

## Injury Reduction at Fermilab

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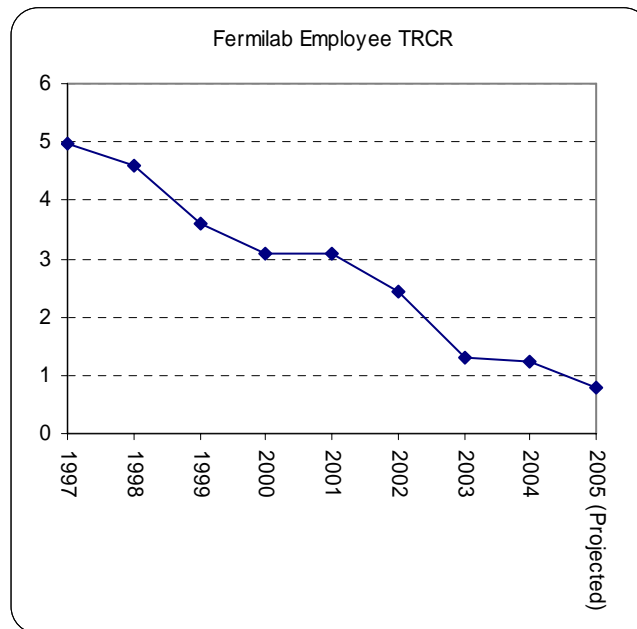
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Success usually comes to those who are too busy to be looking for it.

-- Henry David Thoreau

In a recent DOE Program Review, Fermilab's director presented results of the laboratory's effort to reduce the injury rate over the last decade. The results, shown in the figure below, reveal a consistent and dramatic downward trend in OSHA recordable injuries at Fermilab. The High Energy Physics Program Office has asked Fermilab to report in detail on how the laboratory has achieved the reduction. In fact, the reduction in the injury rate reflects a change in safety culture at Fermilab, which has evolved slowly over this period, due to a series of events, both planned and unplanned. This paper attempts to describe those significant events and analyze how each of them has shaped the safety culture that, in turn, has reduced the rate of injury at Fermilab to its current value.



Some would point to the Tiger Team experience of the early 1990's as the initiating event that began to reshape Fermilab's safety culture. While it is true that this event was unprecedented in terms of raising worker's safety awareness at the time, it carried with it many negative experiences that tended to somewhat offset its positive influence. For the cynics who thought of safety as a bureaucratic and non-value-added obstacle to science, the Tiger Teams approach tended to reinforce that notion.

For Fermilab, the first real opportunity to improve the safety culture came two years later when, in 1995, Fermilab workers participated in the Necessary and Sufficient (N&S) process to identify a "Work Smart" set of safety standards for incorporation into the contract with DOE. The sense of worker empowerment inherent in this process, which we now also recognize as a key principle in Integrated Safety Management (ISM), was something new, energizing and liberating to the Fermilab community. Fermilab's flagship role among the DOE labs in embarking on this process and carrying it through to successful completion, much like its role in carrying out science projects, had the immediate effect of elevating safety to a higher plane of respect and credibility – although not yet equal to the level of science. Certainly, workers believed that the previous non-value-added safety requirements had been eliminated from the contract and replaced with real steps toward an approach comparable to that found in private industry.

The liberation that resulted from the adoption of a Work Smart set of safety standards in 1995 afforded Fermilab the time, resources, and opportunity to look more closely at internal processes, services, and systems with an eye toward self-driven improvement. Many innovative changes, too numerous to delve into here, were initiated between 1995 and 1997. They resulted in better ES&H service, tools, and training. Chief among these innovations was the "tripartite" self-assessment process wherein representatives from the DOE site office, the ES&H Section, and the line organization partnered to review some mutually-agreed upon aspect of safety program implementation. Worker attitude toward safety slowly but surely began shifting in a positive direction. Many additional measures were planned, awaiting time and opportunity for senior management support when Fermilab was overtaken by an unplanned event.

It is often difficult to view a serious accident as anything but a negative and unfortunate occurrence. To a safety director, however, it at once becomes an invaluable opportunity to garner senior management support for initiatives to propel the safety culture forward dramatically and quickly. While no one wishes for accidents, a failure to capitalize on them renders them still more tragic.

For Fermilab, the first major event that served to dramatically transform the safety culture was a 1997 arc-blast accident that sent two subcontract electricians to the hospital with serious burns. This event affected Fermilab in two significant ways. First, it eventually (though not immediately) disabused us of the notion that we did not share responsibility for the safety of our subcontractors. The laboratory's failure to properly supervise and oversee the work of fixed-price subcontract

workers was undeniable as a contributing factor in this accident. The laboratory launched a series of training courses for construction coordinators and task managers who oversee subcontract workers following this event, designed to improve the understanding of safety requirements and responsibilities. These courses continue to evolve and improve to this day.

Second, the preparation of the corrective action plan in response to this accident created the opportunity for us to propose DuPont safety training for Fermilab management. Until this time, there had been little or no training offered to management in how to manage safety. In achieving support for this relatively expensive training proposition, we were extremely fortunate to have recently added an Associate Director for Operations Support within the Directorate who used his prior experience gained elsewhere to persuade others of thinking of this expense as an investment rather than a cost. The training that followed throughout 1998 in a series of separate classes taught by former DuPont plant managers had an immediate and noticeable impact on the worker injury rates. That investment continues to pay dividends.

Although the timing of this management training could not have been predicted since it was a consequence of the aforementioned arc-blast accident, it fortunately coincided with the roll-out of the laboratory's Integrated Safety Management Plan – a requirement of DOE instituted at that time. The principles of ISM have long been ingrained in the safety culture at DuPont, so it was possible to incorporate ISM training into the DuPont safety course without the necessity for redundant training. Not only did that make the training process more efficient, but it helped to avoid the inevitable perception that arises with multiple courses or initiatives – a “flavor of the month.” Having a consistent message about safety is imperative; having too many different initiatives promotes cynicism about all of them.

In a special session of the DuPont safety course held in early 1998, a commitment to reduction in worker injuries was extracted from senior laboratory management. This was significant because it was the first attempt to do so and was not easily accomplished. Until taking the course – and even after having taken it – some senior managers still had difficulty bringing themselves to believe that they could influence the worker injury rate. Why set injury-reduction goals, they reasoned, if it was beyond their ability to control the outcome? Despite this hesitation, they made a leap of faith; they set and publicly announced safety goals. In retrospect, announcing the injury-reduction goals not just for the coming year, but for each of the successive two years, turned out to be a wise decision. It

served notice to the workers that management was committed to this objective and recognized that it would require a sustained, multi-year effort. Quick fixes would not be sufficient; long-term systemic changes would be necessary.

In addition to the DuPont Safety training as well as other improvements in 1998, the laboratory made three other changes that might appear minor, yet when viewed in hindsight, positively influenced Fermilab's safety culture in a major way. The first of these was to restructure the safety committee and its reporting subcommittees so as to include more worker involvement in policy, in procedure development, and in the resolution of technical safety questions. As in the N&S standard-setting process, empowered workers took greater ownership of safety for themselves and for others.

The second change was to begin the distribution of a handout at each weekly senior management meeting listing the injuries reported to the medical department for the preceding week. Previously it was not uncommon for a division head to be unaware that a worker in the division had sustained an injury. Without awareness, managers applied little pressure down the management chain to conduct a thorough investigation of the cause of the injury or to ensure that it would not recur. This weekly distribution almost instantly achieved management awareness and involvement. Senior managers discovered quickly that they were expected to be able to provide an explanation to the director for each injury and what preventive actions had been taken. The elevation of discussion and status of safety performance to the same level of discussion and status of accelerator operations for the first time placed science and safety on the same plane.

The third change was to encourage line managers to begin holding celebrations for safety achievements. Previously, celebrations traditionally recognized scientific achievement. Eventually, over time, it became acceptable, even expected, to treat safety achievement on a par with science milestones. Since that time, many safety celebrations have occurred, with special awards or recognition given to individuals or teams for their contributions to safety.

In late 1998, another unplanned event occurred. Two subcontractor workers were seriously burned when they inadvertently ignited a flammable material they were using to strip a floor at Fermilab. This accident taught us yet another lesson, which was that it is not enough to work out a hazard assessment (HA) with a subcontractor and then leave the contractor to do the work unsupervised. The facts in this accident

revealed that in spite of a reasonably good HA, subcontractors may deviate from the work plan and get into trouble. The lessons from this accident, and others, continue to be used in our attempts to teach task managers that it is impossible to be too inquisitive or too trusting in overseeing the work of subcontract workers.

To capitalize on this accident and address weaknesses in our safety system identified by the tripartite assessments, the laboratory called for a stand-down in order to train all Fermilab and subcontract workers in the process of preparing HA's and in the value of proper work planning.

A number of planned events occurred in 1999 that positively influenced the safety culture. Pushing the reward and recognition theme, the Laboratory Safety Committee created a "Most Improved Safety Performance" annual award to be given to the division or section showing the greatest injury reduction performance in a given year. Eventually, the laboratory created a second award to honor the division or section showing the "best sustained safety performance." Fermilab expended much effort during this year in preparing the laboratory for its preverification review, and eventually, its verification review of ISM implementation by an external DOE review team. Likewise, and simultaneously, significant effort went into the construction completion of the Main Injector and the commissioning of this new accelerator. But the most significant event was the announcement of a new director to lead Fermilab into the 21st century. From the onset, Dr. Witherell announced his intention to carry forward the initiative to reduce injuries that had been started by Dr. Peoples. A message to all employees during his first week on the job left no doubt that he considered this one of his highest obligations as lab director.

When construction of the NuMI Project began in earnest during 2000, Fermilab management and ES&H staff were optimistic that the laboratory was well-prepared for this complex and difficult construction project. Changes in the safety culture were apparent to everyone, and we expected that the NuMI Project would set records for safety achievement. However, we soon began to realize that Fermilab's improved safety culture clashed with that of the construction contractor from the mining industry. In the three years required to complete this major construction project, Fermilab was able to positively influence the safety culture of this contractor, but not before one major accident (resulting in a Type A investigation), several serious injuries, and the insistence that key contractor personnel be replaced on the project. Ironically, this contractor's injury performance improved so dramatically that it was

awarded another large contract in private industry in the Pacific Northwest based on the injury record achieved at Fermilab.

Following the construction accident in mid-2001 resulting in the Type A investigation, Fermilab took additional measures yet again to strengthen and build on the previous improvements to the construction safety program. Although initial measures were taken before his arrival, we were fortunate to have a new Associate Director for Operations Support, with similar qualities to those of his predecessor, take over the helm of steering Fermilab through the final stages of contractual reform and construction contractor management. The new Associate Director also took a more aggressive role in guiding the activities of the LSC subcommittees, walking the work spaces to talk to workers about safety, and promoting safety achievement. Under his leadership, the laboratory achieved significant advances in several technical areas, particularly electrical safety.

In 2002, Fermilab began the distribution of a handout containing key ES&H leading and lagging indicators at the weekly senior management meeting. Like the injury report, this new report had an immediate effect on the injury rates – especially when the indicator results were “colorized” in early 2003 to show level of performance by each division and section. This tool provided senior management its first opportunity to tell at a glance where the problems were that directly or indirectly contributed to Fermilab’s overall injury rate. Pride in organizational performance undoubtedly led several organizations to seek safety improvements through greater line management involvement and peer pressure.

A new medium for raising safety awareness became available in 2003 when Fermilab introduced a daily electronic newsletter with distribution to all workers. Not only was it now possible to communicate safety information in a timely manner but this medium could be used to share success stories and highlight the safety achievements of workers, teams, and organizations. Soon after, the ES&H Section and the Public Affairs office teamed up to produce a weekly “Safety Tip of the Week” column, creating even greater interest and awareness.

Encouraged by its success and now convinced of its ability to shape its safety future, Fermilab senior management took the bold step of preparing its first Annual ES&H Plan in 2004. This plan established a vision for the ES&H Program, identified goals and captured action plans for the continuous improvement of worker safety as well as environmental protection. The laboratory intends to use this plan as the basis for a more vigorous self-assessment plan in 2005.

As we look back over the journey we have taken over the last decade, we recognize that the combination of planned and unplanned events have shaped our safety culture into its current form. (See Appendix A.) It is now commonly accepted that Fermilab's safety culture has changed. The Fermilab community now recognizes that it cannot achieve excellence in science without excellence in safety. Although many workers in line and support staff organizations have contributed significantly, leadership at the Directorate and Division Head level has had the greatest impact on the behavioral transformation of workers attitudes and way of thinking about safety. There is little doubt that the success in reducing injuries is directly correlated to the degree of involvement and importance attached to the subject by the highest levels of Fermilab leadership.

## Appendix A

Timeline	
Jul-95	Work Smart Set approved
May-96	Safety subcommittees need overhaul (most "meet only if necessary")
Jun-96	Reorganize the central ES&H training function
Oct-96	ES&H Web page launched; paperless FESHM, & links to ES&H tools
Jan-97	Begin Tripartite Assessment Process
Apr-97	First Draft of ISM Prepared
Mar-97	Reorganize & revitalize safety committee structure; get ES&H staff working together
May-97	AUI loses contract at BNL; Pena cites imbalance between science & safety; Peoples addresses FNAL workforce
Jun-97	George Robertson named new Associate Director for Operations Support
Jun-97	Regular discussion of injuries & safety performance at Scheduling Meetings
Oct-97	Arc Blast Accident; Contractor & Electrical safety addressed; impetus for DuPont Training supported by Directorate
Feb-98	Began DuPont Training with Sr. Mgmt; First discussion of setting goals (for next three years!).
Feb-98	With Robertson's leadership, begin more formal training of task managers
Mar-98	Annual ESHEC format requires each D/S Head to make presentation
Mar-98	Dr. Peoples addresses LSC; LSC minutes reflect pride taken in safety records
Mar-98	Begin Conducting DuPont Training for Managers & Supervisors/ISM Principles
Apr-98	Begin discussing each injury at weekly Scheduling Meeting
May-98	First round of safety celebrations using URA money
Oct-98	Medical Department transferred from LSS to ES&HS
Oct-98	Kitchen Fire Accident; Emphasis on HA's & Work Planning
Dec-98	Lab Stand-down to train everyone & subcontractors on HA's

Jan-99	Dr. Foxen hired; better case management
Feb-99	Fermi News story about progress in meeting lab-wide goals to reduce DART rate; goals for next two years
Mar-99	LSC Awards to D/S for Most Improved Safety Performance
Apr-99	Pre-Verification of ISM by DOE
Jul-99	Main Injector commissioned
Jul-99	John Peoples/Mike Witherell Transition
Sep-99	Verification of ISM by DOE
Feb-00	Fermi News story about progress in meeting lab-wide goals to reduce DART rate; goal for next year
May-00	NuMI Construction Prep work begins
Aug-00	New LSC format emphasizing regular periodic reports by subcommittees
2001	NuMI Construction Starts in earnest
Jun-01	Drilling rig accident; even greater emphasis on construction safety oversight; many changes
Jan-02	Jed Brown named new Associate Director for Operations Support
Sep-02	Introduce leading/lagging indicators
Nov-02	Electrical Safety Subcommittee begins deliberations on NFPA 70E
Feb-03	Introduce color-coded leading/lagging indicator performance charts
May-03	First organization (PPD) to go over a million hours without a DART case (celebration)
Jul-03	Introduce polo shirt awards w/ completed picture.
Jul-03	Fermi Today launched; provides forum for regular communication on safety
Aug-03	Lab surpasses one year without injury case involving days away from work (a first)
Dec-03	Lab completes first major shutdown w/out injuries; attributed to good planning
Feb-04	Safety Tip of the Week launched in Fermi Today
Feb-05	First Annual Safety Plan published; contains vision for ES&H Program & lays out plans for improvement