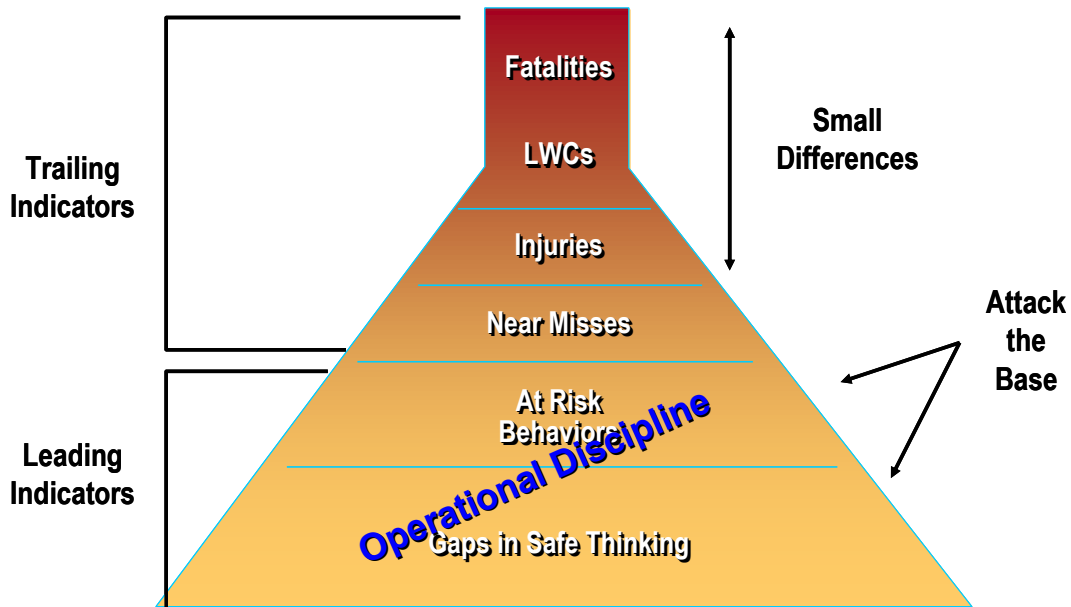


Figure 2 – Safety Triangle

A useful way of looking at OD for PSM is to modify the familiar risk equation, as shown below:

$$\text{Risk} = \frac{\text{Frequency} \times \text{Consequence}}{\text{Operational Discipline}}$$

In this equation, risk is a function of the frequency of a possible event, often determined by the effectiveness of PSM systems and safeguards, and of the potential consequences of the event, characterized by the inherent substance and process hazards. OD, though, is shown in the denominator, such that if OD is 100%, meaning that the PSM systems and safeguards are maintained and operated perfectly all the time, then risk is not affected. If OD is less than 100%, meaning that even well-designed systems are not implemented or followed effectively, then overall risk is increased. If OD is only 50%, for example, then risk is qualitatively doubled. The result of poor OD and higher risk can be serious incidents and injuries, as evidenced, for example, by the Bhopal incident in 1984 [8].

2. A Next Generation Operational Discipline Program

DuPont has included OD as part of PSM training since 1989. Organizations that have a high level of OD usually exhibit an identifiable set of positive behaviors or characteristics. While it is possible that these characteristics may vary from one organization to another, DuPont introduced the following 11 characteristics in 1998 and has used them evaluate and improve OD [1]:

- Leadership by example

- Sufficient and capable resources
- Employee involvement
- Active lines of communication
- Strong teamwork
- Common shared values
- Up-to-date documentation
- Practice consistent with procedures
- Absence of shortcuts
- Excellent housekeeping
- Pride in the organization

When a new effort to improve OD was undertaken, it became clear that these 11 OD characteristics were primarily the responsibility of site leadership and therefore represented “organizational” OD characteristics. Since job tasks are the responsibility of individuals, a new focus on “individual” OD seemed appropriate. As shown in Figure 3, the definition of OD has been split into both organizational and individual views. The traditional definition of organizational OD shown in Figure 4, while important, is not what individuals likely consider when they go about their own work, perhaps believing that organizational issues are handled by someone else. Rather, a focus on conducting their own work safely is clearly in their own self-interest and control. Ultimately, it is believed that this new focus on individuals as part of the OD program will resonate better and more broadly with employees and help contribute to overall improved OD and SHE performance, as shown in Figure 4.

2.1 Organizational Operational Discipline

The 11 organizational OD characteristics listed above have been described in detail previously [1]. However, as the next generation OD program evolved, overlap between these characteristics became evident, and the 11 characteristics were simplified. As shown in Figure 5, most requirements from the existing program remain in the simplified version, due to the overlap and due to overall leadership accountability for most organizational activities. This has resulted in easier communication, training, and understanding of the program. In addition, the complexity and time commitment for evaluating OD and for selecting improvement practices has been reduced and simplified.

Organizational View

The deeply rooted dedication and commitment by every member of an organization to carry out each task, the right way, each time.

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Individual View (New)

I am committed to working safely by doing every task, the right way, every time.

Figure 3 – Two Definitions of OD

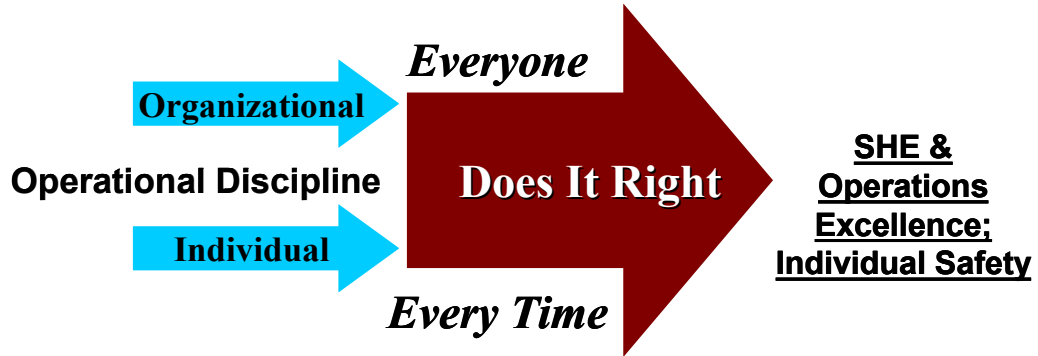


Figure 4 – DuPont OD Program

The four organizational OD characteristics, as shown in Figure 5, are:

- **Leadership Focus** – Leaders are passionate for SHE and model the behavior they expect from others.
- **Employee Involvement** – Employees are active and enthusiastic about participating in SHE activities.
- **Practice Consistent With Procedures** – Work is completed as planned, following authorized procedures.
- **Excellent Housekeeping** – Employees are proud of their workplace, maintaining consistently high levels of housekeeping.

The relationship between these four characteristics is shown in Figure 6. The foundation of any organizational effort is Leadership Focus, without which priority and support for the program cannot exist. Organizational OD also requires strong Employee Involvement, where high levels of uninterested and uninvolved employees will limit the organization's ability to achieve strong SHE performance. The most visible results of Leadership Focus and Employee Involvement are employees following approved procedures (Practice Consistent With Procedure) and maintaining equipment and work areas in good operating condition (Excellent Housekeeping). Without the base of the pyramid being in good shape, it is unlikely that an organization can consistently achieve strong performance at the top of the pyramid.

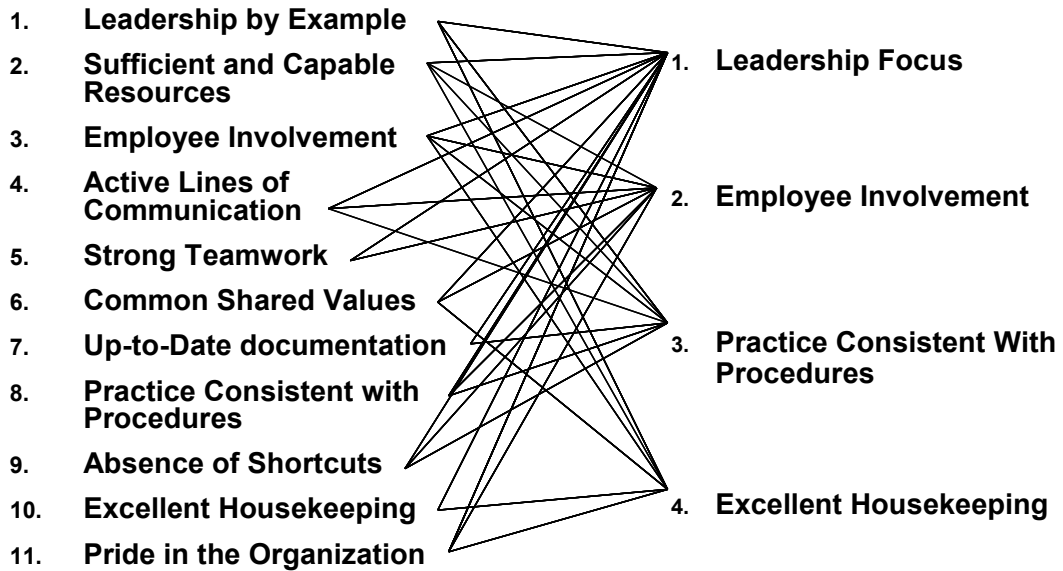


Figure 5 – Organizational OD Characteristics

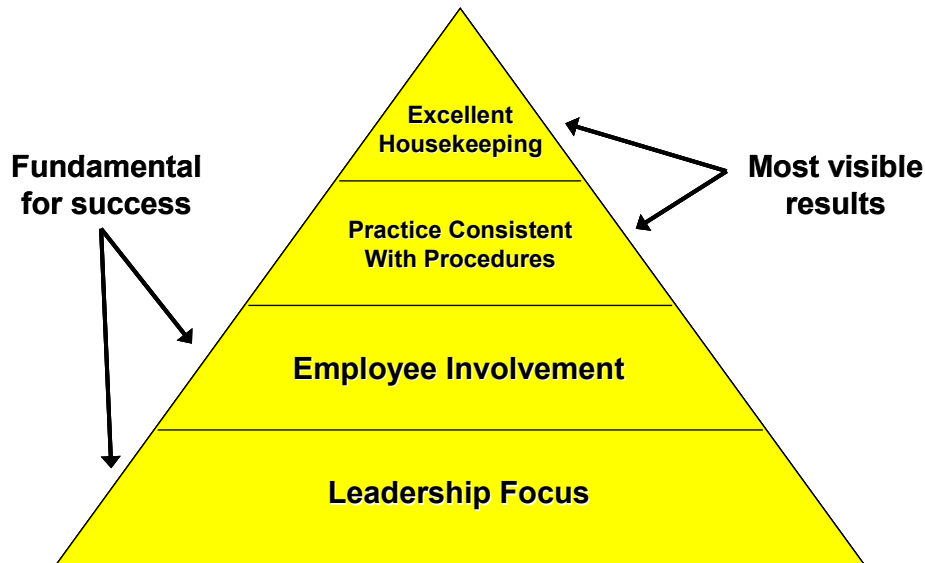


Figure 6 – Organizational OD Pyramid

Each organizational OD characteristic consists of several specific requirements, which are used to define responsibilities, to help with evaluation of OD performance, and to assist with identification of improvement priorities. A summary is provided in Table 1. The descriptions are currently worded to focus on SHE, but they could be easily modified to include general operational excellence. Clearly, some of these descriptions also reflect requirements for related PSM systems, such as Operating Procedures and Personnel Training. For OD, a key is that each requirement is carried out, the right way, each time there is a need and that organizational support for this is provided.

<p style="text-align: center;"><u>Leadership Focus</u></p> <p><i>Leaders are passionate for SHE and model the behavior they expect from others.</i></p> <ul style="list-style-type: none"> • Visibly demonstrate personal priority for SHE as a core value in their decisions. • Clearly document, maintain up-to-date, and communicate SHE goals, standards, and systems. • Monitor SHE performance via metrics, audits, and personal involvement to drive continuous improvement. • Provide sufficient and capable resources to sustain ‘The Goal is Zero’ SHE performance. • Develop and support processes to facilitate employee involvement and effective teams. • Recognize and celebrate good SHE performance. 	<p style="text-align: center;"><u>Practice Consistent With Procedures</u></p> <p><i>Work is completed as planned, following authorized and current procedures.</i></p> <ul style="list-style-type: none"> • Procedures are documented and readily available for all appropriate SHE activities • Clear expectations exist for following procedures and for not taking shortcuts • Procedures are periodically reviewed and authorized to keep them current, including employee participation • All changes, tests, and deviations are reviewed and authorized before use • Training and field audits are conducted to ensure procedures are understood and followed.
<p style="text-align: center;"><u>Employee Involvement</u></p> <p><i>Employees are active and enthusiastic about participating in SHE activities.</i></p> <ul style="list-style-type: none"> • Know and share the organization’s SHE core values and goals. • Volunteer and are active in SHE activities and teams. • Provide feedback and suggestions for improvement. • Show pride in being part of the organization. 	<p style="text-align: center;"><u>Excellent Housekeeping</u></p> <p><i>Employees are proud of their workplace and maintain consistently high levels of housekeeping.</i></p> <ul style="list-style-type: none"> • Clear expectations are established for maintaining good housekeeping. • Standards for equipment and area housekeeping are documented and clearly communicated. • Audits are conducted to monitor and help improve housekeeping.

Table 1 – Characteristics of Organizational OD

2.2 Individual Operational Discipline

While ultimately line management is accountable for all SHE programs at DuPont, achieving high levels of OD and subsequently achieving excellent SHE performance requires the active involvement of all employees in completing every job task correctly and safely every time. Once the concept of individual in addition to organizational OD was developed, a study was made to consider what characteristics best defined individual OD. Specific targets for these characteristics included that they should be:

- Acceptable and meaningful for individuals at all levels of the organization
- Simple and logical
- Measurable and improvable.

A broad search of related literature was conducted [e.g., 9-16] to identify key principles related to individual performance. In particular, people-based (behavior-based) safety references [e.g., 17-26] were helpful and clearly established the need for commitment as one of the required individual OD characteristics. Following extensive reading for background in this area, but not necessarily becoming an expert in any, led to a relatively simple identification of three characteristics required for individuals to work with a high level of OD. While some organizations may find value in a different set of characteristics, the three characteristics, each in first person, are:

- **Knowledge** – I understand how to do a task correctly and safely.
- **Commitment** – I commit to do tasks the right way, every time.
- **Awareness** – I anticipate potential problems and recognize unusual situations.

As shown in Figure 7, an overlap of the three individual OD characteristics is considered essential for an individual to work with a high level of OD. If, for example, an employee has Knowledge and Commitment, but not a high level of Awareness, when things don't go quite as planned, it is more likely that some part of the task may not be completed correctly, possibly leading to an injury or incident. Similarly, if an individual is not committed to completing a task correctly and safely every time, shortcuts may be taken or distractions may occur that lead to a lack of focus. Ideally, sufficient levels of each characteristic are present, such that the employee is working in the "sweet spot" in the center of the overlapping circles.

Each characteristic has several requirements, again in first person, which are necessary to achieve high levels of OD, building on basic tenets of safety. A summary is provided in Table 2. Again, the descriptions are currently worded to focus on SHE, but they could be easily modified to include general operational excellence.

The total OD Program, therefore, is defined by 7 total characteristics. Four characteristics describe the organization focus – Leadership Focus, Employee Involvement, Practice Consistent With Procedures, Excellent Housekeeping – and three characteristics describe the individual focus – Knowledge, Commitment, and Awareness. These characteristics provide the framework for discussing, evaluating, and improving OD, with specific methods discussed in the next section.

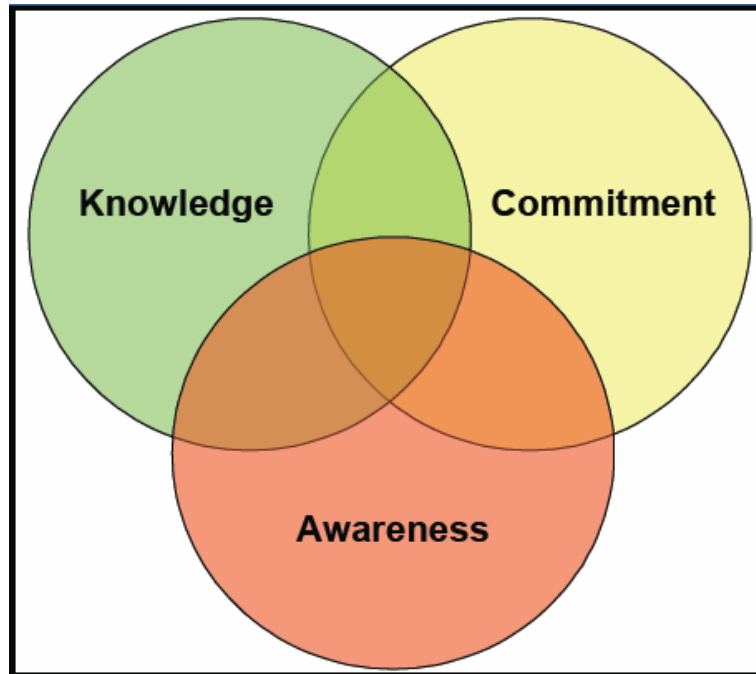


Figure 7 – Individual OD Characteristics

3. Program Implementation

The next generation OD program was communicated to regional groups early in its development to introduce planned upgrades and to allow for broad feedback on the program content and direction. Since different sites have different issues and priorities, it was emphasized that use of many aspects of the program would be voluntary and flexible, based on specific site needs. Specific questions asked for feedback included:

- Do you see this approach adding value for your region or site?
- How can this approach be improved to add more value?
- Do you have any input on practices that can be used to help improve OD?

Several path forward items were also identified that were being developed in support of the OD program, including:

- Improved OD evaluation tools, including auditing and incident investigation
- New guidance for improving OD
- Upgraded training.

An overview of these items is provided in this section, which are also discussed in more detail separately [27].

<p style="text-align: center;"><u>Knowledge</u></p> <p style="text-align: center;"><i>I understand how to do my tasks safely and correctly.</i></p> <ul style="list-style-type: none"> • I know the correct way to do my job task, based on procedures, training, and other SHE system requirements. • I understand why the job task is being done in a certain way, what needs to be accomplished, and how it should be done. • I ensure that my equipment, tools, and PPE, if needed, are in good condition. • I make sure my co-workers also know how to do their job task safely. 	<p style="text-align: center;"><u>Commitment</u></p> <p style="text-align: center;"><i>I commit to do my tasks the right way every time.</i></p> <ul style="list-style-type: none"> • I take personal responsibility for properly understanding my job task and making sure it can be completed safely every time. • I plan to follow procedures carefully without shortcuts. • I trust that procedures have been developed for a purpose, but suggest changes if they don't make sense. • I focus on the task at hand and set aside personal and work distractions. • I care for my safety and the safety of my co-workers.
<p><u>Awareness</u></p> <p><i>I anticipate potential problems and recognize unusual situations.</i></p> <ul style="list-style-type: none"> • I anticipate that my job task may not go as planned. • I understand if there are any unusual circumstances or hazards associated with my job task. • I monitor my work environment carefully, including the activity of my co-workers. • I prepare to respond quickly and safely, troubleshooting as needed, based on my training and procedures. • I stop, think, and review procedures, or ask for help, when unsure of what to do, or if the task unexpectedly changes. 	

Table 2 – Characteristics of Individual OD

3.1 Evaluating Operational Discipline

The most readily available data for evaluating OD is found in site SHE metrics. Periodic review of these metrics, with emphasis on specific identification of OD contributions, can provide an excellent view of OD performance without much additional effort. Examples of metrics that may relate to OD include:

- No. of incidents (especially incidents with OD key factor)
- No. of injuries (especially injuries with OD key factor)
- No. of audit findings (especially findings that relate to OD)
- No. of scheduled activities not completed on schedule
- No. of overdue findings, tests and inspections, etc.
- Amount of waste generated
- Poor product quality and customer complaints
- Higher costs

- Lower process uptime or utilization
- Staff turnover rates

An example for the possible OD contribution to incidents at one site is shown in Figure 8. In this scenario, it appears that OD improved in 2004, possibly due to an emphasis on OD at the site or perhaps for other reasons. Since that time, the contribution of OD to incidents at the site has steadily increased until almost all incidents have OD as a key factor or root cause. This suggests that any gains from earlier efforts were not sustained and that the site could benefit from additional focus on OD. Additional analysis of the incident data may help identify which specific OD characteristics need to be improved. Additional evaluation tools can also be used to further evaluate OD at the site.

The most useful OD evaluation tool is the OD Self-assessment [1]. The OD Self-assessment has been revised and simplified using an internet survey tool [28], which allows for rapid analysis of OD based on a survey of all site employees or subgroups, as desired. The survey collects specific responses to various graded (1 to 5) or yes/no questions, which correspond to the seven organizational and individual OD characteristics. Questions also allow participants to identify specific problem areas, to provide suggestions for improvement, or to identify current activities that seem to be working well. An example question and typical result is shown in Figure 9. Advantages of the survey tool versus previous small group discussion approaches [1] include involvement of more people, easier data analysis, and direct evaluation of participant attitudes for individual OD characteristics. If desired, the survey data can also be evaluated using a small group to help determine a specific, prioritized path forward.

Additional methods have been developed for evaluating OD through various audit approaches and in incident investigations to provide flexibility, based on site needs [27].

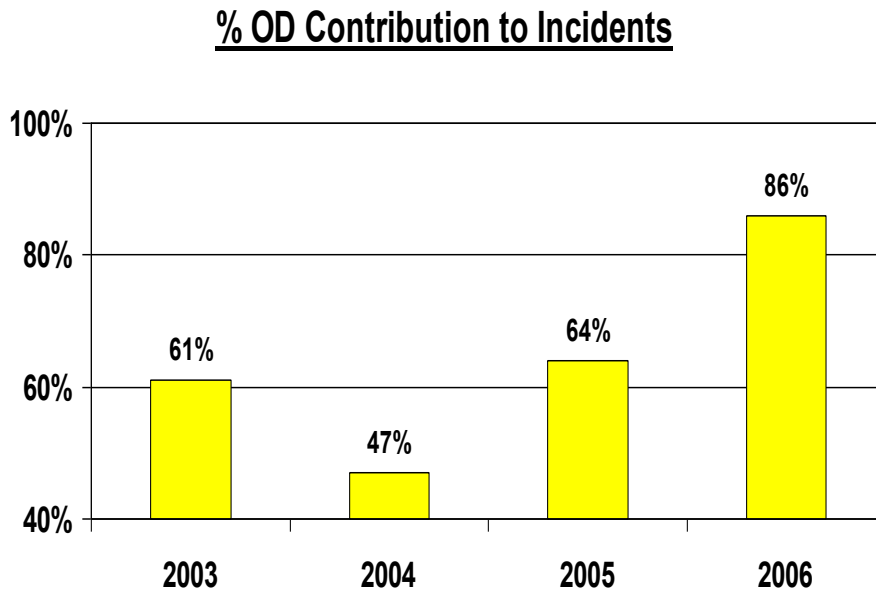


Figure 8 – Example Site OD Metrics Data

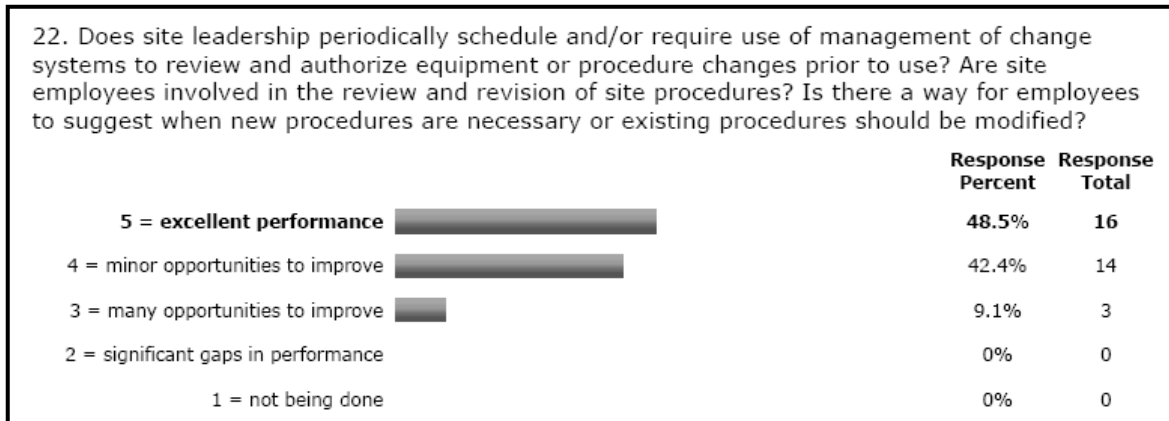


Figure 9 – Example OD Self-Assessment Survey Data

3.2 Improving Operational Discipline

The lack of specific improvement guidance for OD has sometimes limited the effectiveness of OD programs. For example, using available OD evaluation tools [1], it was possible to identify OD characteristics that needed to be improved, but when site management looked for guidance on possible approaches, little guidance was often available. In addition, improvement tools that might work at one site might not work at another, due to differing site processes and culture. An important aspect of the next generation OD program, therefore, has been to develop an internet-based “OD Toolbox” based on internal and external practices that could provide easily-accessed, flexible improvement guidance and tools. Existing practices have been combined with new approaches solicited from sites and identified from literature searches. Specific tools can be flexibly selected to target improvement in weaker OD characteristics, based on site needs and preferences. Overall, development of the OD Toolbox will be evergreen, as sites gain more experience in working on OD improvement and as additional practices are identified.

3.3 Operational Discipline Training

A one-day OD Leadership Workshop has been developed with the following goals:

- Build value for why OD is important
- Introduce the “next generation” DuPont OD program
- Review methods for evaluating and improving OD
- Develop a path forward for improving OD at the site, based on site goals.

The Workshop is usually presented at one site, but it has also been offered to multi-site groups with few changes. Participants have generally included a cross-section of site roles and levels to provide diverse views for developing a path forward for improving OD at the site.

Pre-work for the workshop includes developing a short summary of current OD performance based on site SHE metrics. Participants also complete the OD Self-assessment survey prior to the workshop, and a summary of the results is used in the workshop to provide additional data on current OD performance and to provide suggestions for improvement. Typically, 2-3 areas for improvement are identified, and an initial path forward for each is developed. Sites have then taken this information back to site leadership groups for further refinement and prioritization versus other site SHE activities.

The recommended path forward following the workshop is to provide a shorter version of the training to all site employees to build value for OD and awareness of the DuPont OD program. The site can then send the OD Self-assessment survey to all employees, if desired, for broad input on the current status of OD at the site and to develop suggestions for improvement. Follow-up meetings based on the OD Self-assessment and on the planned path forward should then be held with employees for additional discussion of OD performance and improvement at the site.

Additional training, such as for use in safety meetings, has also been developed to assist sites with implementation of their OD improvement efforts.

4. Summary

Well-designed SHE systems are only as effective as the day-to-day ability of everyone in an organization to rigorously follow procedures correctly and safely every time. Once effective SHE systems have been developed, therefore, the greatest opportunity for maintaining and improving SHE performance may result from emphasizing, evaluating, and improving OD. High levels of OD in an organization help ensure strong SHE performance and overall operating excellence. OD problems can lead to poor SHE performance and higher overall risk, possibly resulting in serious injuries and catastrophic incidents. A complicating factor is that every company and every site is different, often with somewhat different cultures and practices. A “one size fits all” approach to OD therefore is unlikely to be successful for all organizations or sites.

The OD program at DuPont has been revised and simplified to include both organizational and individual OD characteristics that can be evaluated and improved in a flexible way. Organizational OD is focused on ensuring the dedication and commitment of everyone in the organization to carry out each task, the right way, each time. Leadership Focus and Employee Involvement are fundamental to achieving success in organizational OD and in maintaining high levels of Practice Consistent With Procedures and Excellent Housekeeping as visible indicators of performance. Ultimately, organizations are successful through the actions of individuals, who work safely by doing their tasks, the right way, every time. Individual OD is focused on ensuring that individuals have the Knowledge, Commitment, and Awareness to succeed and be safe. Both organizational and individual OD are necessary to achieve high levels of OD and sustained excellent SHE performance.

As Jim Collins writes in *Good to Great* [11]:

Sustained great results depend upon building a culture of self-disciplined people who take disciplined action...

A comprehensive OD program, such as the one described in this paper, can be an important element in the transition from good SHE performance to continued great SHE performance.

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