

Polygraphs and Security

**A Study by a Subpanel of Sandia's Senior
Scientists and Engineers**

October 21, 1999

Executive Summary

Because of concerns raised in Congress and the Executive Branch about inadequate security in the national nuclear weapons laboratories, the Department of Energy (DOE) plans to institute polygraph screening for some employees and applicants. These tests are intended to identify subversives and deter potential ones. This policy seemingly assumes that polygraph tests, test interpretation, and any follow-up processes will accurately identify subversives and nonsubversives. We conclude that there is no adequate scientific basis for this assumption. No specific polygraphic or behavioral response has been directly linked to the act of deception and there are too many subjective factors involved in the administration and interpretation of polygraph tests to be able to predict and control their effectiveness and limitations.

A review of the scientific literature on polygraph testing revealed substantial concern about polygraph accuracy for screening, and Federal law for most situations bars such usage. A summary of scientific opinion from a recent survey concludes that most psychology experts do not consider polygraphy to be technically sound and even more believe that skilled subversives can defeat polygraph tests.

Two general uses of polygraph testing are specific-incident investigations (as when an individual has been accused of a crime) and general screening (where a target population is tested to see if any of them have committed any crime). Published estimates of polygraph accuracy for specific-incident situations, based on the agreement of polygraph results with known facts, vary depending on the context in which data were obtained and the quality of data collection, selection, and analysis. A 90% accuracy rate is a reasonable expectation for adequately controlled specific-incident tests. It is, however, unwarranted to assume these accuracy rates apply to screening applications of polygraphy. Adequate studies have not been done for screening applications. Thus, it is impossible to predict what error rates (false negative—subversive passes polygraph test; false positive—innocent person fails polygraph test) and inconclusive results would occur in the proposed DOE screening. But, the costs and consequences of such errors need to be considered before the DOE policy is implemented. False positive results subject individuals to increased scrutiny and unwarranted suspicion. Even if a suspect is eventually exonerated, the process can damage that person's career and job performance. Such possibilities can make it more difficult to recruit and keep personnel with the high professional qualities on which the nuclear weapons program relies.

Issues resulting from false positive results have influenced agencies to “tune” polygraph tests (reduce the number of positive indications for screening). In fact the DOE has stated that a 2% positive indication is anticipated. Tuning polygraph tests to decrease positive results increases the probability of false negative results, thus reducing the intended effectiveness of the tool. Consequently, real subversives may be more likely to become insiders—particularly if over-reliance on polygraph testing leads to reduced emphasis on other security and counterintelligence methods.

Polygraph testing could drive away existing innocent, talented workers who have provided value to national security programs and deter prospective, talented employment candidates from considering a career in the national laboratories. Resources that could have been applied directly to national security programs or to finding more effective ways to enhance security may be wasted in administering a polygraph screening program and dealing with the consequences of false identifications.

We believe that the entire national laboratory security system should be improved using a systems approach in which the cost and benefits of changes can be plausibly estimated. A full systems evaluation is necessary because computer technology has fundamentally changed threats to national security. We doubt that polygraph screening of employees will provide value to an integrated security system.

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Preface

Sandia's Senior Scientists and Engineers ("Seniors") provide a service to the Laboratories as independent, experienced, corporate evaluators of technical issues. They are available as a group to assist Sandia management with technical reviews of particularly significant issues and programs. Implementation uses subpanels of the Seniors (helped as necessary by other Sandia staff) to conduct the initial, detailed review of issues or programs. The reports of the subpanels are then made available for review by all other Seniors prior to submission to management.

This document is the report of the subpanel studying polygraphs and security at Sandia. Members of the subpanel are:

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Charter

"I believe that the question of polygraphs is a central one that will occupy more and more of our time before it's over. ... The crux of the issue is that, while few if anyone really advocates the use of more extensive polygraphs as a screening tool (because of the false positive problems), a large body of opinion suggests that polygraphs are a useful investigatory tool. I confess to not knowing where we as a management team should stand on this issue ... I would appreciate your thoughts and inputs as to where we would like this issue to come out" C. Paul Robinson

Acknowledgments

Dianna Blair (9811) made major contributions to this report. Parts of the background, approach, text, references, and philosophy came from her. The Seniors on this subpanel are indebted to her and gratefully acknowledge her contributions. Jerry Allen (4100) encouraged us to consider alternatives to improve security. Dan Garber (4141) provided several editorial improvements. Julie Kesti (4915) provided literature searches and references. Larry Greher (11200) provided references to court cases, Bob Park (11300) helped us interpret the Employee Polygraph Protection Act, and Paul Shoemaker (5002) provided good "leads" and direction.

1.0 Introduction

Because of concerns raised in Congress and the Executive Branch about inadequate security at the national weapons laboratories, the Department of Energy (DOE)¹ plans to institute polygraph screening for employees who have access to the most sensitive categories of classified information and materials, as well as applicants for such positions. These tests are intended to identify actual subversives and deter potential ones. This policy seemingly assumes that polygraph tests, test interpretation, and any follow-up processes will accurately identify subversives and nonsubversives.

The best summary of polygraphy that we found is the Office of Technology Assessment (OTA) report. The OTA concluded that “while there is some evidence for the validity of polygraph testing as an adjunct to criminal investigations, there is very little research or scientific evidence to establish polygraph test validity in screening situations.”^{2,3}

Although the accuracy of polygraph screening is very questionable, congressional legislation is mandating such screening by DOE: The proposed legislation requires a polygraph examination for all persons in “... positions with access to the most sensitive categories of classified information and materials, as well as applicants for such positions.”⁴

Senator Domenici has made it clear that he is concerned about mandatory polygraph testing:

US Senator Pete Domenici today urged DOE Secretary Bill Richardson to carefully consider the implementation of mandatory polygraph tests for agency employees, contending that ‘a polygraph cannot be the sole determinant of the fitness for duty of national security workers.’

‘Loyal workers threatened by false positives must have rapid and sure recourse before their careers and work are ruined and critical national security programs are impacted through incorrect loss of key researchers,’ Domenici wrote Richardson. ‘Large numbers of such false positives may overload any system you devise to handle them. Complete plans to address this issue should be in place before large numbers of tests begin.’⁵

¹ Acronyms used in this report are given in Appendix I.

² *Scientific Validity of Polygraph Testing: A Research Review and Evaluation*, Office of Technology Assessment (Henceforth called the OTA Report), November 1983, p. 8. (available at <http://www.wws.princeton.edu/~ota/disk3/1983/8320.html>).

³ References are listed in Appendix II.

⁴ Polygraph Examination Regulation, *Federal Register*, v. 64, 45062 (1999) (to be codified at 10 C.F.R. pts. 709, 710, and 711) (proposed Aug. 18, 1999).

⁵ Pete Domenici, “Domenici Concerned Over Polygraph ‘False Positives,’” Press Release, www.senate.gov/~domenici/press, August 6, 1999.

Senator Bingaman has expressed clear opposition to DOE's plans for implementing polygraphs:

I am writing to express my opposition to plans by the Department of Energy (DOE) for implementing counterintelligence polygraphs, as proposed in the Federal Register in August 18, 1999. This rule goes far beyond what I envision as being an appropriate use of polygraphs, which would be as a limited investigative tool in cases where other evidence suggests the possibility of espionage. My opposition is based on five factors.

1. The proposed rule's basic premise, that screening polygraphs offer a specially effective tool for detecting guilty individuals, is not supported by scientific evidence.
2. The provisions of the proposed rule are unacceptably vague on key issues, such as who would be subject to requirements of the rule, and overboard in the potential categories of individuals who might be affected.
3. The proposed rule, in my view, does not give sufficient consideration to the privacy and other legal issues that will result from DOE's proposed program.
4. The proposed rule takes what I believe to be an unrealistic view of the problem of false positives. I am concerned that persons who are judged to have "failed" a polygraph screening will not be easily cleared, as this would involve proving a negative. The latter will, in my opinion, be particularly difficult to do, judging from the partisan atmosphere in which DOE security issues have been treated over the last year.
5. As a result of the proceeding four factors, I believe that the proposed counterintelligence polygraph program will make it much more difficult for the DOE laboratories to attract and retain the best and brightest scientific and technical talent.⁶

This report addresses an essential question: In a full systems context—as one of many security and counterintelligence tools—will polygraph testing add to or subtract value from the quality and security of the nuclear weapons program?

2.0 Polygraphy

2.1 Theory

We begin the discussion of polygraphy with information about the theory of polygraphy. The most commonly accepted theory underlying polygraph testing is that, when the person being examined fears detection, such fear produces a measurable physiological reaction (e.g., elevation of pulse, respiration, and blood pressure, and/or increased

⁶ Jeff Bingaman, "Proposed Department of Energy Polygraph Examination Regulation," Memo to Secretary Bill Richardson, September 16, 1999.

perspiration) if the person answers deceptively. Thus, in this theory, the polygraph instrument is measuring the fear of detection rather than deception *per se*. The examiner infers deception when the measured response to questions about a crime or an unauthorized activity is different than the response to other questions.

A very recent study by Eli Lehrer points out that basic polygraph technology has not changed in the last 60 to 70 years:

Skeptics and polygraph professionals agree that the fundamental technology, which measures breathing, pulse, blood pressure and galvanic skin response (sweating) has remained unchanged since ... the 1930s. American Polygraph Association President Richard Keifer says that computers have simplified the work but agrees that the measurements have not changed.⁷

The utility of the polygraph depends strongly on the subject's confidence that it detects deception. Subjects who have little technical training may be convinced that a polygraph can detect deception. On the other hand, national lab employees typically have graduate degrees in the physical sciences. The differences in mind set with respect to technology, the limitations of technology, and the resulting confidence in polygraphy are immense.

2.2 Applications

Two general applications of polygraph testing are specific-incident⁸ investigations (as when an individual has been accused of a crime) and general screening (where a target population is tested to see if any of them have committed any crime). Published estimates of polygraph accuracy for specific-incident situations, based on the agreement of polygraph results with known facts vary depending on the context in which data were obtained and the quality of data collection, selection, and analysis.

Polygraphs are used in conjunction with many test protocols—such as the Control Question Test (CQT), Guilt Knowledge Test, Relevant/Irrelevant Technique, and Peak of Tension Test. Polygraphs are used by experienced and new examiners in direct and in “blind” tests.⁹ They are also used when facts are known and tests are controlled and in cases when the “facts” are determined from confessions, evidence, and judicial decisions.

⁷ Eli Lehrer, “Lies, Damned Lies and Polygraph Tests,” *Insight on the News*, v. 14, n. 28, August 3, 1998, p. 44.

⁸ From page 98 of the OTA report: “A principal use of the polygraph test is as part of an investigation (usually conducted by law enforcement or private security officers) of a specific situation in which a criminal act has been alleged to have, or in fact has, taken place. This type of case is characterized by a prior investigation that both narrows the suspect list down to a very small number, and that develops significant information about the crime itself. When the polygraph is used in this context, the application is known as a specific-issue or specific-incident criminal investigation.”

⁹ In a blind polygraph test, the evaluator of the test uses only the information recorded during the test, has absolutely no interaction with the person being tested, and is assumed not to have any other information (such as demographic data) about the person tested.

In specific-incident applications with controlled conditions, polygraphy can be useful. The following psychology laboratory experiment is an example of conditions where reasonable accuracy may be achieved:

Prototypically, the experiment is a card test with one of 6 simple geometries on each card. The subject is shown one card, which one is unknown to the examiner. ... The polygraph examiner then shows each card to the subject and asks if this is the seen card. The subject replies 'no' after each trial. After repeated trials, the differential polygraphic response to the guilty knowledge (the seen card) can be detected about 90% of the time based on simple Autonomic Nervous System (ANS) reactions to the 'lie.'¹⁰

General screening applications of polygraphy are a totally different matter. The examinee is not naïve; the screening accuracies are much lower; and there is much more at stake than a card experiment (such as national security, clearances, jobs, and jail). Furthermore, measures to counter the effects monitored by the polygraph have been found and the use of countermeasures by a guilty party upsets the conditional probabilities of accurate detection and identification.

For both specific-incident and screening applications, many external variables can influence test results, including countermeasures, test protocol, test calibration, and the personalities, biases, and tactics of the interrogator and the subject. A summary of scientific opinion from a recent survey concludes that most psychology experts do not consider polygraphy to be technically sound and even more believe that skilled subversives can defeat polygraph tests.¹¹

2.3 Accuracy

What is the accuracy of a polygraph? One might as well ask, "What is the accuracy of a computer, pencil, or automobile?" It depends on what it is used for, how it is administered, and who is using it.

A summary of more than 2000 specific-incident cases in the 1980s shows an accuracy of 98% for cases where the examiner was directly (or interactively) involved in the decisions. In more than 900 specific-incident cases during the same time period, the accuracy was 90% for evaluators performing blind tests.¹²

In 1983, the OTA provided the following summary of results for research on the CQT in specific-incident criminal investigations:

- Six previous reviews of field studies: average accuracy ranged from 64 to 98 percent.

¹⁰ Dawson et al, "The Electrodermal Response," *Principles of Psychophysiology—physical, social and inferential elements*, J. T. Cacioppo and L. G. Tassinari, Eds., 1990, p. 312.

¹¹ W. G. Iacono and D. T. Lykken, *J. App. Psych.*, v. 82, 1997, pp. 426-433.

¹² Norman Ansley, "The Validity and Reliability of Polygraph Decisions in Real Cases," *Polygraph*, v.19, 1990, pp. 169-181.

- Ten individual field studies: correct guilty detections ranged from 70.6 to 98.6 percent and averaged 86.3 percent; correct innocent detections ranged from 2.5 to 94.1 percent and averaged 76 percent; false positive rate (innocent persons found deceptive) ranged from 0 to 75 percent and averaged 19.1 percent; and false negative rate (guilty persons found nondeceptive) ranged from 0 to 29.4 percent and averaged 10.2 percent.
- Fourteen individual analog studies: correct guilty detections ranged from 35.4 to 100 percent and averaged 63.7 percent; correct innocent detections ranged from 32 to 91 percent and averaged 57.9 percent; false positives ranged from 2 to 50.7 percent and averaged 14.1 percent; and false negatives ranged from 0 to 28.7 percent and averaged 10.4 percent.¹³

What, then, is meant by polygraph accuracy? The short answer is that in many studies on polygraphy, accuracy “refers to the number of correct decisions of the total number of decisions, after the inconclusives have been set aside [emphasis added].”¹⁴ In general, accuracy is a weighted average of the percentages of true positives and true negatives. These averages are questionable because of differing test conditions.

The OTA report also comments on polygraph accuracy:

A major reason why scientific debate over polygraph validity yields conflicting conclusions is that the validity of such a complex procedure is very difficult to assess and may vary widely from one application to another. The accuracy obtained in one situation or research study may not generalize to different situations or to different types of persons being tested.¹⁵

A great deal of information highlights the gulf between polygraph accuracies for specific-incident cases and for screening. Illustrative information is summarized below.

The OTA report expresses reservations about use of the polygraph for screening:

... while there is some evidence for the validity of polygraph testing as an adjunct to criminal investigations, there is very little research or scientific evidence to establish polygraph test validity in screening situations, whether they be preemployment, preclearance, periodic or aperiodic, random, or dragnet [emphasis added].¹⁶

D. T. Lykken recently reported similar concerns about polygraph screening tests:

Concerned by the lack of evidence for the validity of these procedures, the Subcommittee [US House Select Committee on Intelligence in 1979] urged the director of the Central Intelligence Agency (CIA) to institute research on the ‘accuracy of the polygraph in the pre-employment setting and to establish some level of confidence in the use of that technique.’ No credible research on the important

¹³ OTA Report, p. 97.

¹⁴ N. Ansley and M. Garwood, *The Accuracy and Utility of Polygraph Testing*, US Department of Defense Report, Washington, DC, 1984, p.61.

¹⁵ OTA Report, pp. 7-8.

¹⁶ OTA Report, p. 8.

topic, however, has as yet been published. ... No one knows whether the screening test has some, slight, or no validity at all.¹⁷

According to a Department of Defense Polygraph Institute report about the use of polygraphs for screening in a controlled test with programmed guilty or deceptive examinees, accuracies ranged from 55.6% to 83.3%.¹⁸ The 55.6% number is not much better than chance, especially since the inconclusive decisions were excluded.

Clearly the use of polygraph testing for screening is problematic. We return to the OTA report for a concluding statement about polygraph accuracy in general:

No overall measure or single, simple judgment of polygraph testing validity can be established based on available scientific evidence [emphasis added].¹⁹ There are two major reasons why an overall measure of validity is not possible. First, the polygraph test is, in reality, a very complex process that is much more than the instrument. Although the instrument is essentially the same for all applications, the types of individuals tested, training of the examiner, purpose of the test, and types of questions asked, among other factors, can differ substantially. ... For example, there are differences between the testing procedures used in criminal investigations and those used in personnel security screening. Second, the research on polygraph validity varies widely in terms of not only results, but also in the quality of research design and methodology. Thus, conclusions about scientific validity can be made only in the context of specific applications and even then must be tempered by the limitations of available research evidence.²⁰

2.4 Countermeasures

The fact that countermeasures can affect the results of a polygraph test is well established. For instance, the OTA report has the following comments on countermeasures:

Theoretically, polygraph testing—whether for personnel security screening or specific-incident investigations—is open to a large number of countermeasures, including physical movement or pressure, drugs, hypnosis, biofeedback, and prior experience in passing an exam [emphasis added]. The research on countermeasures has been limited and the results—while conflicting—suggest that validity may be affected. OTA concluded that this is particularly significant to the extent that the polygraph is used and relied on for national security purposes, since even a small

¹⁷ D. T. Lykken, *A Tremor in the Blood*, Plenum Press, NY, 1998, p. 161.

¹⁸ *Comparison of Psychophysiological Detection of Deception Accuracy Rates Obtained Using the Counterintelligence Scope Polygraph and the Test for Espionage and Sabotage Question Formats*, Department of Defense, Fort McClellan, AL, Polygraph Inst. Report No.: DODPI93-P-0044; DODPI-R-0008, June, 95, Abstract.

¹⁹ OTA Report, p. 4.

²⁰ OTA Report, p. 4.

false negative rate (guilty person tested as nondeceptive) could have very serious consequences [emphasis added].²¹

If polygraph testing is to be more widely employed in national security investigations, there is an urgent need for research on countermeasures. Particular priorities would be research on drugs, biofeedback training, and subject gullibility, and motivation. Such research needs to be carried out both in field situations and in the laboratory. There are a number of drugs that are suspected of lowering ANS arousal and that theoretically may be able to invalidate the results of a polygraph examination or compel an 'inconclusive' finding. A first priority is to extend ... research on meprobamate (which reduced detectability) to other psychoactive drugs. Biofeedback training, as well as other forms of training have not been investigated, yet their effects on polygraph examinations may be substantial. Subjects' beliefs about the accuracy of the polygraph may also be critical. As suggested by the research ... individuals who believe their underlying thoughts are detectable are more likely to provide truthful responses. The reverse phenomenon seems feasible and it would seem possible to train individuals to believe that the polygraph is ineffective. Such training might be accomplished by providing individuals with false feedback on the polygraph as well as by specific instructions during simulated polygraph examinations. Similarly, subjects who can be easily trained to beat the polygraph may be more desirable as intelligence agents [emphasis added].²²

Similar comments appear in the *Journal of Applied Psychology*:

Effects of countermeasures on the CQT polygraph test were examined in an experiment with 120 subjects recruited from the general community. Subjects were given polygraph tests by an examiner who used field techniques. Twenty subjects were innocent, and of the 100 guilty subjects, 80 were trained in the use of either a physical countermeasure (biting the tongue or pressing the toes to the floor) or a mental countermeasure (counting backward by 7) to be applied while control questions were being presented during their examinations. The mental and physical countermeasures were equally effective: Each enabled approximately 50% of the subjects to defeat the polygraph test. ... Moreover, the countermeasures were difficult to detect either instrumentally or through observation.²³

A summation of the professional view of polygraphy is found in a recent article in the *Journal of Applied Psychology*. "92% of a scientific psychology community believes criminals or subversives can beat a polygraph."²⁴ That is, countermeasures, or methods to defeat detection, are believed to be effective by the knowledgeable scientific community.

²¹ OTA Report, p. 5.

²² OTA Report, p. 91.

²³ C. R. Honts, D. C. Raskin, and J. C. Kircher, "Mental and Physical Countermeasures Reduce the Accuracy of Polygraph Tests," *J. Appl. Psych.*, v. 79, n. 2, 1994, pp. 252-259.

²⁴ W. G. Iacono and D. T. Lykken, *J. App. Psych.*, v. 82, 1997, pp. 426-433.

A 1999 article by Robert Park presents a similar opinion from a Federal Bureau of Investigation (FBI) expert:

‘There is almost universal agreement that polygraph screening is completely invalid,’ Federal Bureau of Investigation polygraph expert Dr. Drew Richardson asserts. (Richardson taught his 10-year-old son to beat the test.) In 1997 Senate testimony, Richardson warned, ‘To the extent that we place any confidence in the results of polygraph screening, and as a consequence shortchange traditional security vetting techniques, I think our national security is severely jeopardized.’²⁵

The DOE Polygraph Examination Regulation states that “A counterintelligence-scope polygraph examination both serves as a means to deter unauthorized disclosures of classified information and provides a means for possible early detection of disclosures to enable DOE to take steps promptly to prevent further harm to the national security.”²⁶ If polygraph countermeasures are as effective as indicated above, it seems unlikely to us that polygraph examinations will be effective in either deterring or detecting “unauthorized disclosures.”

2.5 False Results

The fact is well established that polygraph tests produce false results, especially tests used for screening. This section details the magnitude of the problem and notes the bias against innocent, loyal employees. Unfortunately, the solution to the false positive problem is not apparent. The Seniors believe that preventing this problem (by not mandating polygraph testing) is much more appropriate than trying to find cures *ex post facto*.

False negatives. False negative results (subversives who “pass” the polygraph test) pose an obvious increased threat to national security. This major issue seems to have been overlooked by the public, their elected representatives, and the rest of the bureaucracy.

James Matte comments on false negatives:

Perhaps the greatest danger is that a clever and convincing psychopath can talk a polygraph examiner into believing him even though the polygraph charts indicate deception.²⁷

The failure of a set of polygraphs to expose Aldrich Ames is particularly revealing. There are several possible reasons why Ames may have been able to defeat polygraph

²⁵ Robert L. Park, *What’s New*, Washington, DC, Jun. 25, 1999.

²⁶ Polygraph Examination Regulation, *Federal Register*, v. 64, 45062 (1999) (to be codified at 10 C.F.R. pts. 709, 710, and 711) (proposed Aug. 18, 1999).

²⁷ James Matte, *Forensic Psychophysiology Using the Polygraph*, J.A.M. Publications, 1996, p. 296.

tests. He may have used one or more countermeasures,²⁸ he may have taken so many tests that he had no confidence in the polygraph, or perhaps the false positive rate was artificially reduced to the point that real positives were minimized. David Wise focuses on the examiners:

The problem ... was that the examiners in each case had failed to establish the proper psychological atmosphere of fear and intimidation. Unless the subject is afraid of detection the experts said, the needle won't jump. The tests ... were invalid because the examiners were too friendly.²⁹

In a screening application, the polygraph cannot identify a false negative. Thus, the weapons laboratories must use an individual's subsequent actions (as in the Ames case) to infer that a polygraph test provided a false negative. Clearly, the percentage of the work force that "passes" a polygraph-screening test via false negatives cannot be determined. To the degree that any credence is placed in polygraph tests, this is yet another argument against using polygraphs for screening.

False positives. In 1983, the OTA concluded "that the mathematical chance of incorrect identification of innocent persons as deceptive (false positives) is highest when the polygraph is used for screening purposes [emphasis added]. The reason is that, in screening situations, there is usually only a very small percentage of the group being screened that might be guilty."³⁰

The fact that false positives are widely known to be a problem is illustrated by part of the proposed legislation: "The Secretary shall prescribe any regulations necessary to carry out this section. Such regulations shall include procedures, to be developed in consultation with the Director of the Federal Bureau of Investigation, for identifying and addressing 'false positive' results of polygraph examinations."³¹

The following decision tree illustrates the problems with false results. It starts with 5000 employees being tested where 1% (50 persons) are assumed to be subversives (S) and the remaining 99% (4950 persons) are assumed to be not subversive (S*). This tree shows that even when a very generous accuracy of 90% is assumed for this screening application, 91.7% of those charged as guilty by the "lie detector" are, in fact, innocent. This represents a bias against the innocent of more than 10 to 1.

²⁸ The KGB told Ames, "Get a real good night's sleep. Be fresh and rested. Be cooperative. Develop rapport with examiner. ... And try to remain as calm and easy as you can." (See David Wise, *Nightmover*, Harper Collins, 1995, p. 146.)

²⁹ David Wise, *Nightmover*, Harper Collins, 1995, p. 211.

³⁰ OTA Report, pp. 5-6.

³¹ National Defense Authorization Act for Fiscal Year 2000 (Printed w/ House Amend.), S. 1059, 106th Cong. § 3187(d) (1999).

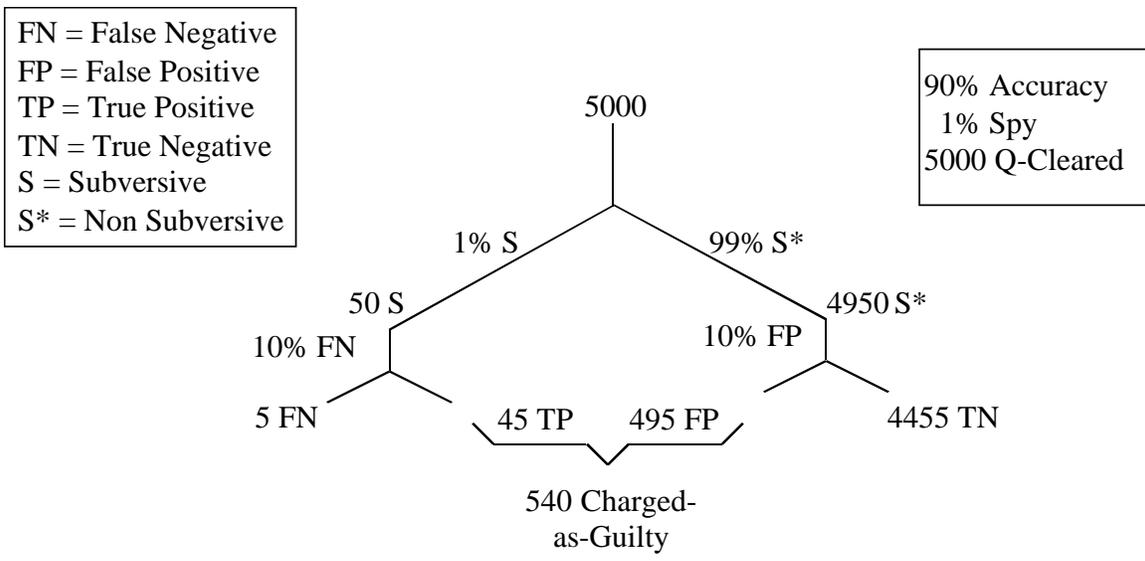


Figure 1. Polygraph Predictions.

Because it is impossible to prove a negative, using such techniques to determine an employee’s suitability puts the employee at a great disadvantage. Raising doubts about a person’s loyalty or security performance can adversely impact that person’s career. With reported polygraph screening accuracy rates, 10% to 50% of national laboratory employees interrogated might be labeled security risks. Furthermore, relying heavily upon such a technique would result in a false sense of security. As discussed in Section 2.4, subversives can learn countermeasures to evade detection.

2.6 Examiner Influence

A subtle but significant part of polygraphy is the reliability of the polygraph examiner. All humans (even polygraph examiners) have biases of one sort or another that can create errors in polygraph test interpretations.

The accuracy of polygraph tests for screening is poor even with examiners who were probably unbiased. The large-scale implementation of polygraph screening at the weapons laboratories will require hiring many more examiners. Yet to prove that examiners are fair, DOE will have to construct tests to winnow the list of examiners (including current ones). Given that people who discriminate tend to believe in their actions, what kind of tests should be used? The ability to come up with a list of qualified examiners who can also create impartial fear and intimidation is a daunting task.

Examples. Examiners may influence polygraph tests in a number of ways.

According to Norman Ansley, the difference between direct and blind polygraph tests can affect accuracy (See Section 2.3):

A summary of more than 2000 specific-incident cases in the 1980s shows an accuracy of 98% for direct examiner decisions. In more than 900 specific-incident cases during the same time period, the accuracy was 90% for evaluators performing blind tests.³²

An article in the *Journal of Applied Psychology* makes the point that experts perceive examiners and tactics as important factors in polygraph tests:

When experts were asked if they would they submit to a ‘friendly’ polygraph (e.g., one administered by their lawyer), if they were guilty of a crime, 73% responded in the affirmative. However, only 35% would agree to take an ‘adversarial’ polygraph (say one administered by a prosecutor), if they were innocent.³³

James Matte discusses the potential vulnerabilities of examiners to con artists:

Perhaps the greatest danger is that a clever and convincing psychopath can talk a polygraph examiner into believing him even though the polygraph charts indicate deception.³⁴

In this last instance (which includes the Aldrich Ames case discussed in Section 2.5), polygraphs are worse than useless—they are a significant threat to national security.

This issue subsumes the issue of examiner certification. Certification is necessary but may not be sufficient. Ames’ examiner was certified, the examiners involved in CIA sex discrimination cases³⁵ were certified, and it seems reasonable to assume that the examiners involved in the accuracy studies given in the first example were certified. Yet, in all these cases, examiner influence is clear.

Who will guard the guardians? We recognize that DOE will use controls to reduce examiner influence. However, we believe that additional actions may be necessary. DOE needs to ensure that examiners do not place any individual at a disadvantage for extrinsic reasons. This can happen during the pre-interview, the test, or re-examinations. DOE needs to determine whether the procedure is more threatening to particular ethnic groups, age groups, or genders. We believe that statistics should be kept and made available to the public regarding all non-negative results (deception indicated, no opinion, refusal to be tested, and test termination). Also, demographic and other pertinent information on all examiners should be a matter of public record.

³² Norman Ansley, “The Validity and Reliability of Polygraph Decisions in Real Cases,” *Polygraph*, v.19, 1990, pp. 169-181.

³³ W. G. Iacono and D. T. Lykken, *J. App. Psych.*, v. 82, 1997, pp. 426-433.

³⁴ James Matte, *Forensic Psychophysiology Using the Polygraph*, J.A.M. Publications, 1996, p. 296.

³⁵ Daniel Jeffreys, “Getting Down on ‘The Farm.’ (CIA’s humiliating polygraph tests are making it difficult to hire and keep operatives: reprinted from *The Independent*, Nov. 27, 1996),” *World Press Review*, v. 44, n. 3, March, 1997, p. 30.

Other agencies are being sued because of alleged abuse and discrimination. DOE should minimize potential diversion of national security funds to litigation and should demonstrate a commitment to diversity. Although the above measures may help, we believe that the best way for DOE to do this is to refrain from polygraph screening tests.

3.0 DOE Implementation

The following flow diagram is a draft description of how we think DOE will implement the newly proposed polygraph process.³⁶

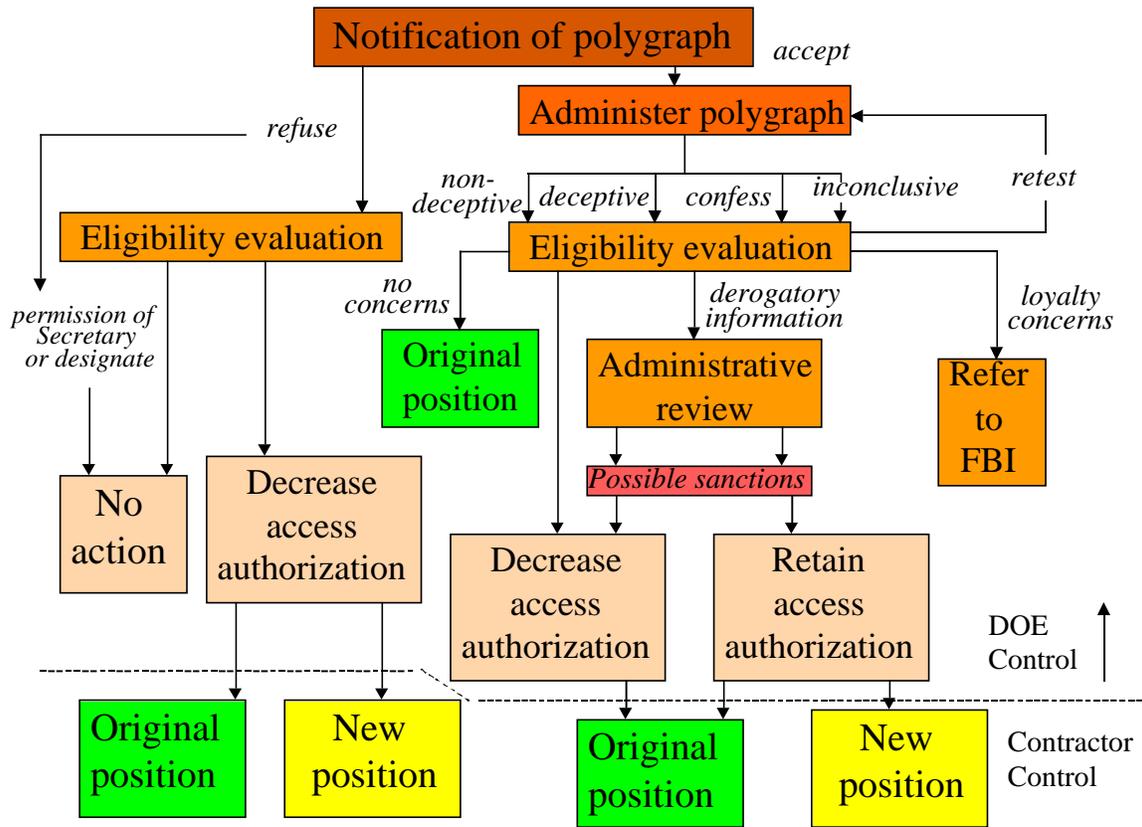


Figure 2. Draft flow diagram for the DOE polygraph process.

DOE plans to reduce the number of positives to reduce the issues resulting from false positives. The “Catch 22” is the minimization of real positives and the increased risk that subversives will not be detected. Reducing the target number of positives to an arbitrarily low number (2% is the security czar’s suggested number) will almost ensure

³⁶ This description was derived based on a draft version of DOE N 472.2 “Use of Polygraph Examinations,” a memo from Vic Reis to Rose Gottemoeller (Subject: Issuance of Notice on Use of Polygraph Examinations) with attached comments dated March 11, 1999, conversations with Richard Brown DOE/Defense Programs, and a DOE draft policy from the Office of Counterintelligence, 10 CFR part 709, Polygraph Examination Regulations.

that some guilty people will pass. Further, by giving individuals accused of wrongdoing the opportunity to exonerate themselves by taking a polygraph and by speeding up clearance processing by offering applicants a polygraph (now permitted), ill-intentioned people may more easily remain or become workers in the weapons complex.

Although scientific debate continues on the accuracy of polygraph techniques for ascertaining past criminal activities, the validity of using polygraphy for screening employees to predict future behavior is very questionable.

3.1 Improvements Needed

The Seniors do not trust polygraph testing to screen employees. Nevertheless, we recognize that polygraph tests may still be imposed by Congress and the DOE. If polygraph screening is required, the following suggestions and questions must be addressed.

DOE must act to minimize the undesirable side effects of polygraph screening. The most immediate side effect is that of low morale and possible inconclusive and false positive responses. The announced policy of transferring people from a “cleared” job to an “uncleared” one is not enough—there are issues of records and career progression and development within the laboratories. In the longer term, DOE will have to refine its internal security systems to detect individuals who can deceive the polygraph. DOE will also have to address the issue of polygraphs in recruiting. How can negative recruiting effects be mitigated when a potential recruit is told that such testing may be required for employment?

Will those who are already employed and cleared have their access withdrawn until their evaluations are complete? Who will make career-impacting decisions and on the basis of what additional information? Will a standard background reinvestigation suffice or will a more thorough one be initiated? Will DOE focus its finite resources on individuals who probably pose no threat to national security instead of on effective systems to eliminate subversives? During the polygraph process, examinees will provide a great deal of information from both control and security-related questions. How will this information be used? Should individuals have the right to receive a copy of their polygraph results? What will the DOE’s policy be for passes, fails, and inconclusives?

DOE should establish a much clearer process regarding polygraphs. The process should include:

- a clarification of employees eligible for polygraph testing (Positions that DOE has determined have “access to the most sensitive categories of classified information and materials, as well as applicants for such positions” is too broad.),
- a clear indication of the types of behavior that are being searched for in the testing,

- a clear indication of the process to be followed once a positive or inconclusive indication is found or if the use of deliberate or inadvertent countermeasures is suspected or detected,
- the right of appeal and what constitutes an acceptable defense against an accusation,
- an indication of the documentation that will accompany an accusation,
- some proof that the follow-up will not bear any resemblance to anecdotal accounts of past practices for reviewing security suitability of employees accused in other venues (Note that in Figure 2, the far right hand side—referring loyalty concerns to the FBI—raises the specter of McCarthyism.), and
- a definition of the exceptions and an explanation about why should they be allowed (In Section 709.25 the DOE reserves the right under “a limited national defense and security exception” to rely on the results of a polygraph as the sole basis for taking action.).

Private sector employees are protected from blanket use of the polygraph by the Employee Polygraph Protection Act of 1988 (EPPA), which stipulates that an employer can be fined \$10,000 for even suggesting that an employee take a polygraph as a condition of employment. Unfortunately, the EPPA excludes individuals working in national security from this protection. An executive order protects federal employees from repercussions if they refuse to take a polygraph; placement of this information in the employee’s personnel file is forbidden. However, similar protection of national laboratory employees has not been adjudicated—they may or may not be protected.

What happens to national laboratory employees who refuse to be polygraphed? Supposedly, they will be moved to positions of equal responsibility and opportunity that do not require a access to sensitive information. However, finding an equivalent position may be impossible because of the specialized nature of work at nuclear weapons laboratories. Thus, it is possible that refusing to be polygraphed will result in career impacting consequences.

4.0 National Security Concerns

Potential impacts of false positives on national security are that (1) talented and loyal individuals may either leave or never seek employment at the laboratories and (2) resources may be wasted to clear the falsely accused and settle lawsuits.

Polygraphy testing will impact recruiting and retention. Some persons may “fail” the test and others may refuse on principle to take the test because of the polygraph’s demonstrated lack of validity. In the long term, this will erode the caliber of the laboratory’s technical staff, with obvious impacts on research and development.

In the short term, employee commitment and morale may be lowered because polygraph screening tests create an atmosphere of distrust between employer and employee, are

demonstrably unreliable, and indicate that DOE is unwilling to base security concerns on evidence. Daniel Jeffreys quotes some cogent words of warning on this subject: “‘The polygraph test is undermining morale throughout the [CIA],’ says Michael Kelly, a former intelligence officer who is now an attorney specializing in employee lawsuits against the CIA.”³⁷

A recent survey of Sandia National Laboratories employees has indicated similar concerns regarding morale, recruiting, and retention:

With respect to external recruiting ... an estimated 27% of the technical staff would not have applied to Sandia if a polygraph examination had been required.

With respect to retention, a total of 32% would (9%) or might (23%) transfer out of a position that required a polygraph and 15% would (2%) or might (13%) resign from Sandia if a polygraph was required.

[T]he effect on morale is another concern with respect to staff quality and productivity. Overwhelmingly ... the respondents anticipate a negative effect About one-half anticipate a somewhat negative effect and another one-third anticipate a very negative effect, in contrast to the 3% that anticipate a positive effect.³⁸

The Seniors believe that a threat to the national laboratories’ mission readiness has a basis in reduced congressional trust of DOE and the laboratories. This lack of trust is evinced in a bill recently passed by the US Senate: “The Secretary may not permit a covered person to have any access to any high-risk program or information unless that person first [emphasis added] undergoes a counterintelligence polygraph examination and consents in a signed writing to the counterintelligence polygraph examinations required by this section.”³⁹

5.0 Alternative Measures

Improved use of the existing security system. Instead of relying on polygraph tests, we advocate more rigorous implementation of current processes and improved awareness and education for both management and staff regarding subversive warning signs (living beyond one’s means, feeling unappreciated in one’s job, drinking problems, unreported foreign travel, etc.).

³⁷ Daniel Jeffreys, “Getting Down on ‘The Farm.’ (CIA’s humiliating polygraph tests are making it difficult to hire and keep operatives: reprinted from *The Independent*, Nov. 27, 1996),” *World Press Review*, v. 44, n. 3, March, 1997, p. 30.

³⁸ Robert G. Easterling, “Commentary on DOE Proposed Polygraph Examination Regulation, 10 CFR, Parts 709, 710, 711,” September 16, 1999.

³⁹ National Defense Authorization Act for Fiscal Year 2000 (Printed w/ House Amend.), S. 1059, 106th Cong. § 3168(d) (1999).

We need to recreate the DOE culture of security consciousness. Due to environment, safety, and health concerns, former DOE Secretary Watkins opened operations in the complex to such a level that an agent could more easily piece together operations at the plants. Former DOE Secretary O'Leary subsequently ordered the declassification of thousands of documents and the use of uniformly colored badges for all employees, cleared or not.

Security clearances are the first line of defense against the insider threat. However, the rigor and quality of the security clearance process has degraded through the years, for both bureaucratic and budgetary reasons. Under the Atomic Energy Commission, all employees and contractors were subject to a Q-level background investigation performed by the FBI. Today, uncleared investigators do background checks and L-cleared administrators manage the database of clearances. Clearly, the present system needs greatly increased rigor. We need more Q clearances in the laboratories. We also need more Q clearances outside the laboratories (e.g., for background investigators and DOE database administrators).

In addition to the requirement for a security clearance, the laboratories operate under the DOE policy of an employee's "need to know." This security principle requires that access to classified matter be limited to persons who possess appropriate access authorization and who require such access (need to know) in the performance of official duties. The Seniors believe that the need-to-know processes must be improved by increased use of Sigma levels, compartmentalized information, and code words for specific categories of information.

If the polygraph screening proposed by DOE is implemented, it must be integrated with the existing system of assessing the reliability of people who do weapons work. That system includes recruiting and hiring selectively, having a clearance process, doing periodic clearance updates, and asking managers to be vigilant for deviant behavior. Although the existing system is not perfect and its reliability is difficult to quantify, we doubt that polygraph screening will improve this system.

New security system requirements. Cyber security in particular needs to be improved throughout the national defense complex. Recent news regarding Moonlight Maze (where the Russians are suspected of computer hacking "sensitive military secrets, including weapons guidance systems and naval intelligence codes ..." ⁴⁰) highlights the need for improvement.

We believe that the entire national laboratory security system should be improved using a systems approach in which the cost and benefits of changes can be measured. Valid indications of security levels and continuous improvement would result. A full systems evaluation is necessary because computer technology has fundamentally changed threats to national security.

⁴⁰ Ron Edmonds, "Russian hackers steal US weapons secrets," *Times Newspapers Ltd.*, July 25, 1999.

Preventing compromise of information by individuals having custody is extremely difficult. Individuals can, if necessary, memorize documents and transcribe them at home. Therefore, we must ensure that a single insider (the most common subversive profile) cannot steal “the whole store” or some large subset of it. Techniques for preventing such extended compromise include strengthened need-to-know processes and cyber and physical security techniques to minimize the possibility that an individual with limited access to data can expand that access.

Paul Robinson provides an apt summary of the situation:

In my estimation, the counterintelligence program addressing laboratory espionage must become much more sophisticated if it is to be effective. An insider spy at the laboratories is likely to be a Ph.D. in a technical discipline and possess advanced knowledge of computer systems and their vulnerabilities. It will be important for DOE to work in close partnership with the FBI and other law-enforcement and intelligence agencies on methodologies for detecting and apprehending such spies.⁴¹

The Seniors believe that internal advisory committees and red teams should be used. Other alternatives (such as more stringent physical and cyber security, sting operations, and increased surveillance) might be considered. However, alternatives must possess an intellectual foundation that can win acceptance by the scientific community in the laboratories. We believe that polygraph-screening tests are being implemented to mollify Congress—not as a viable part of a security system.

6.0 Conclusions

The Seniors find no scientific or programmatic justification for polygraph screening of employees. In fact, we believe that if polygraph testing is implemented by DOE, national security is likely to decrease by (1) making it easier for subversives to become insiders, (2) driving away talented workers and making it more difficult to recruit new workers, (3) wasting resources trying to correct the errors caused by polygraph testing, and (4) reducing employee commitment (a very important factor in national security and protection against subversion).

Countermeasures and false negatives. Most psychology experts believe that skilled subversives can use countermeasures to defeat polygraph tests. Countermeasures are a serious concern because false negatives give adversaries easier access to information. The potential for false negatives may also give the laboratories an unwarranted sense of security. Because of countermeasures, we don’t think that polygraph examinations will accomplish DOE’s intent—to deter or detect subversive individuals.

⁴¹ C. Paul Robinson, Sandia National Laboratories, “Testimony before the Senate Select Committee on Intelligence,” July 14, 1999.

Accuracy. Reasonable accuracy can be expected for adequately controlled, specific-incident tests. However, it is unwarranted to assume these accuracy rates for screening applications, where accuracies have not been proven to be much better than chance.

False positives. The mathematical chance of incorrect identification of innocent persons as deceptive (false positives) is high in screening applications because only a very small percentage of the group being screened might be guilty. Many innocent individuals will have careers damaged by testing and the relationship between this cost and benefit is not evident. “Tuning” polygraph tests to decrease positive results increases the probability of false negative results, and further reduces its effectiveness in identifying subversives. No technical evidence supports the contention that false positive rates can be as low as 2%. Furthermore if rates are this low, it is doubtful that any subversives will be caught or deterred.

Security system. The entire security system should be improved using a systems approach in which the cost and benefit of changes can be measured. The system should be able to be prototyped, have mechanisms to measure its effectiveness, and be amenable to improvements. A real “service in the national interest” would be to define such a security system that improves national security in both the short and long term.

Appendix I: Acronyms

ANS	Autonomic Nervous System
CIA	Central Intelligence Agency
CQT	Control Question Technique
DOE	Department of Energy
EPPA	Employee Polygraph Protection Act
FBI	Federal Bureau of Investigation
OTA	Office of Technology Assessment

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