



Safety Performance of Security Forces at the Department of Energy Facilities



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Safety Performance of Security Forces at the Department of Energy Facilities

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1. Introduction

The Department of Energy (DOE) operates many nuclear and non-nuclear facilities and National Laboratories located throughout the United States. DOE employs a security force whose mission is to protect DOE sites from theft, sabotage, and other hostile acts that could adversely impact national security, worker and public safety, and property. After September 11, 2001, the demands and responsibilities of DOE's security guards increased significantly; most notably at nuclear facilities where the threat of terrorism or nuclear materials theft has increased. The work of security forces can often be stressful, physically demanding, and may expose them to radiological or chemical hazards in addition to the usual risks involved in their work. DOE protective forces personnel must conduct their work safely while maintaining site security.

The scope of this report is limited to evaluating the safety performance of DOE's security contractors and does not address safeguards and security measures. It examines the safety performance of the sites or facilities recognized by DOE's Voluntary Protection Program (VPP). Some references cited in Appendix A describe issues and concerns relative to safeguards and security measures.

The DOE VPP, established in January 1994 and modeled after the Occupational Safety and Health Administration (OSHA) VPP, promotes safety and health excellence through cooperative efforts between labor, management, and site entities. DOE has also formed partnerships with other Federal agencies and with the private sector for advancing and sharing its VPP experiences and preparing for program challenges and growth. As an example, the DOE's VPP headquarters team is mentoring the Department of Defense as they work to establish a Department-wide VPP. Additionally, VPP is growing internationally. As it develops, the DOE VPP has become a model for foreign governments and international businesses seeking to improve the safety and health performance of their citizens and workers. The DOE's VPP headquarters team is assisting Ireland in establishing a VPP and working with Finland in their capacity as advisors to the European Union on occupational safety and health and implementation of VPP.

The DOE utilizes its VPP as a method to promote improved safety and health performance through public recognition of outstanding programs. Although modeled after OSHA's program, DOE's VPP is broader in scope because of the type and complexity of work within DOE, including elements of radiation protection, nuclear safety, and emergency management. The DOE VPP provides proven benefits to participating sites, the most notable of which is an average annual cost avoidance of over \$250,000 for large sites. In addition, VPP sites often enjoy improved labor-management relations, reduced workplace injuries and illnesses, increased employee involvement, improved morale, reduced absenteeism, and public recognition.

The DOE VPP consists of three programs or levels of recognition: Star, Merit, and Demonstration. Contractors with outstanding safety and health programs receive Star recognition, the highest achievement level. Contractors with highly effective programs who commit themselves to attain Star status within five years may apply for Merit status. The rarely used Demonstration program allows DOE to recognize contractors who demonstrate safety excellence

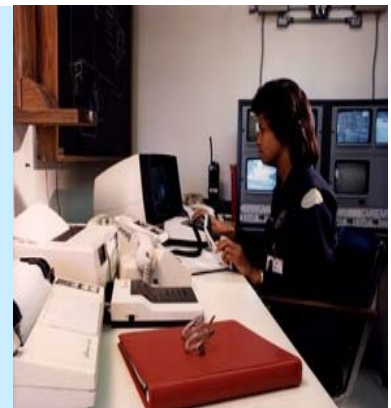
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in unusual situations that require additional information for Star status to be approved. Once approved, Star sites are reevaluated every three years, while Merit and Demonstration sites are evaluated annually or until upgraded to Star status.

The DOE VPP consists of five major elements or tenets: Management Leadership, Employee Involvement, Work Site Analysis, Hazard Prevention and Control, and Safety and Health Training. The purpose of on-site evaluations is to verify that the safety programs satisfy VPP requirements. In addition to on-site visits, the DOE VPP team within the Office of Environment, Safety and Health (EH) reviews the annual self-evaluation reports submitted by the contractors to ensure that the sites are maintaining continuous improvement. These annual reports are comprehensive and candid in identifying strengths and weaknesses in their programs. For example, the following statement from the Protection Technology Hanford (PTH) 2004 Annual Report describes the strengths and areas for improvement.

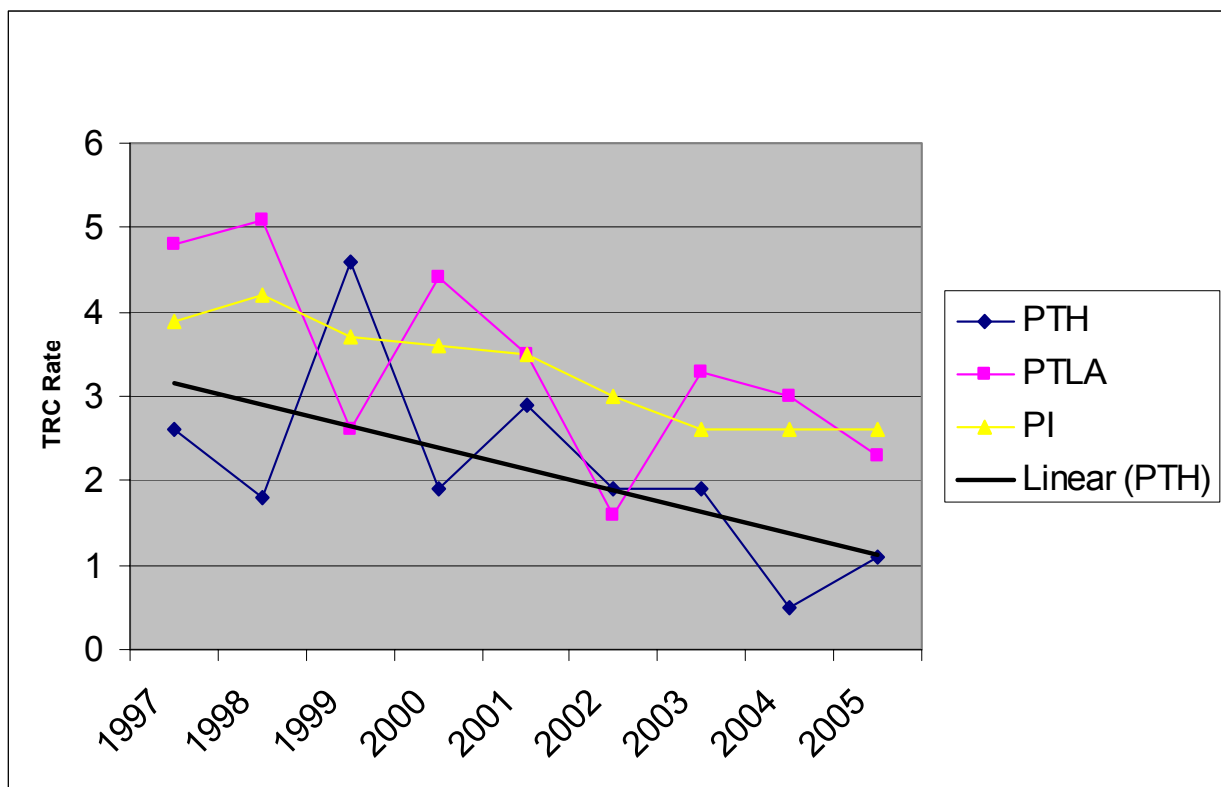
“This assessment concluded that PTH is satisfactorily maintaining and sustaining its Environment, Safety and Health (ES&H) program using the core functions and guiding principles of Integrated Safety Management System (ISMS). ES&H policies are established that are consistent with the Department of Energy (DOE) policy, and these are communicated to SAS (Safety and Security) employees. An evaluation of the SAS ES&H Program performed by representatives from all SAS workgroups during the Employee Safety Refocus Workshop (ESRW), held in August 2003, concluded that all the elements of a successful safety program were in place. The benefits of ISMS are recognized and PTH continues to instill this throughout the workplace. The success of this is extolled by employees admitting that the safety culture is being carried home with them to their families and community. This assessment identified 50 areas of strength and 43 areas for improvement. Although areas for improvement are identified, the majority of these, when objectively evaluated, are minor in nature, and employee task teams are already working to address them. The report makes 12 recommendations, five of which are administrative in nature. Continuing to make progress on the recommendations made by the ESRW (first of the 12 recommendations made in this report) and effective communications will have the greatest impact on the health and safety of the SAS workforce.”

Protection Technology Hanford (PTH) is a subsidiary of Day & Zimmerman, a company founded in 1901 with corporate offices in Philadelphia, PA, and operating from more than 150 worldwide locations including two DOE facilities at Hanford and Los Alamos. PTH has become a subcontractor to Fluor Hanford, Inc. at Richland, WA. PTH is responsible for management, operation, and integration of all safeguards and security services of the Hanford Site except Pacific Northwest National Laboratory. These services include functional design, testing, and upgrade of safeguards and security systems. Other services include material control and accountability, physical security, personnel security, technical security, information security (classified and unclassified), vulnerability assessments, and the Hanford Patrol.



This report, presents the analysis of current data and other technical materials, which illustrate how an organization’s participation in the VPP affects its injury and illness rates. The DOE’s PTH contractor is used here as an example. Figure 1 illustrates PTH’s Total Recordable Case (TRC) rates since 1997. The following data shown in Figure 1 and Table 1 for PTH and Protection Technology Los Alamos (PTLA) were obtained from DOE’s Computerized Accident/Incident Reporting System (CAIRS) and the Bureau Labor Statistics for private industry.

Figure 1. TRC Rates at PTH, PTLA and Private Industry



PTH and PTLA are both subsidiaries of Day & Zimmerman. PTLA has been operating at Los Alamos since 1992 with a \$100 million security contract. PTLA has a larger work force (approximately 645 guards) compared to PTH’s workforce of 360 guards. Both organizations comply with the same DOE protective force requirements and the safety policies of Day & Zimmerman. PTLA is not a VPP site, where as PTH is a VPP STAR site having obtained this recognition in 2000 from DOE, based on their injury and illness rates and the safety culture developed by VPP principles. The data in Table 1 indicates that PTH’s injury and illness rates were consistently below private industry during 2000-2005, and that the rates were significantly below PTLA’s rates during this period with the exception of the year 2002. The graph in Figure 1 suggests that the trend of TRC rates at PTH is downward consistent with private industry.

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Table 1. Total Recordable Case Rates (1997-2005) at PTH and PTLA

Year	PTH TRC Rate	PTLA TRC Rate	Private Industry TRC Rate
1997	2.6	4.8	3.9
1998	1.8	5.1	4.2
1999	4.6	2.6	3.7
2000	1.9	4.4	3.6
2001	2.9	3.5	3.5
2002	1.9	1.6	3.0
2003	1.9	3.3	2.6
2004	0.5	3.0	2.6
2005	1.1	2.3	NA

Note: 2005 data are based on the first two quarters of 2005, 3rd and 4th Quarter data were not available in CAIRS at the time of this analysis. Private industry data in Column 4 corresponds to the SIC 7380 rates up to the year 2003 and NAICS 5616 data for the years 2004-2005. Bureau of Labor Statistics has not yet published the NAICS data for the year 2005.

The average TRC rate for the years 1997-1999, three years prior to achieving the VPP STAR, is 3.0. Similarly, the average TRC rate after obtaining the STAR (2000-2005) is 1.7. This shows that PTH reduced the injury and illness rates by 43% subsequent to the implementation of DOE VPP. Similar reductions in Lost Work Days or Days Away, Restricted or Transferred (DART) case rates were also noted from the CAIRS database.



2. Background Information

Several DOE sites, such as Hanford, Nevada, and Savannah River, are expansive and cover thousands of acres. In order to protect such large sites, security forces personnel must drive tens of thousands of miles annually; therefore, vehicular accidents are a major concern.

Physical exercises and drills conducted by security forces personnel are very demanding and tasks have contributed significantly to injuries and illnesses. The most severe of these occurred in 1995 at Savannah River Site, when a Special Response Team member received fatal injuries from a fall from a rappelling tower during a training exercise. Firearm safety is another major issue confronting security forces personnel. On several occasions, guards have inadvertently shot themselves or others, sometimes due to lack of proper firearm training and/or poor execution of operating procedures. Compounding the firearm safety issues is the fact that some training facilities are not located on site (e.g., at Strategic Petroleum Reserve facilities), which makes it more difficult for the guards to obtain the necessary training or live-fire experience.



Financial resources, including salaries, available to the security contractors at some sites may not be sufficient to retain quality workers. Our review noted that a disparity appeared to exist in salaries between the guards at nuclear and non-nuclear facilities. The aging DOE workforce and the recruitment of younger security personnel is an issue that should be regularly addressed by DOE at the Headquarters and Field Office levels. Additional incentives may need to be provided to attract younger, high-quality workers. A recent report, *Federal Law Enforcement Pay and Benefits – A Report to Congress*, July 2004, SHRP/CEFSR/RG-01 (http://www.opm.gov/oca/LEO_Report04.pdf), published by the Office of Personnel Management (OPM), is a study comparing the job classifications, pay, and benefits of Federal law enforcement officers. OPM found circumstances among Federal law enforcement officers at various agencies similar to our findings. They recommended that Congress establish a Government-wide framework for law enforcement personnel to ensure the elimination of such disparities.

Security guards are often the first responders to site radiological accidents. If security forces are not properly trained to wear personal protective equipment (PPE) or to respond to radiological emergencies, their risk of exposure and subsequent illness increases significantly.

At several DOE sites, the security forces formed unions and associations to enhance their safety programs and performance. These unions and associations utilize their well-defined organizational lines of communication to keep workers better informed about safety and health issues and re-enforce existing communications and training. For example, PTH and the Hanford Guards Union

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work closely to improve safety at the site. They also participate in safety programs such as VPP. This report identifies the contractors participating directly as VPP Star sites or participating within a Star site; for example, the security forces at the Honeywell FM&T, Kansas City Plant. At some sites, more than one security contractor company is used by DOE, and at other places a single contractor covers all site facilities (e.g., at Hanford, PTH supports Fluor Hanford Inc., Bechtel Hanford, and several other smaller contractors at the site).

In general, injury and illness rates of the security forces staff are higher than those of other DOE contractors. This is also true in private industry. However, during the past few years, the rates have improved significantly, as evidenced by data available from DOE and from the Bureau of Labor Statistics. Further discussion of this topic follows in Section 4 of this report.

Historically, security contractors' safety performance has lagged somewhat behind that of other DOE operational types, as shown by the analysis we conducted in 1985 (see Appendix B). However, during the past 20 years security contractors' performance improved significantly because of their implementation of various safety programs such as VPP, ISMS, and Behavior-Based Safety. At least two security contractors (PTH and Wackenhut Nevada) have achieved VPP Star status, and three others (Santa Fe Security at WIPP, Strategic Petroleum Reserve Security, and Wackenhut Oak Ridge) are in the process of applying for DOE VPP recognition.



3. Comparison with Private Industry Security Contractors

In the past, the task of selecting the appropriate Standard Industrial Classification (SIC) code for comparison to private sector operations was extremely difficult if not altogether impossible. Previously, DOE attempted to utilize at least two different SIC's for comparison: SIC 9221, "Police Protection" and SIC 7380 "Detective, Guard, and Armored Car Services."

None of these offered an acceptable comparison. The Bureau of Labor Statistics (BLS) collected data for SIC 7380 from a wide range of business-related service employers, which significantly diluted the specificity of the sample. Review of data collected for SIC 7380 and discussions with BLS officials revealed that few, if any, of those surveyed could be compared to a paramilitary security organization such as those utilized by DOE. In addition, BLS did not collect data for SIC 9221, "Police Protection," since police agencies are public sector employers exempt from reporting requirements. In some cases, DOE used voluntarily reported data from the National Safety Council for comparisons of private sector performance to DOE security force performance.

The new North American Industry Classification System (NAICS) provides more flexible and appropriate codes for comparing injury and illness rates of DOE sites with those of private industry. NAICS code 561612 "Security Guards and Patrols Services," would be the appropriate code for comparison, however, BLS did not collect or publish data for private industry at this level of detail. Therefore, the closest code for which BLS data are available, NAICS 5616 "Investigation and Security Services," which includes guards, armored car and patrol services, was used for comparison purposes. Private industry's TRC and DART rates for 2004 for NAICS code 5616 are 2.6 and 1.2, respectively. The TRC and DART rates of the VPP STAR sites PTH and WSI-Nevada, are below private industry rates.



4. Injury and Illness Data

DOE’s Computerized Accident/Incident Reporting System (CAIRS) is the main data source for safety performance. Forty-six organizations are represented in the CAIRS database under Operation Type code 9 (Security and Protective Forces). Of these 46 organizations, 4 are contractors to Naval Reactors facilities, and 17 are discontinued or inactive organizations. Six of the 25 remaining organizations were not analyzed in this study because they employ less than 20 employees. The remaining 19 organizations were selected for this analysis. Table 2 lists the CAIRS organization codes of the 19 selected security contractor organizations .

Table 2. CAIRS Organization Codes of DOE Security Contractors

Name of Contractor	CAIRS Organization Code	Number of Employees*	VPP status
Argonne National Laboratory (ANL) -East	1000719	40	Not a VPP site
Argonne National Laboratory (ANL)- West	1001009	67	Not a VPP site
Bechtel BWXT Idaho (BBWI - INL)	3005009	280	VPP Star site
Brookhaven National Laboratory (BNL)	1001009	55	Not a VPP site
BWXT - Pantex	0515009	807	Not a VPP site
Fermi National Accelerator Laboratory (Fermi Lab) Security	1002509	25	Not a VPP site
Fluor Fernald	4523709	22	VPP Star site
Honeywell Federal Manufacturing and Technologies (FM&T), Kansas City Plant (KCP)	0531009	118	VPP Star site
Lawrence Livermore National Laboratory (LLNL) Security	0580409	365	Not a VPP site
Protection Services – Strategic Petroleum Reserves (SPR) 4 sites in Texas and Louisiana	9609009	260	VPP Star sites
Protection Technology Hanford (PTH)	7505099	369	VPP site
Protection Technology Los Alamos (PTLA)	0544809	645	Not a VPP site
Sandia Security	0578009	349	Not a VPP site
Santa Fe Protection Services, Waste Isolation Pilot Plant (WIPP)	070319	30	VPP Star site
Wackenhut Services Inc. - Nevada (WSI - NV)	0529009	302	VPP Star site
Wackenhut Services Inc. - Y-12 (WSI – Y-12)	0558909	512	Not a VPP site
West Valley	456909	21	VPP Star site
WSI – Oak Ridge (WSI – OR)	4007509	376	Not a VPP site
WSI - Savannah River (WSI - SR)	8509509	935	VPP Star site

**Approximate number of employees derived from Total Work hours in Table 3
(Column 3 divided by 2000)*

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Data for the injury and illness rates and total work hours for the selected 19 security contractors listed above were collected from CAIRS for the years 1995 through the 2nd quarter of 2005.

Table 3 compares the changes in total work hours among security contractors before and after September 11, 2001. As Table 3 illustrates, DOE security contractors generally increased their total work hours during this period. Increases may have been due to perceived potential threats from terrorist activities after September 11, 2001.

Table 3. Total Security Forces Average Work Hours Before and After September 11, 2001, by Contractor

Contractor Name	Work Hours per Year (in thousands) before 9/11	Work Hours per Year (in thousands) after 9/11 ¹	Difference	Percentage Difference
ANL East	41	81	+40	97.6%
ANL West	117	134	+17	14.5%
BBWI - INL	775	561		
BNL	128	111	-17	-13.2%
BWXT - Pantex	1,217	1,614	+397	32.6%
Fermi Lab Security	40	49	+9	22.5%
Fluor Fernald ³	62	45	-17	-27.4%
Honeywell FM&T, Kansas City Plant (KCP)	226	235	+9	4%
LLNL Security	620	730	+110	17.7%
PTLA	1,139	1,291	+152	13%
PTH	666	601	-65	-9.7%
Sandia Security	706	698	-8	-1%
Santa Fe Protection Services - (WIPP)	55	60	+5	9%
SPR	381	519	+138	36%
West Valley ³	44	43	-1	-2.2%
WSI - OR ²	1,343	952		
WSI - Y-12 ²	1,342	1,023		
WSI - NV	527	604	+77	14.6%
WSI - SR	1,648	1,869	+221	13.4%

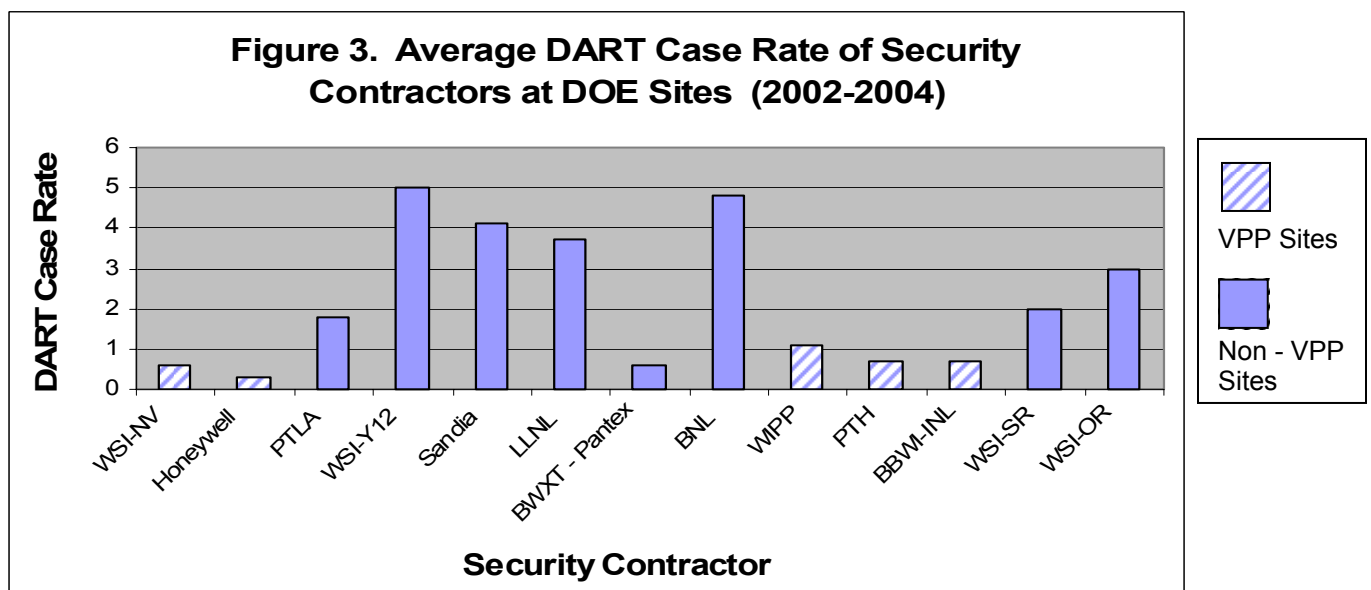
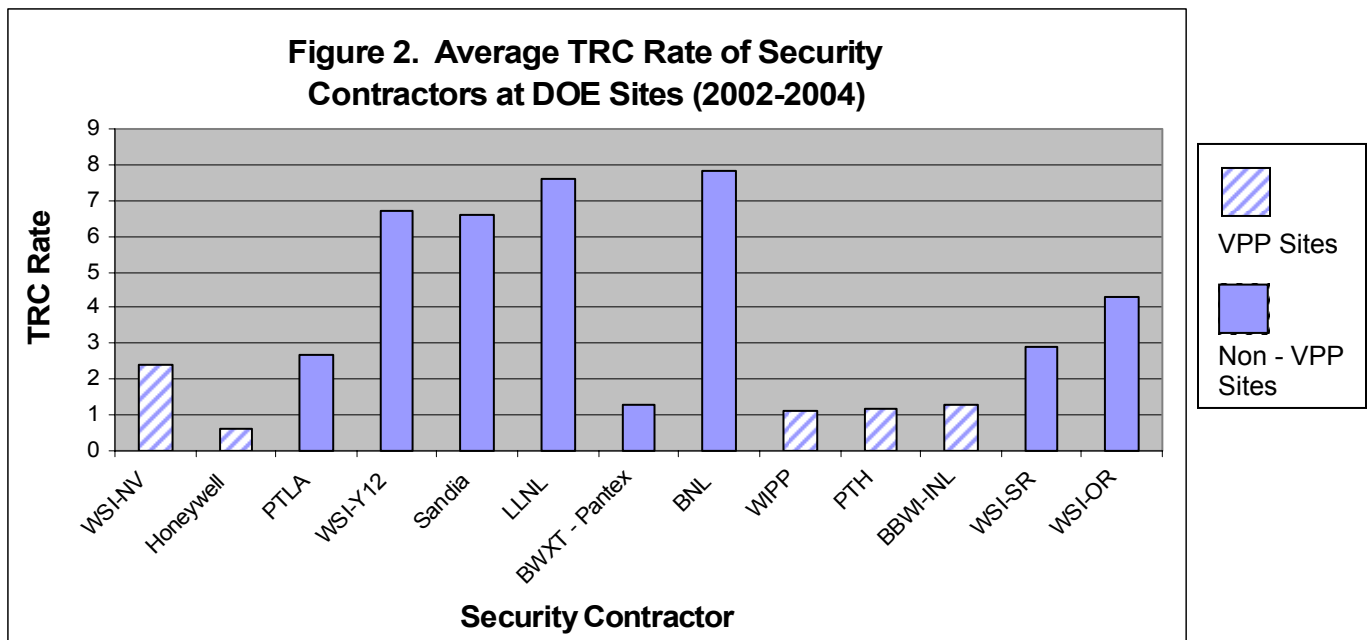
Note 1. Work hours per year in columns 2 and 3 are three-year averages (1999-2001 and 2002 - 2004).

Note 2. Security services in Oak Ridge were split when Y-12 became part of the National Nuclear Security Administration (NNSA) in 2000. WSI reports under two codes: one for DOE Oak Ridge Operations and one for Y-12. The number of security patrol officers needed at Y-12 is significantly greater than that needed for DOE Oak Ridge. Due to these changes in the organization, it is not appropriate to calculate the “difference” in column 4.

Note 3. Fluor Fernald and West Valley are reducing their workforces and they are scheduled to be closed after completing site cleanup.

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Increased work hours and job stress notwithstanding, DOE security forces have been able to maintain low injury rates and their safety performance has continued to be excellent. Figure 2 shows the average TRC rates and Figure 3 shows the DART case rates of the major security contractors for the years after September 11, 2001 (2002-2004). In addition to the significant increase in work hours for many contractors, training at many of these facilities has become more rigorous and demanding. For example, WSI-NV is in the process of implementing a Security Police Officer (SPO) III Program to add an additional level of intensity in security forces training. Nonetheless, Table 4 on injury and illness rates of security contractors shows a continued high level of commitment to employee safety and health. Further statistical analysis of injury and illness data is provided in Section 4.



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DOE security contractors with VPP Star status have achieved lower injury and illness rates than most of the non-VPP sites in DOE. As Figure 2 illustrates, site security contractors such as Honeywell FM&T Kansas City and the contractors at WIPP have lower injury rates than those at the non-VPP sites such as LLNL, Sandia, Oak Ridge, and BNL; this suggests that the security contractors at non-VPP sites such as LLNL or BNL could benefit from adopting VPP. The average TRC rate during 1999-2001 at BWXT Pantex was 4.4 and the DART case rate was 2.6. However, this security contractor made significant improvements during 2002-2004 as evident by figures 2 and 3 and implies that BWXT Pantex is eligible for apply for DOE VPP recognition provided it satisfies other VPP criteria.

Table 4. Injury & Illness Rates of Security Contractors (1999-2001 vs. 2002-2004)

Contractor Name	TRC Rate Before 9/11	TRC Rate After 9/11	DART Rate Before 9/11	DART Rate After 9/11
ANL East	0	0.8	0	0.8
ANL West	4.6	0.5	2.3	0
BBWI - INL*	3.9	1.3	1.6	0.7
BNL	6.2	7.8	5.2	4.8
BWXT - Pantex	4.4	1.3	2.6	0.6
Fermi Lab Security	3.3	2.7	1.6	0
Fluor Fernald* **	2.1	1.5	0	1.5
Honeywell FM&T(KCP) *	3.0	0.6	1.2	0.3
LLNL Security	12.2	7.6	3.9	3.7
PTLA	3.5	2.7	2.9	1.8
PTH*	3.1	1.2	1.0	0.7
Sandia Security	5.7	6.6	2.9	4.1
Santa Fe Protection Services - WIPP*	3.6	1.1	2.4	1.1
SPR *	2.6	2.4	1.4	1.0
West Valley* **	7.5	1.6	4.5	0
WSI - NV*	2.8	2.4	2.3	2.2
WSI - SR	5.0	2.9	3.0	2.0
WSI - Y-12		6.7		5.0
WSI-OR	6.5	4.3	4.1	3.0

Data Source: CAIRS

Note: The rates in columns 1 and 3 are the three-year (1999-2001) averages.

The rates in Column 2 and 4 are the three-year (2002-2004) averages.

*Denotes VPP Star sites or subcontractors to VPP Star sites.

**Fluor Fernald and West Valley sites are scheduled for closure within two years.

NNSA Security Contractors



Established by Congress in 2000, NNSA is a semi-autonomous agency within the U.S. Department of Energy responsible for enhancing national security through the military application of nuclear energy. NNSA maintains and enhances the safety, security, reliability, and performance of the U.S. nuclear weapons stockpile without nuclear testing; works to reduce global danger from weapons of mass destruction; provides the U.S. Navy with safe and effective nuclear propulsion; and responds to nuclear and radiological emergencies in the U.S. and abroad.

Table 5. Injury & Illness Rates of Selected NNSA Security Contractors (2002-2004) Average

NNSA Security Contractors	TRC Rate	DART Rate
BWXT – Pantex	2.6	0.6
Honeywell FM&T (KCP)*	0.6	0.3
LLNL Security	7.6	3.7
PTLA	2.7	1.8
Sandia Security	6.6	4.1
WSI - Y-12	6.7	5.0
WSI-NV*	2.4	0.6
Private Industry	2.6	1.2

* VPP participants or subcontractors to VPP contractors

It is possible that the work activities and demands as well as the actual physical environment at some NNSA sites and National Laboratories engaged in defense work present a substantially higher degree of occupational risk. For example, it is possible that training activities such as force-on-force exercises for security personnel present a substantial increase in the potential for injuries at these sites. Accordingly, comparison of the injury and illness rates of security personnel at these facilities to the rates for personnel at sites engaged in environmental remediation or other non-defense related activities may not be as meaningful as the comparison of like operations. Further research and analysis will be required in order to determine if this is the case.

Office of Science Security Contractors

DOE is the single largest Federal government supporter of basic research in the physical sciences in the United States, providing more than 40 percent of total Federal funding for this vital area. It oversees, and is the principal Federal funding agency of, the Nation's research programs in high-energy physics, nuclear physics, and fusion energy sciences. DOE manages fundamental research programs in basic energy sciences, biological and environmental sciences, computational science, and materials and chemical sciences.

Table 6. Injury & Illness Rates of Selected Office of Science Security Contractors (2002-2004) Average

Office of Science Site	TRC Rate	DART Rate
ANL-East	0.8	0.8
BNL	7.8	4.8
Fermi Lab Security	2.7	0
Private Industry	2.6	1.2



Office of Environmental Management (EM) Security Contractors

Whether a small spill or a large disposal area, EM takes actions to protect human health and safety. EM cleans up contaminated soil using a variety of methods: removal and disposal in a specialized facility; on-site processing to remove contaminants; capping in place to prevent further contamination; and natural remedies such as using native plants to absorb contaminants.

Table 7. Injury & Illness Rates of Selected Office of Environmental Management Security Contractors (2002-2004) Average

Office of EM Security Site	TRC Rate	DART Rate
BBW- INL*	1.3	0.7
Fluor Fernald*	1.5	1.5
PTH*	1.4	0.9
Santa Fe Protection Services - WIPP*	1.1	1.1
West Valley*	1.6	0
Private Industry	2.6	1.2

* VPP participants or subcontractors to VPP contractors

5. Statistical Analysis of Safety Data

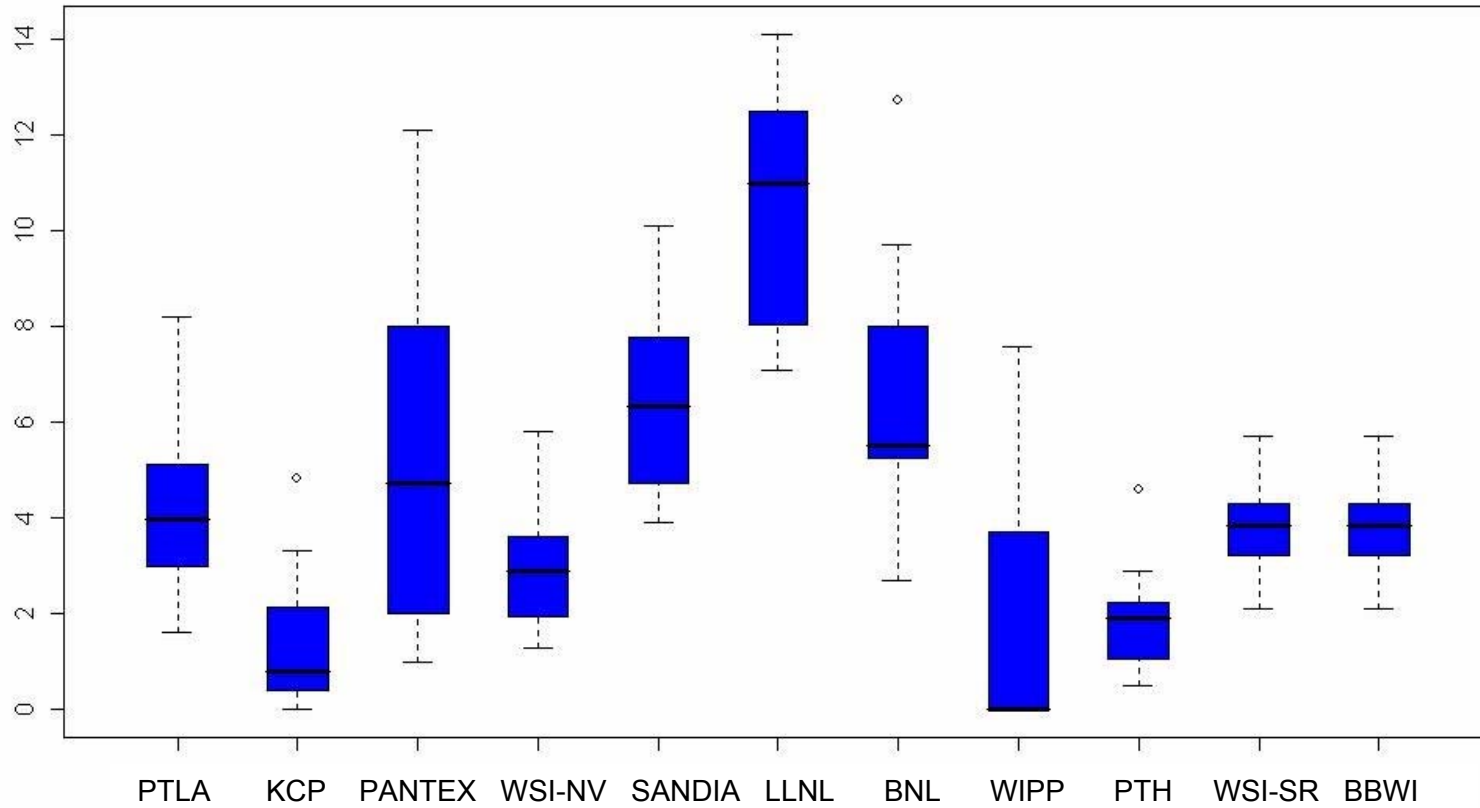
This section includes the graphs and statistical tests used to analyze the occupational safety data of DOE security forces. The statistical techniques include box plots, and paired t-tests. These tests are standard statistical methods widely used by analysts to perform data mining and to conduct tests of hypothesis. The computer software utilized for this analysis is called “R,” a free software program based on S or S-Plus that was developed by Bell Laboratories in New Jersey (see *Modern Applied Statistics with S* by W.N. Venables and R.D. Ripley, Springer Publishing Co, 4th Edition, 1999).

One method of summarizing the distribution of data is the box plot developed by John W. Tukey (see Tukey’s *Exploratory Data Analysis*, Addison Wesley Publishing Company, 1977, or *Visualizing Data*, by William Cleveland, AT&T Bell Laboratories, Murray Hill, NJ). In Figure 4, box plots of the annual data for the years 1995 to 2005, 2nd quarter are presented for 11 major DOE security contractors. The filled circle inside the box is the median, and the upper and lower ends of the box are upper and lower quartiles (75th and 25th percentiles). The “whiskers” shown above and below the boxes are calculated as 1.5 times the inter quartile range. The unusual data points falling outside this range are shown as “out tiers.” The center of the box is the median of the 11 TRC rate values for each facility or site shown to describe the variation in the data. The box plot for WSI-SR shows the least variation or spread in the data. WSI-SR was a VPP Star site until recently, and it is possible that the site continued its safety culture and practicing the VPP program without formally being a participant. The box plots for Sandia, LLNL, and BNL suggest that there are opportunities for these laboratories to improve safety performance.

Figure 4 plots the TRC data of 11 major DOE security contractors by using the above technique to compare their safety performance. The graph suggests that the TRC rates of PTH, Honeywell FM&T (KCP), WSI- NV, Santa Fe Protection Services (WIPP), are among the lowest in the DOE security forces. These sites are VPP participants. On the other hand, sites such as Sandia, PTLA, LLNL, and BNL, which are not VPP sites, exhibited higher injury rates from 1995 through 2005. One exception to this is the excellent safety performance of BWXT Security at Pantex. However, the data at Pantex exhibit higher variation or spread than the VPP sites.

Finally, the TRC and DART rate data for the years before and after September 11, 2001, (presented in Table 4) were considered to determine any differences in safety performance. The p-value (0.01893) for TRC suggests rejecting the alternate hypothesis that the difference is zero with 95 percent confidence. Similarly, the null hypothesis that there is a difference between the DART rates before September 11, 2001 and after September 11, 2001, can be rejected at a 99 percent confidence level. This implies that the safety performance of the security guards at DOE facilities did not diminish after September 11, 2001.

Figure 4. Box Plots of TRC Rates of Major DOE Security Contractors, 1995-2005



Note: KCP, WSI-NV, WIPP, WSI-SR and BBWI are VPP participants or contractors at a VPP site

**Table 8. t-test
Statistical tests for the difference between injury rates of before and after
September 11, 2001***

<p>Paired t-test data: DART_before and DART_after t = 2.5786, df = 18, p-value = 0.01893 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: 0.1462465 1.4327009 sample estimates: mean of the differences 0.7894737</p>
<p>Paired t-test data: TRC_before and TRC_after t = 3.4895, df = 18, p-value = 0.002617 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: 0.632506 2.546441 sample estimates: mean of the differences 1.589474</p>

* Considered the data of the 19 selected security contractors

6. Impact of VPP on Safety Performance

VPP's impact on safety performance at DOE sites can be measured in two distinct areas: financial (e.g., health care costs) and non-financial (e.g., injury and illness rates, employee morale). For this study, injury and illness rates for VPP and non-VPP DOE security contractors were specifically viewed and compared with those of private industry. However, injury and illness rates as they relate specifically to an aging security workforce were not addressed. This issue requires further examination in view of an aging population in DOE.

The review of annual reports, self-assessments, and on site visits of participating sites also provided the opportunity to evaluate the impact VPP has on safety performance as it relates to employees and operations in the workplace.

Impact on Employees: Managers and Workers

Manager Commitment and Leadership

This study found senior management to be very supportive of the VPP program and an integral part of its success. The VPP program has been instrumental in fostering open and expanded communications between management and workers. Many employees often indicated that prior to VPP they rarely saw top managers in the workplace. However, since the managers have become involved with VPP, it has been likely to see them participate in safety inspections and walk-a-rounds, attend safety committee meetings, and informally speak with employees on a number of general topics. Employees commented that seeing top managers in the workplace gives them a sense that management cares for them.

Although managers believe that becoming more visible in the worksite and listening to employee concerns is an important part of building and maintaining trust among workers, they are also required to be more responsive to measurable performance indicators such as behaviors of first-line supervisors. Therefore, achieving and maintaining VPP status is a team effort at all levels.

Managers at VPP sites overwhelmingly believe in leading by example and that immediate supervisors greatly influence their workers. Ultimately, if supervisors and managers embrace VPP, workers will also embrace it.

Employee Involvement

Most organizations realize the impact workers' attitudes and perceptions have on productivity. This study found that VPP sites take major strides in assuring employees of their importance to facility missions and goals. VPP sites maintain a high level of manager/worker trust that ultimately translates into improved worker attitudes toward performance, motivation, and productivity. Interviews revealed employees feel engaged and part of the decision-making

processes that pertain to their safety and health. Employees indicated that they are given the opportunity to serve on various safety and health committees and are often members of safety inspection teams. They may also serve on accident investigation teams, if needed.

Employees at all levels consistently feel comfortable going to their supervisors and managers with safety concerns and suggestions to improve the work environment as well as their own performance.

This study also found that VPP sites have recognition and disciplinary programs in place that are clearly understood at all levels. Employees that have worked at both VPP and non-VPP sites often noted that recognition and disciplinary programs are believed to be executed with consistency and fairness at the VPP sites. Incentive programs, utilized to motivate employees to maintain peak physical condition, are also in place at some VPP sites. These programs provide secondary benefits that build and strengthen employee morale.

Impact on Operations in the Workplace: Hazard Recognition, Worksite Analysis, and Safety and Health Training

The core of VPP (in security performance operations) is to ensure employees work in a productive and safe environment. Hazard recognition, worksite analysis, and safety and health training all directly impact security performance operations through continuous improvement of the overall safety and health program.

Hazard Recognition and Worksite Analysis

VPP sites have in place a culture that encourages workers to identify and report hazards without the fear of reprisals from management. Employees can report their concerns through various communications. Examples range from employees exercising their right to stop work if they feel the work is unsafe or may potentially create a hazard, reporting a concern through a safety committee or a supervisor, or reporting anonymously through an employee concern box. Although these vehicles are available and are widely used throughout non-VPP DOE and private industry facilities, interviews have indicated that employees at VPP sites are apt to use these mechanisms more freely because of the trust established between worker and manager. Employees often commented that there has been a positive change in their attitude and a greater desire to report safety concerns at a VPP site than at a non-VPP site. In most cases, once a concern was made known, feedback was either said to be immediate or in an acceptable timely manner at VPP sites.

Employees often remarked that if lessons learned from an event could benefit other organizations the information would be shared with other site contractors through email messages, newsletters, safety committee meetings, or other communication mechanisms. Employees were assured that their safety and health concerns were addressed at all necessary levels.

Safety and Health Training

Training for security and protective force personnel is diverse and physically demanding. It often creates many unique training challenges (e.g., development of emergency hands-on simulation exercises) that include responding to site-specific, physical, chemical, biological, and/or radiological hazards and events.

A core process of the VPP training approach is to deliver focused safety and health training, such as hazard recognition and reporting. Personnel indicated that training programs at VPP sites more than adequately accomplished the goal of teaching workers how to identify hazards and potentially hazardous conditions. Workers and managers all agreed that having the opportunity to participate in safety walk-a-round groups that identify and follow-up on a variety of safety and health issues helps to reinforce the traditional classroom courses. In many cases, workers feel that the required non-security related training topics, primarily hazard recognition, provide valuable information that is often shared with family members and the community at large.

A primary example of how safety and health training activities at VPP sites have influenced workers' lives in and outside of the workplace is evident in the continued success of the annual Hanford Site Health and Safety Exposition, which has become a model of community outreach in DOE. The Health and Safety Exposition is an event of information, equipment, supplies, and success stories that promote the health and safety of workers both at home and at work. Organizers of the exposition believe one way to foster safety, as a value in employees' lives, is to provide ways to share safety-and health-related lessons learned and success stories.

DOE VPP sites also utilize daily safety talks, pre-job briefing/meetings and the distribution of lessons learned and various site publications as tools for informal training opportunities.

7. Conclusions

This analysis indicates the following:

1. DOE security contractors generally increased their work force and/or work hours after September 11, 2001.
2. Even though the work hours have increased significantly for most contractors and the security guards have been prepared to undertake more risky operations to protect DOE facilities after September 11, 2001, injury rates of the security contractors have not increased.
3. Security contractors participating in DOE VPP appear to have better safety performance than non-VPP contractors.
4. Based on information obtained from previous on site assessments and reports, this study concluded that the safety success of DOE VPP can be attributed to an active safety-conscious culture, which has been associated with VPP.

Appendix A

Other reports, reviews or audits of DOE Protective Forces Operations

The operation and function of DOE protective forces and other Federal security forces has been the focus of a number of reports, reviews, and audits by the DOE Office of Inspector General (IG), the General Accounting Office (GAO), and the Office of Personnel Management. These reports and findings were reviewed during the preparation of this document. Findings such as those in the report *Management of the Department's Protective Forces* (DOE/IG-0602, June 2003), where reviewers noted that declining training opportunities may have affected security officer morale, retention, and their safety and health, were considered in this review.

I. Related Reports from the Office of Inspector General

- *The Department's Basic Protective Force Training Program* (DOE/IG-0641, June 2004). DOE's facilities were not required to report departures from the core-training curriculum for security forces personnel to either the responsible program secretarial office or to the Office of Security. The large number of curriculum modifications identified during the audit raised concerns as to the curriculum's validity and its usefulness as a benchmark for evaluating the performance of protective forces training. Management generally concurred with the findings and recommendations.
- *Management of the Department's Protective Forces* (DOE/IG-0602, June 2003). This report found that the DOE faced a number of challenges that could adversely affect its protective forces program. These challenges included delays in processing security clearances, increasing overtime costs, potential employee retention problems, and operational vulnerabilities associated with unscheduled work stoppages. Management generally concurred with the findings and recommendations and agreed to initiate corrective actions.
- *The Restructure of Security Services by the Oak Ridge Operations Office* (DOE/IG-0487, October 2000). The Oak Ridge Operations Office did not manage the restructuring of its security services in a way that would have achieved its overall security goals for the site. Specifically, it failed to perform an analysis of security services staffing levels, determine the scope of work to be transferred, or develop cost-reduction measures or incentives to ensure efficient contractor performance. In addition, the Oak Ridge Operations Office did not consider cost as a ranking factor in selecting a security services contractor. Management concurred with the findings and recommendations and agreed to initiate corrective actions.
- *Audit of Construction of Protective Force Training Facilities at the Pantex Plant* (WR-B-95-06, May 1995). This report found that the construction of a physical training facility at DOE's Pantex Plant was not necessary to fulfill mission needs and that DOE did not consider all viable alternatives to constructing a weapons tactics and training

facility. These conditions occurred because a Justification for New Start was never prepared and approved for these two projects. NNSA management officials at Headquarters and the Field Office did not concur with all the findings and recommendations in this report.

- *Audit of the Department of Energy's Security Police Officer Training* (CR-B-95 03, February 1995). The audit disclosed that DOE had not established standardized annual refresher training requirements for its security forces, and individual sites were developing and implementing training programs and course plans without standardization.
- *Audit of the Management and Cost of the Department of Energy's Protective Forces* (DOE/IG-0354, July 1994). The audit noted several opportunities for DOE to improve the operational efficiency of its protective forces, including eliminating overtime paid to officers prior to their working a basic 40-hour workweek. Management concurred with the findings and recommendations and agreed to take appropriate actions to improve the efficiency of managing protective forces staff.
- *Management of the Central Training Academy, Albuquerque, New Mexico* (DOE/IG-0309, May 1992). The audit disclosed that Wackenhut (1) was provided credentials and shields that improperly identified employees as being Federal agents and officers and used DOE's official seal without proper authorization; (2) incurred costs not necessary for performing contract work; (3) performed work outside the general scope of its contract; and (4) operated a souvenir store on Government property. All of these activities occurred with the knowledge of DOE officials. Management generally agreed with the findings and recommendations.

II. Related Reports from the GAO

- *Nuclear Security, NNSA Needs to Better Manage Its Safeguards and Security Program* (GAO-03-471, May 2003). NNSA has not been fully effective in managing its safeguards and security program in four key areas. As a result, NNSA cannot be assured that its contractors are working to maximum advantage to protect critical facilities and materials from individuals seeking to inflict damage. The four areas are as follows: (1) defining clear roles and responsibilities; (2) assessing sites' security activities; (3) monitoring contractors' corrective actions; and (4) allocating staff. NNSA disagreed with GAO's conclusion that NNSA was not performing the comprehensive annual assessments of contractors' performance required by DOE policy. GAO continues to believe that NNSA's current efforts do not ensure conformance to DOE policies including policy on Integrated Safety Management.
- *Department of Energy, Key Factors Underlying Security Problems at DOE Facilities* (GAO/T-RCED-99-159, April 1999). Physical security controls involve the protection, primarily through security personnel and fences, of facilities and property. In 1991, GAO

reported that security personnel were unable to demonstrate basic skills such as the apprehension and arrest of individuals who could represent a security threat. Prior to that report, in 1990, GAO reported weaknesses in security personnel skills, as some security personnel could not appropriately handcuff, search, or arrest intruders or shoot accurately.

III. Reports from the Office of Independent Oversight and Performance Assurance Safeguards and Security Evaluations*

- Independent Oversight Safeguards and Security Inspection of Y-12, Volume I, “Security,” July 2005 (*Classified*)
- Independent Oversight Safeguards and Security Inspection of the Sandia Site Office and Sandia National Laboratory, Volume I, “Security,” May 2005 (*Classified*)
- Independent Oversight Safeguards and Security and Emergency Management Inspection of the Nevada Test Site, “Summary Report,” September 2004 (*Classified*)
- Independent Oversight Safeguards and Security Inspection of the Nevada Test Site, Vol. 1, September 2004 (*Classified*)
- Independent Oversight Special Review of Protective Force Management and Capabilities, June 2004 (*Classified*)
- Independent Oversight Special Review of Lock and Key Programs, June 2004 (*Classified*)
- Independent Oversight Special Review of Incidents, Inquiries, and Infractions Program at DOE Field Elements, June 2004 (*Official Use Only*)
- Independent Oversight Safeguards and Security and Cyber Security Inspection of the Y-12 Site Office and Y-12 National Security Complex, Vol. II, January 2004 (*Classified*)

*Facts and data contained in these classified documents were not incorporated in this document.

IV. Related Report from the Office of Personnel Management

- *Federal Law Enforcement Pay and Benefits – A Report to Congress*, July 2004, U. S. Office of Personnel Management. SHRP/CEFSP/RG-01;
http://www.opm.gov/oca/LEO_Report04.pdf - A study comparing the job classifications, pay, and benefits of Federal law enforcement officers. OPM found that the mission of Federal law enforcement has expanded and changed greatly since the terrorist attacks of September 11, 2001 and that current pay structures and benefits do not provide sufficient flexibility to address law enforcement-specific pay, benefits, and classification problems.

Appendix B Historical Information

DOE F 1325 B
(12-84)

United States Government

Department of Energy

memorandum

DATE: November 12, 1985
REPLY TO:
ATTN OF: EH-34
SUBJECT: Statistical Analysis of Safeguards and Security Accident Data

TO: Carl A. Caves, EH-34

Introduction & Summary

Statistical data collected by EG&G Idaho Inc., in their report (September 1985 report) includes information on the safety performance of DOE security contractors during CY 1980-1985.

It is evident from the data base that (a) the injury/illness rate of DOE Security safeguards employees is significantly higher than not only DOE general workforce but higher than other risk groups such as the DOE construction workers; approximately three times the DOE overall work force and twice the construction worker's rate; the DOE Security employees comprise approximately 2-1/2 percent of the total DOE workforce, but their accident percentage ranges from 11 to 17 percent of all accidents reported; (b) the motor vehicle accident rate as well as the dollar loss rate due to auto accidents by the security guards is also significantly higher than the other work groups in DOE. The rates are 70 percent above DOE vehicle accident rate, and 116 percent above the dollar loss rate; (c) 1984 is the worst year so far, however, projections based on historical data indicate 1985 would be even worse in terms of safety performance.

Recognizing the fact that security guard work is a high risk profession, and that the available statistical data is rather limited, a careful analysis was conducted to understand the factors which are causing the accidents. The results of the statistical analysis should be helpful to develop a program plan for improving the safety performance.

The major conclusions of the statistical analysis are:

- o Multiple Regression Analysis gives a projection of 420 accidents (injury/illness) in 1985.
- o Statistical tests such as t-test for paired comparisons, and Chi-Square test show that the difference between the accident rates of security guards and DOE construction workers is highly significant during 1980-85.
- o The rapid increase in the number of security guards during 1983-84 should not necessarily be the main reason for increase in the accidents. A similar growth rate of construction workers did not cause increase in the accidents percentage.

Safety Performance of Security

- o Increased training programs, Special Response Teams (SRT), and additional requirements by security guards seem to be unique factors influencing the accident rate in the Safeguards and Security Program.
- o Major changes in Defense Programs, increased number of visitors to DOE sites, accelerated weapons production by DP, increased tensions in the international politics, international terrorist activities including hijacking civilian (commercial) aircrafts, may have indirectly contributed by increasing the percentages of security needs through an increased awareness to the accident rates.
- o To test the difference between the safety performance of the five major security Analysis of Variance was applied. The safety performance of the contractors is significantly different, especially the performance of Mason & Hanger at Los Alamos is far worse than the other contractors.
- o Safety performance indicators calculated on the basis of four major contractors, excluding Mason & Hanger, would show that the safeguard contractors performance is not as bad as indicated earlier, and in fact the averages tend to be closer to the construction workers' rates. The security accident rates during 1981-82 were lower than construction workers' (Table 1) rates due to the absence of Mason & Hanger's data (which did not begin operations until 1983).

Statistical Analysis

The safety performance data of the Security guards was compared with the safety data of (a) total DOE workforce, and (b) DOE construction contractors. The construction work usually involves high hazards and their safety record is perhaps the worst in DOE. The accident data of total DOE workforce is presented in Table 1, and the construction workers data is presented in Table 2.

Table 1 - DOE Accident Data

	Total DOE Workforce	No. of Accidents	Rate
1982	150,776	3,050	2.00
1983	155,989	3,071	1.97
1984	166,108	3,196	1.92

It is obvious from Table 1 that the accident rate of DOE workforce has remained constant over the past 3 or 4 years. The total workforce has increased by 3 percent during 1982-83, and by 6 percent during 1983-84 not affecting the accident rate. On the contrary, the rate seems to be decreasing indicating excellent overall DOE safety record.

Safety Performance of Security

Table 2

Comparison of Security Accident Data with Construction Contractors

	<u>Safeguards & Security</u>			<u>Construction</u>		Rate*
	No. of Guards	Accidents	Rate*	No. of Workers	No. of Accidents	
1981	2500	112	4.5	9302	552	5.9
1982	2953	157	5.3	8447	511	6.1
1983	3395	262	7.7	9538	474	5.0
1984	4214	352	8.4	11386	564	5.0

*Rate of Accidents per 100 employees

A comparison was made of the accident rates between DOE Security guards and construction workers using the data from Table 2. A statistical test of hypothesis was formulated as follows:

Test the Null hypothesis,

Ho: $P_1 = P_2$

against alternative hypothesis

Hi: $P_1 > P_2$

Where P_1 and P_2 are proportion of accidents of Security guards and construction workers respectively. For example, in 1985 $P_1 = 0.0835$, and $P_2 = .0496$. The Security contractors data collected by EG&G Idaho, Inc., may be treated as sample data since several other DOE contractors perform security tasks inhouse as part of their overall operations, but do not report the accidents due to security forces separately. The Student's t-test states reject the null hypothesis if the calculated t-value is larger than the theoretical value (5% level of significance) of t-distribution

$$t = \frac{P_1 - P_2}{\sigma_{P_1 - P_2}}$$

Where

$$\sigma_{P_1 - P_2} = \sqrt{\bar{P}\bar{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

$$\bar{P} = \frac{4214(.0835) + 11386(.0496)}{4214 + 11386} = 0.0587$$

$$\sigma_{P_1 - P_2} = .0042$$

$$t = .0039 / .0042 = 8.07$$

For large sample sizes, t distribution approaches normal (Gaussian) distribution, i.e., for one-sided test, deviate value, 1.64 can be used. Therefore, reject the null hypothesis since 8.07 is greater than 1.64.

Safety Performance of Security

To compare the accident rates among the five major contractors, data in Tables 3 and 4 were utilized.

Table 3

Total Recordable Case (TRC) Rates

	Contractor				
	APS-ID	Mason & Hanger	WS-NV	WS-SR	Wells Fargo
1980	-	-	7.9	-	-
1981	0	-	4.6	-	-
1982	5.2	-	4.6	-	9.9
1983	4.2	14.2	8.5	1.3	11.9
1984	4.1	23.7	4.6	1.4	2.5
1985	17.5	37.0	3.6	0.9	6.6
Average	8.6	24.97	5.57	1.2	7.0
Rank	2	1	4	5	3

Table 4

Motor Vehicle Accident Rates

	APS-ID	Mason & Hanger	WS-NV	WS-SR	Wells Fargo
1980	-	-	9.6	-	-
1981	0	-	4.7	-	-
1982	0	-	4.9	-	24.0
1983	1.7	1.2	4.0	0	8.2
1984	3.4	23.0	10.9	6.2	1.7
1985	12.1	7.5	5.1	4.8	7.9
Average	5.73	10.57	6.67	3.67	5.93
Rank	4	1	2	5	3

In Tables 3 and 4, abbreviations such as APS and ID are used to imply the names of the five major security contractors.

APS-ID: American Protective Service - Idaho
 Mason & Hanger: Mason & Hanger - Los Alamos
 WS-NV: Wackenhut Services - Nevada
 WS-SR: Wackenhut Services - Savannah River
 Wells Fargo: Wells Fargo Guard Services - Oak Ridge

Safety Performance of Security

The data in Tables 3 and 4 indicate that TRC rates as well as the motor vehicle accident rates for the Mason & Hanger at Los Alamos are higher than other security contractors. However, the conclusions are based on extremely limited data. For example, the safety performance data of Mason & Hanger at Pantex is not available for evaluation.

Multiple Regression Analysis to Forecast Accidents

A regression model to forecast the accidents may be formulated as follows:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5$$

Where

a is a constant (intercept), b_1, b_2 etc. are regression coefficients, and
y = No. of accidents (dependent variable)

X1 = No. of security guards

X2 = No. of DOE employees (total workforce)

X3 = No. of visitors to DOE sites

X4 = An index of Defense Program activities such as the FY 84 or 85
funding for weapons production

X5 = Social and political events taking place outside the site
including international/terrorist activities (Qualitative
Variable)

The data on variables Y, X1 and X2 were collected and a regression analysis was performed. The model can be improved by adding the data on variables such as X3, X4 and X5. Total DOE workforce X2 was found to be not a significant variable. However X1 is highly significant. The attached computer printout generated by SAS (Statistical Analysis System) software package (Energy Information Administration/DOE) suggests that statistical tests such as F-test, t-test and the R-Square imply the regression model is an excellent fit. Based on this model, and assuming that X1 = 4640 security guards are employed in 1985, the regression model predicts number of accidents as approximately 420.

Further analysis to test the differences between type of accidents may be conducted. The nature of injuries suggest that security guards experienced a higher rate of "sprain and strain" type of accidents than other DOE workers. Other factors such as age, sex and location of employment may also have some impact. Increased number of accidents due to firearms, and helicopter accidents suggest that additional training for safety including Human Factors training would be helpful to improve safety performance. Statistical data related to the training programs offered by DP/DOE such as the Central Academy at Los Alamos, may be collected to evaluate the effectiveness of the training programs.

CONCLUSIONS

The DOE Safeguards and Security contractor accident rates of injury/illness as well as motor vehicle accidents are significantly higher in 1983-84 than during 1981-82. The safety performance of the Mason & Hanger at Los Alamos was found to be the worst among all the security contractors.

The major reasons for the high accident rates for security forces may be due to increased training exercises, working with new weapons, and special programs such as SRT (Special Response Teams). However, improved safety programs with respect to the above activities is essential and in addition the programs to be developed should be implemented uniformly on a DOE-wide basis.


Rama Sastry
Office of Operational Safety

cc: Danny Sheppard
William Mott
Roy Lee
Ed Patigalia