INDEPENDENT OVERSIGHT REVIEW OF THE DEPARTMENT OF ENERGY QUALITY ASSURANCE PROGRAM FOR SUSPECT/COUNTERFEIT PARTS

Revision 1
May 1996

Office of Oversight

Environment, Safety and Health
U.S. Department of Energy

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EXECUTIVE SUMMARY

The Department of Energy (DOE) and its predecessor agencies have always applied quality assurance (QA) measures to identify and reject items that do not conform to specifications. In the past ten years, there have been particular concerns about suspect/counterfeit parts in applications that could pose a threat to worker and public health and safety in DOE facilities.

The Office of Oversight was directed to conduct this special study to determine the current status and effectiveness of DOE's QA program for suspect/counterfeit parts. The study highlights the complex issues associated with suspect/counterfeit parts in the Department today, and suggests program enhancements that may improve DOE managers' ability to deal with these issues.

DOE's QA-suspect/counterfeit parts program is partially meeting the performance-based QA requirement for nuclear and non-nuclear programs that "items and services meet established requirements and perform as specified." No reported injuries have been attributed to suspect/counterfeit parts within the Department, and no immediate safety hazards attributable to suspect/counterfeit parts that were serious enough to immediately shut down facility operations were found at the sites reviewed during this study. However, many suspect/counterfeit parts were identified by the study team. Some of these parts were found in systems with important safety-related functions, and the presence of many of these had not been previously identified by the site QA program. In some cases, suspect/counterfeit parts may be adequate for use because their properties are comparable to the design specifications. However, DOE facilities have not adequately evaluated the suitability of such parts for continued use. In addition, some facilities have not adequately identified critical systems and conducted inspections to remove suspect/counterfeit parts that could pose a hazard to workers.

Improved procurement procedures have been effective in reducing the introduction of suspect/counterfeit parts through some known channels. For example, DOE facilities now purchase Grade 5 and Grade 8 bolts only from a very limited number of suppliers; controlling direct purchase of these common bolts, which constitute the overwhelming majority of suspect/counterfeit parts within DOE, has nearly eliminated one significant channel for introducing suspect/counterfeit parts. Varying degrees of concern remain regarding "legacy" parts, whose presence on site predates the implementation of a QA-suspect/counterfeit parts program; suspect/counterfeit parts that are a part of new equipment purchased from outside manufacturers; and subcontractors and their equipment.

In 1991, the Inspector General issued a report identifying shortcomings in the suspect/counterfeit parts program that cast doubt on the program's ability to address these concerns. DOE issued an action plan in 1993 intended to correct those shortcomings. Many of the provisions of the action plan have been completed. For example, many DOE contractors participate in the Supplier Quality Information Group, a voluntary organization for sharing information on vendors and related topics, and a number of sites have established lessons-learned networks to share information on a variety of subjects, including suspect/counterfeit parts.

However, some important elements of the Department's QA programs that pertain to suspect/counterfeit parts are in need of improvement: overall program coordination and integration are lacking, formal implementation guidance is needed in some areas, information about suspect/counterfeit parts is not being effectively disseminated by DOE Headquarters, effective training has not reached some categories of workers, program assessments have not been routinely conducted, and the analysis and inspection of critical safety systems have not been comprehensive. In addition, some provisions of the 1993 DOE action plan that addresses the recommendations of the 1991 Inspector General's report have not been completed. For example, most sites did not have comprehensive lists of all safety systems, structures, and components whose failure could adversely affect the environment, safety, and health of the public and/or the health and safety of workers, as required by the 1993 Plan, even though this requirement has been in effect for three years. Without the assurance that all of

these systems have been identified, there can be little confidence that they have all been inspected for suspect/counterfeit parts in accordance with the 1993 Plan.

DOE's five guiding principles of safety management form the basis of this study. The assessment of these five principles as they pertain to the QA-suspect/counterfeit parts program describes a program that is functioning with varying degrees of effectiveness:

- Line managers in the field recognize the need for an effective QA-suspect/counterfeit parts program, and have taken some of the steps necessary to implement such a program. The program seems to have lost priority with Headquarters managers over the past several years, and, with a few exceptions, their involvement with the field in this area has been minimal. Some important line management responsibilities are not being carried out. For example, neither Headquarters line managers nor those in the field are regularly tracking and trending the performance of the QA program with regard to suspect/counterfeit parts in any formal manner, nor are they documenting the results. Because DOE line managers have not fully addressed the continuing problem of suspect/counterfeit parts, many of the problems pointed out in the 1991 Inspector General's report continue to exist today. This continuing problem needs increased management attention to bring these issues to closure.

- DOE QA policies and procedures provide a basic framework for program implementation. These broad requirements, however, should be supplemented by more specific guidance to promote a more consistent approach to addressing suspect/counterfeit parts issues across the DOE complex, including the appropriate and consistent application of a graded approach to dealing with suspect/counterfeit parts.

- Some elements of the workforce, such as managers, engineers, procurement, and QA personnel, are sufficiently knowledgeable to carry out their responsibilities in the QA-suspect/counterfeit parts program. However, other elements of the workforce who are essential to an effective program, such as receiving, maintenance, and crafts personnel, have not received adequate training to enable them to effectively implement the elements of the program for which they are responsible.

- While oversight of the QA-suspect/counterfeit parts program in the past has primarily focused on identifying suspect/counterfeit parts and not on the effectiveness of program management, management-level oversight of the program is now being conducted.

- Successful enforcement actions have been taken. However, enforcement actions are difficult or impossible to initiate when suspect/counterfeit parts are discovered after they have been placed in service. Difficulties in enforcement often result from difficulties in determining the identity of the responsible supplier with the necessary degree of certainty. The earlier suspect/counterfeit parts can be identified (e.g., by performing receipt inspections), the better the chances are that the responsible supplier can be identified and successful actions taken. Though communicated through a number of mechanisms, better dissemination of information will increase their value as a deterrent to potential suppliers of suspect/counterfeit parts in the future.

Enhancements that should be considered to improve the effectiveness of the QA-suspect/counterfeit parts program are:

- Reviewing policies and guidance to ensure the appropriate and consistent application of a graded approach to dealing with suspect/counterfeit parts, such as that used in the commercial nuclear industry

- Improving the accessibility of current, comprehensive information on suspect/counterfeit parts, including lessons learned by other sites, current technical information, and reliable vendors

- Ensuring that all workers responsible for implementing the suspect/counterfeit parts program have the knowledge and skills necessary to perform their jobs

- Identifying all critical systems, structures, and components to ensure that all such elements have been inspected for suspect/counterfeit parts

- Establishing a means to coordinate and integrate elements of the program.

These enhancements, which are consistent with those of the 1991 Inspector General's report and the 1993 DOE action plan, are offered for consideration by DOE managers responsible for developing and implementing the Department's QA program for suspect/counterfeit parts to reduce potential safety hazards to DOE workers and the public that result from suspect/counterfeit parts.

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ACRONYMS AND INITIALISMS

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
EH	Department of Energy, Office of Environment, Safety and Health
FAR	Federal Acquisition Regulations
FM-1	Associate Deputy Secretary for Field Management
IFI	Industrial Fasteners Institute
IG	Department of Energy, Inspector General
ORPS	Occurrence Reporting and Processing System
QA	Quality Assurance
QC-1	Quality Criteria Standards document
QM-1	Department of Energy, Office of Quality Management
SAE	Society of Automotive Engineers
SESE	Supplier Evaluation and Suspect Equipment (module in SPMS)
SPMS	Safety Performance Measurement System (no longer in operation)
SQIG	Supplier Quality Information Group

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INDEPENDENT OVERSIGHT REVIEW OF THE DEPARTMENT OF ENERGY QUALITY ASSURANCE PROGRAM FOR SUSPECT/COUNTERFEIT PARTS

1.0 INTRODUCTION

Suppliers who knowingly misrepresent critical characteristics of the parts and equipment they sell cost the U.S. government, industry, and consumers millions of dollars every year. More importantly, they endanger the health and safety of workers and the public. Counterfeit parts and equipment that do not perform as specified have caused the failure of critical systems, often with potentially disastrous results. The recently publicized failure of counterfeit bolts securing air-to-air missile launchers that caused several near-crashes of U.S. military aircraft is a recent case in point. The death of a construction worker in Tennessee during the construction of the Saturn automobile plant in the early 1980s, caused in part by the failure of a counterfeit bolt, is another example that shows how long the problem has existed. The criminal prosecution and recovery of over $100 million from Teledyne, Inc., for falsifying certification tests of electronic relays it sold to the Department of Energy (DOE), the Department of Defense, and the National Aeronautics and Space Administration illustrate the potential magnitude of these cases. Ongoing discoveries of suspect/counterfeit parts at DOE facilities show that the problem continues to exist in the Department.

Suspect/counterfeit parts cost the U.S. government and consumers millions of dollars every year and endanger the health and safety of workers and the public.

To address the potential threat that suspect/counterfeit parts could pose to DOE workers and the public, the Office of the Deputy Assistant Secretary for Oversight initiated a number of activities beginning in mid-1995. Oversight placed increased emphasis on the field's quality assurance-suspect/counterfeit parts programs during safety management evaluations, in keeping with the Office of Environment, Safety and Health (EH) oversight responsibilities, which include oversight of the Department's quality assurance (QA) programs. In addition, Oversight reviewed relevant policy documents and occurrence reports to determine the nature and magnitude of the problem within the Department. The results of that review, contained in an Office of Oversight report, *Independent Oversight Analysis of Suspect/Counterfeit Parts Within the Department of Energy* (November 1995), indicate a lack of consistency and comprehensiveness in the Department's QA-suspect/counterfeit parts program. A detailed analysis of the causes and impacts of the problem was recommended. In response, this review was initiated to determine the effectiveness of the Department's QA program for suspect/counterfeit parts.

The Office of the Deputy Assistant Secretary for Oversight initiated a series of activities to address the threat of suspect/counterfeit parts within the Department of Energy.

This study goes beyond merely assessing and reporting the status of the program, however. It is our intention to highlight the complex issues associated with suspect/counterfeit parts in the Department today and to present approaches that DOE managers might consider to address these issues.

A 1991 Inspector General's report and the Department's 1993 action plan provide the historical foundation of the Department's suspect/ counterfeit parts problem.

The 1991 report of the DOE Inspector General (IG), titled *Concerns with the Effectiveness of the Department's Quality Assurance Program Regarding Product Substitution Issues*, and the October 1993 *Plan for the Suspect/Counterfeit Products Issue in the Department of Energy* (hereinafter referred to as the "1993 Plan") provided the historical foundation of the suspect/counterfeit parts problem within the Department and the actions the Department committed to take in addressing it. Other key documents that served as the basis for analyzing the program included the DOE Status of Actions with Regard to Suspect Parts, dated July 22, 1992, and DOE Procurement Controls to Preclude Purchase of Suspect/Counterfeit Parts dated April 28, 1993.

The study was conducted by gathering information from managers at all levels and a number of other persons associated with the QA program at DOE Headquarters and in the field. Information was gathered during a number of field activities, including visits to three DOE sites selected specifically for this study (the K-25 Plant at Oak Ridge, Brookhaven National Laboratory, and the Pantex Plant); reviews

of QA programs during safety management evaluations at the Savannah River Plant and the Hanford Site; and surveillances conducted by EH Residents at the Idaho National Engineering Laboratory, the Rocky Flats Environmental Technology Site, Sandia National Laboratory-Albuquerque, the Stanford Linear Accelerator Center, and the Yucca Mountain Site. The sites chosen for the study were selected based on a number of considerations, including the need to visit a cross section of missions and activities across the complex.

As a performance measure of program effectiveness, a team of experts inspected selected safety systems and other critical, mission-essential equipment at these sites for the presence of suspect/counterfeit parts. Systems and equipment with a direct impact on DOE worker and public health and safety were selected for inspection after reviewing EH site profiles and discussing facility operations with site personnel.

While not all Departmental facilities were reviewed, the results were sufficiently consistent to identify Department-wide trends.

Unlike the safety management evaluations conducted by the Office of Oversight, the intent of this special study is not to evaluate the performance of specific DOE elements. Rather, its intent is to identify and characterize systemic problems with policy, guidance, and implementation. Accordingly, the observations and conclusions contained in this report are not attributed to specific persons, DOE operations offices, or facilities. The information was obtained from a number of specific sources and observations and was all used to formulate the overall conclusions and observations of this report that are applicable across the Department. Site-specific observations were communicated directly by the study team to facility points of contact so that immediate corrective actions could be taken when necessary. While not all facilities were reviewed, the observations made were consistent at both DOE Headquarters and in the field, and the Office of Oversight believes the data to be sufficient to identify trends across DOE facilities.

2.0 BACKGROUND

The Department's suspect/ counterfeit parts program is firmly rooted in its quality assurance program.

DOE's QA policy requires that "items and services meet established requirements and perform as specified," firmly establishing the Department's efforts to address suspect/counterfeit parts as an integral element of the Department's overall QA program. The Department's overall QA program is governed by DOE Order 5700.6C. With certain exceptions, QA for DOE's nuclear programs are subject to 10 CFR 830.120. QA for the weapons program is governed by the Quality Criteria Standards document, QC-1. While none of these documents specifically mentions suspect/counterfeit parts, broad policy requirements in each establish the general foundation for a QA-suspect/counterfeit parts program. In addition, DOE Order 440.1, Worker Protection Management for DOE Federal and Contractor Employees, specifically requires DOE elements to maintain a suspect/counterfeit parts program. Other policy documents pertaining to suspect/counterfeit parts include DOE Order 232.1, Occurrence Reporting and Processing System, and

DOE Order 4330.4B, Maintenance Management Program. The 1993 Plan provides implementation guidance.

Suspect/counterfeit parts became a widespread concern in the 1980s.

Since the beginning of the Manhattan Project in the early 1940s, the Department and its predecessor agencies have been concerned about items that do not conform to specifications. However, suspect/counterfeit parts became a widespread concern in the U.S. in the early to mid-1980s, largely as a result of discoveries of suspect/counterfeit parts in high-profile military and space programs, and the subsequent reporting by the national news media. Public interest further intensified in the wake of special Congressional hearings on suspect/counterfeit parts by Congressman John Dingell (D-MI), Chairman of the House Water and Energy Committee.

In 1989, two to three years after DOE sites began taking action to remove suspect/counterfeit parts from their inventories and critical safety systems, the IG conducted inspections at several DOE sites and found numerous suspect/counterfeit bolts and several suspect/counterfeit electrical components. As a result of these discoveries, IG representatives met with the DOE Senior Nuclear Managers Group to express their concern over the Department's apparent lack of progress in addressing this problem.

In August 1991, EH and the Office of Nuclear Energy jointly revised QA program policy and issued DOE Order 5700.6C. The revised order assigned the program secretarial offices (the Offices of Defense Programs, Environmental Management, Nuclear Energy, and Energy Research) overall responsibility to ensure that the QA policy requirements were met by facility line managers, including both DOE operations offices and management and operating contractors. Cross-cutting support functions, such as policy development, technical assistance (including training), and oversight, were divided between EH for non-nuclear programs, and the Office of Nuclear Energy and the then Office of Nuclear Safety for nuclear programs.

In November 1991, the IG issued its final report, titled *Concerns with the Effectiveness of the Department's Quality Assurance Program Regarding Product Substitution Issues.* The report found that the Department's QA program had not been effective in preventing the introduction of suspect/counterfeit parts into the workplace and that the lack of Department-wide policies and procedures regarding the issue was a primary cause of DOE's inability to develop and implement effective corrective actions. The 1993 Plan was issued to address these concerns. It called for revisions in procurement practices to prevent the introduction of additional suspect/counterfeit parts into DOE facilities; inspections of storage areas and safety systems, structures, and components to identify, analyze, and remove existing suspect/counterfeit parts where necessary; reporting of all instances where suspect/counterfeit parts were discovered; training of persons responsible for various aspects of the program; and periodic assessments of the program's effectiveness.

The 1991 Inspector General's report found that the Department's quality assurance program had not been effective in preventing the introduction of suspect/counterfeit parts.

While to date there have been no reported instances of accidents or near-misses within the Department as the result of suspect/counterfeit parts, thousands of these parts have been discovered in a wide variety of applications at DOE facilities, including critical safety systems. Nuclear weapons programs have always focused their QA programs on a wide range of parts and equipment, including the ability to track most parts and components back to their origins. The non-weapons QA-suspect/counterfeit parts program addresses a variety of items, including Grade 5 and Grade 8 bolts; piping components such as

Thousands of suspect/counterfeit parts have been discovered at Departmental facilities, including critical safety systems.

pipe flanges and valves; electrical components such as circuit breakers, relays, and switches; and computer and other electronic components.

While the overwhelming majority of suspect/counterfeit parts found at DOE sites are Grade 5 and Grade 8 bolts, the true extent of the suspect/counterfeit parts problem affecting other types of parts is difficult to ascertain. Certainly parts other than bolts are a small fraction of the overall number of suspect/counterfeit parts identified each year in DOE facilities. However, other parts are also inherently more difficult to identify than suspect/counterfeit bolts, which can be visually identified by their headmarks or lack thereof. The vast number of different types of parts present in DOE facilities, all of which could be subject to counterfeiting, and many of which can only be identified as counterfeit through testing or when they fail in service, clearly points out the need for a strong engineering involvement in design, specification, procurement, and review as a first line of defense against this problem.

3.0 QUALITY ASSURANCE MANAGEMENT EVALUATION

The Department of Energy's five guiding principles of safety management apply to the Department's QA-suspect/counterfeit parts program and form the framework of this special study.

The five guiding principles of safety management form the frame- work of this study.

Sections 3.1 through 3.5 of this report present an evaluation of the potential problems of suspect/counterfeit parts using the five guiding principles of safety management. Within these sections, a number of potential program enhancements are identified; these are discussed in more detail in Section 4.0.

3.1 Line Manager Responsibility and Accountability

Line managers in the field who were interviewed for this study understand their roles and responsibilities, and uniformly stated their commitment to maintaining an effective QA-suspect/counterfeit parts program. This commitment is evidenced in a number of ways, the most basic of which is the fact that all of the sites visited, which represent a wide cross section of DOE programs, missions, and activities, have documented, functioning QA-suspect/counterfeit parts programs in place. However, these programs are in need of enhancements in a number of areas, many of which were also identified in the 1991 IG report. Many of the provisions of the 1993 Plan have been addressed, although shortfalls were identified in the implementation of several Plan elements.

All of the sites visited have functioning quality assurance programs that address suspect/counterfeit parts.

While the effectiveness and efficiency of these programs varies from site to site, the basic framework for addressing the suspect/counterfeit parts problem exists at the three sites chosen for this study, as well as other sites reviewed by EH Residents and Office of Oversight safety management evaluations.

Line managers in the field have also demonstrated their commitment to the program by implementing innovative means of compensating for some of the gaps in program guidance and technical support from DOE Headquarters. For example, the Supplier Quality Information Group (SQIG) was formed by DOE contractors to share information on vendor inspections and related information in the absence of an official source for this information. In addition, the field has established lessons-learned networks to share information on a variety of subjects, including suspect/counterfeit parts.

Line managers in the field have implemented innovative means to address suspect/counterfeit parts problems.

Likewise, the EH managers responsible for policy and technical assistance generally understand their specific roles and responsibilities, although they are less clear about which organizations are responsible for elements of the program other than their own. Their commitment to the program during the time period 1991 to 1994 was adequate, as evidenced by the development of a training program that has been of value to all DOE facilities, the conduct of technical assistance visits, and the establishment of a working group to deal with cross-cutting issues.

The priority of the program at Headquarters has been slipping over the past several years.

The program's priority within Headquarters, EH, and the program offices has changed during the past several years. After the 1991 IG report and the 1993 Plan were issued, a number of actions were taken to address the problem of suspect/counterfeit parts. These actions included issuing a Quality Alert and forming a working group to address related issues. However, following this initial flurry of activity, the degree of emphasis on the program has decreased. For example:

- The roles and responsibilities defined in the QA order have not been revised to reflect DOE's current organizational structure, and while responsibility for various QA program support functions now resides in EH, no organization has overall responsibility for coordinating and integrating the various elements of the QA program, including suspect/ counterfeit parts.

- Some provisions of the 1993 Plan have not been fully implemented.

- Other than the 1992 Quality Alert and a Safety Flash issued in 1994, Headquarters has provided little technical information concerning suspect/counterfeit parts to the field. In contrast, the Nuclear Regulatory Commission has issued 32 bulletins and information notices pertaining to various aspects of the suspect/counterfeit parts problem. DOE has provided similar information during training courses, but that information only reaches a portion of DOE sites at any one time. Some sites have taken the initiative to obtain this information from other sources. However, DOE has not formally provided useful information to the field in a systematic and comprehensive manner.

- Headquarters established a suspect/counterfeit parts working group in 1994, but after meeting twice in the initial ten-month period, the group has not met until recently, when it was reestablished in response to concerns raised by the IG and the Defense Nuclear Facilities Safety Board (DNFSB).
- EH funding for suspect/counterfeit parts technical assistance has been reduced to the point that the long-term effectiveness of some activities, such as training support, may be in jeopardy.

Program effectiveness varies from site to site.

The impact on the field of this reduced leadership from DOE Headquarters has varied. For example, one of the sites visited during the study has an effective QA program to address suspect/counterfeit

parts; this program includes regular inspections, comprehensive training for workers at all levels whose duties involve the suspect/counterfeit parts program, and a well documented, formally structured methodology for applying a graded approach. In contrast, another of the sites visited has a much less effective program that has only identified a few suspect/counterfeit parts since the time period 1991 to 1993, despite the fact that the study team identified hundreds in safety related systems within several days, showing that suspect/counterfeit are present at this site. The effectiveness of the programs at other sites reviewed for this study varied as well.

Field personnel expressed their need for an effective, user-friendly method of sharing information on suspect/-counterfeit parts.

Field personnel interviewed for this study consistently expressed their need for an effective, user-friendly means of sharing information on suspect/counterfeit parts among the sites and Headquarters. While the Occurrence Reporting and Processing System (ORPS) is being used to report suspect/counterfeit parts discoveries and corrective actions, sites use rollup reports that consolidate into quarterly reports; the reports do not provide a means of sharing other useful information of interest, such as technical information and vendor performance.

Members of the Supplier Quality Information Group share useful vendor information.

Many contractors participate in SQIG as a means of sharing vendor information. Some of the personnel interviewed indicated that, with some additional development, SQIG could be expanded to serve as a DOE-wide source of vendor information.

Line managers' ability to carry out their responsibilities for the QA-suspect/counterfeit parts program, particularly at DOE Headquarters, would be enhanced by defining the responsibility to integrate and coordinate the various program elements. There are many ways in which this function could be accomplished. Whatever option is selected, the responsibilities should include maintaining an appropriate degree of emphasis on the program throughout the Department; coordinating and integrating the various program elements to promote a long-term, cost effective approach that is smoothly integrated into routine facility operations; providing a forum to air and resolve Department-wide issues; and interfacing with other government agencies. This area is discussed in more detail in Section 4.5.

Summary. Line managers in the field are committed to maintaining effective QA-suspect/counterfeit parts programs, and they understand their roles and responsibilities in making the program successful. All sites visited have implemented the basic framework for a program to address suspect/counterfeit parts, although the efficiency and in some cases the effectiveness of these programs has suffered to varying degrees from the reduced attention and emphasis on the issue at DOE Headquarters. Line managers' ability to carry out their responsibilities for the QA-suspect/counterfeit parts program, particularly at DOE Headquarters, would be enhanced by defining the responsibility to ensure consistent attention and emphasis within the Department and to promote a long-term, cost effective approach that is integrated into routine facility operations.

Line managers in the field are committed to effective quality assurance and suspect/counterfeit parts programs.

3.2 Comprehensive Requirements

Policy and Guidance. The policy for the Department's efforts to address the problem of suspect/counterfeit parts lies within the overall framework of DOE QA programs. When properly implemented, this policy provides an adequate basis for an effective program.

Departmental policy adequately supports effective suspect/ counterfeit parts measures.

The Department's overall QA program is governed by DOE Order 5700.6C, and the QA programs at DOE's nuclear facilities fall under the requirements of 10 CFR 830.120. The provisions of these two documents are basically identical. They contain general, performance-based requirements (e.g., "items and services meet established requirements and perform as specified") that establish the basic requirements for a QA program, which, in turn, provides the framework for a suspect/counterfeit parts program.

The Department's program covering suspect/counterfeit parts is based on the quality assurance program requirement that "items and services meet established requirements and perform as specified."

The nuclear weapons program follows QC-1, a quality control program implementation document developed and administered by the Albuquerque Operations Office. Because the weapons program rarely purchases off-the-shelf parts of the types that make up the vast majority of the Department's suspect/counterfeit parts problem, the weapons QA program was reviewed to a lesser extent than the other two elements of the DOE QA program. The review of weapons program QA was limited to a review of QC-1 and inspections of support equipment. Parts used in weapons were not inspected.

In addition to QA policies, suspect/counterfeit parts are also addressed in DOE Order 440.1, Worker Protection Management for DOE Federal and Contractor Employees. The requirements of DOE Order 440.1, which apply to all DOE programs, are specific to suspect/counterfeit parts programs. This order requires that DOE elements maintain suspect/counterfeit parts programs; identify, document, test, and remove suspect/counterfeit parts; report suspect/counterfeit parts to the program office and IG; ensure the quality of products with critical safety functions; and maintain knowledge of suspect/counterfeit parts and vendors.

There is depth to the Department's policies and procedures that apply to suspect/counterfeit parts. In addition to the requirements discussed above, DOE Order 5480.21, Unreviewed Safety Questions, and facility-specific non-conformance programs also affect the handling of suspect/counterfeit parts. DOE Order 5480.21 identifies various conditions under which existing safety analyses can be rendered inadequate. These conditions include the availability of information, operational events, and non-conforming conditions. The latter of these applies to suspect/counterfeit parts. DOE Order 5480.21 requires the analysis of these conditions and, based upon the results of that analysis, a determination to (1) restore the facility to its intended condition, (2) take compensatory actions, and/or (3) modify the existing documentation. Systems not covered by DOE Order 5480.21 typically have similar but less rigorous provisions for dealing with non-conforming conditions.

While DOE policy for both nuclear and non-nuclear QA programs clearly establishes the requirement for a QA program, it does not contain specific details on what the suspect/counterfeit parts program should look like or how it should be implemented. The 1993 Plan, which was issued as a memorandum from the Office of Nuclear Energy, acting for the Secretary, provides such detailed guidance in some areas,

The 1993 plan for addressing Departmental suspect/counterfeit parts issues should be formalized as Departmental guidance.

and most facilities are using it as the basis for their QA-suspect/counterfeit parts programs. The QA Order requires DOE contractors to develop implementation plans for their QA programs and requires program offices to review and approve these plans. While these implementation plans existed at the sites visited for this study, the comprehensiveness and consistency of these plans could be enhanced if additional guidance were available to the contractors preparing the plans and to the DOE offices responsible for ensuring that they are adequate. Providing this guidance would also address the 1991 IG finding that "the lack of standard, Department-wide policies and *guidelines* [emphasis added] regarding product substitution contributed to the inability of the Department and its contractors to develop and implement the necessary corrective actions to address these issues."

DOE policy on suspect/counterfeit parts also lacks guidance for the appropriate and consistent application of a graded approach similar to that used by the commercial nuclear industry (i.e., selecting from a range of options to deal with suspect/counterfeit parts, from immediate replacement when an immediate safety hazard exists, to leaving a part "as is" if analysis indicates that it is capable of performing as required in the specific application). This area is discussed in additional detail in Section 4.1.

In general, the field's implementation of the quality assurance-suspect/counterfeit parts program has been effective, but significant inconsistencies were noted.

Implementation. Implementation of DOE's QA-suspect/counterfeit parts program in the field has been partially successful, as evidenced, for example, by the near-elimination of direct purchases of fasteners as a source of suspect/counterfeit bolts due to improved procurement practices. However, significant inconsistencies in effectiveness were observed among the facilities visited. For example, one of the facilities visited for this study had not discovered any suspect/counterfeit parts during the past two years, despite the fact that the study team identified hundreds within several days. In contrast, another of the facilities visited has an active "walkdown" and maintenance inspection program that has identified numerous suspect/counterfeit parts during the same period. The potential risks that suspect/ counterfeit parts present to DOE workers and the public are similar at both facilities, yet one facility is much more effective in identifying these parts and reducing the risk.

Many of the provisions of the 1993 Plan have been completed. For example:

- Implementation plans were developed, reviewed, and approved by DOE.
- Inspections were conducted, and a large number of suspect/counterfeit parts were identified and removed.
- Procurement controls were strengthened.
- Suspect/counterfeit parts are being reported.

- The Quality Alert, published in 1992, disseminated technical information on suspect/counterfeit parts.

- Training has been conducted at most sites.

- Program assessments have been conducted by DOE and contractor organizations.

- Enforcement actions have been brought to closure, and a significant amount of money has been recovered.

Procurement measures have nearly eliminated one of the major sources of suspect/counterfeit parts, the direct purchase of bolts.

Of special note are procurement measures implemented as a result of the IG report. These measures have been effective in addressing some aspects of the suspect/counterfeit parts issue and have nearly eliminated the direct purchase of bolts as a source of suspect/counterfeit parts. Most sites also have vendor qualification programs, including onsite inspections of vendor operations. In addition, local engineering organizations generally had an appropriate level of involvement in the design, specification, and procurement processes at the sites visited. Engineering organizations developed specifications, including acceptance criteria, that were incorporated into purchase orders and contracts. They developed acceptance test protocols, when needed, and performed the analyses required for the application of a graded approach to determine appropriate actions when suspect/counterfeit parts were discovered in service.

The 1993 Plan is not yet fully implemented.

While considerable progress has been made in implementing the 1993 Plan, much remains to be done. For example:

- Suspect/counterfeit parts continue to be discovered throughout DOE facilities, including in safety-related systems.

- There is no assurance that all critical safety systems have been inspected, because lists of these systems have not been developed.

- There is no easily accessible means of disseminating suspect/counterfeit parts information other than actual discoveries.

- Adequate training has not been provided to certain categories of workers with important functions in the suspect/counterfeit parts programs at their sites.

Discrepancies have been noted at some sites concerning the completion of 1993 Plan elements. For example, the DNFSB stated that they were assured in an October 1995 meeting that all suspect/counterfeit parts had been identified and removed from a specific DOE facility, yet when DNFSB staff members inspected the facility several months later, they found several suspect/ counterfeit parts. Responsibility for validating the completion of elements of the 1993 Plan at specific sites rests with the cognizant operations office.

Most facilities have not developed comprehensive lists of critical safety-

Inspections of parts stored in storerooms or maintenance shops have been completed, resulting in the identification and removal of large numbers of suspect/counterfeit parts. However, suspect/counterfeit parts continue to be found in inventories. Suspect/counterfeit parts have also been identified and removed from many safety-related systems, structures, and components. However, many facilities have not developed comprehensive lists of all safety systems, structures, and components whose failure could adversely affect the environment, the safety and health of the public, and/or the health and safety of workers as required by the 1993 Plan, even though this requirement has been in effect for over two years. Without the assurance that these systems have been identified, there can be little confidence that they have all been inspected for suspect/counterfeit parts in accordance with the 1993 Plan. These lists are important tools for the efficient application of a graded approach to determine the appropriate actions when suspect/counterfeit parts are discovered in service. Additional discussion of this area is provided in Section 4.4.

related systems, structures, and components.

A significant element of the information database being used nationwide for suspect/counterfeit parts training and for field identification of suspect/counterfeit bolts may not be current. The most common means of identifying suspect/counterfeit bolts is through charts illustrating the bolt headmarks of manufacturers known to have produced counterfeit bolts. These charts, present throughout every DOE facility visited during the study, are based on tests conducted in the late 1980s by various organizations, such as U.S. Customs, the Department of Transportation, and the Industrial Fasteners Institute. Interviews with representatives of these organizations revealed that the DOE information has not been updated. As a result, manufacturers that are not listed on the charts may now be producing counterfeit bolts. DOE should consider working with other affected government agencies to develop updated charts.

The charts used to identify manufacturers who have produced counterfeit bolts are out of date.

Over 4,000 suspect/counterfeit bolts and seven suspect/counterfeit electrical relays and circuit breakers were identified by the study team at the three sites visited. These parts were found in nuclear reactors, nuclear accelerators, uranium enrichment facilities, nuclear and hazardous waste treatment facilities, weapons assembly and disassembly facilities, and facilities that have nuclear reactors and nuclear accelerators. The types of systems and equipment within these facilities where these parts were found included fire suppression systems, hoisting and lifting equipment, high pres-

Over 4,000 suspect/counterfeit parts were identified at the study sites.

sure steam and water systems, and high voltage electrical distribution systems. Over 100 of the bolts were located in areas designated by the sites as critical safety systems; the presence of these bolts had not previously been identified by the site QA program. For example, at one facility, 116 suspect/counterfeit bolts were found in main header piping connections for the fire suppression system. The sites' initial determinations were that these bolts did not present an imminent safety hazard in the specific applications in which they were found. However, the fact that such parts were found in critical systems, some of which had been previously inspected, raises questions about the effectiveness of detecting suspect/counterfeit parts.

The primary locations of suspect/counterfeit parts at DOE facilities today are: (1) systems, structures, and components that predate the implementation of suspect/counterfeit parts programs at DOE facilities (i.e., "legacy" parts), (2) new equipment purchased from outside manufacturers, and (3) subcontractors and their equipment.

"Legacy" parts account for most suspect/counterfeit parts in Departmental facilities today.

Most of the suspect/counterfeit parts being found in service today are so-called "legacy" parts, meaning that they were placed in service before the facility implemented suspect/counterfeit parts control measures. When discovered in an in-service application, their presence does not indicate a failure of the current procurement system to control suspect/counterfeit parts. It does point out, however, the importance of thorough inspections of critical systems, structures, and components to identify and remove suspect/counterfeit parts that are not suitable for

their applications. The continuing problem of legacy parts is an indication that facilities' inspections have not been entirely effective in identifying and removing suspect/counterfeit parts. It also indicates that training has not focused on some categories of workers, such as maintenance and other crafts persons.

New equipment is one of the primary pathways for suspect/ counterfeit bolts.

While procurement controls seem to have effectively eliminated direct purchases as a source of suspect/counterfeit bolts, receipt inspections have been less effective in identifying suspect/counterfeit bolts in new equipment purchased from outside manufacturers. For example, many of the over 4,000 suspect/counterfeit bolts identified during this study were found in new valves supplied by reputable national manufacturers. Other than these bolts, all of the components of these valves were genuine. New equipment is one of the primary pathways for suspect/counterfeit bolts entering DOE facilities today.

All of the sites visited have quality clauses in purchase orders and contracts. However, many sites do not have "flow down" provisions that apply quality requirements to all subcontractor levels and do not inspect equipment used and/or provided by subcontractors. As a result, subcontractors and their equipment are another of the primary sources of suspect/counterfeit parts.

Few program assessments are being conducted.

Assessment. The 1993 Plan requires that line managers include suspect/counterfeit parts programs in their assessment programs. While assessments were conducted during 1991 through 1994, during the last several years only one operations office and none of the contractor organizations have assessed the effectiveness of their QA-suspect/counterfeit parts programs to gauge their effectiveness and identify areas requiring attention. This lack of program assessment includes the absence of tracking or trending via ORPS and other reports of suspect/-counterfeit parts discoveries to identify potential problem areas. Tracking and trending suspect/counterfeit parts occurrences is an important management tool that provides valuable feedback on system performance. It identifies systemic program weaknesses and provides information on how to correct them. The lack of Department-wide tracking and trending in this area is another indication of the absence of an integrated, Departmental approach to addressing the suspect/ counterfeit parts issue. As a result, opportunities to improve the program's effectiveness are being lost.

The most important elements of the 1993 Plan that have not been completed are formal, documented analyses of critical systems, structures, and components.

Summary. Comprehensive requirements for the QA-suspect/ counterfeit parts program exist, although improvements are needed. The policies that govern DOE's efforts to address the problem of suspect/counterfeit parts lie within the framework of the Department's QA programs. There is considerable depth to the Department's efforts to deal with suspect/counterfeit parts. In addition to the QA programs, a number of other related programs address suspect/counterfeit parts, albeit indirectly in some cases. DOE's policies lack sufficient guidance on implementing QA-suspect/counterfeit parts programs and on the application of a graded approach consistent with commercial nuclear industry practice. Implementation of the program has been relatively

successful, but the effectiveness of programs at the sites visited varied significantly. Many of the provisions of the 1993 Plan have been completed and have successfully addressed significant portions of the suspect/counterfeit parts problem. The most significant uncompleted item is the conduct of formal, documented analyses of all critical system, structures, and components to ensure that all such elements have been inspected for suspect/ counterfeit parts.

3.3 Competence Commensurate with Responsibilities

When the need for suspect/counterfeit parts training was identified in the 1993 Plan, DOE Headquarters responded by sponsoring the development of a training program and presenting the training to the field on request. Over 2,500 persons were trained by the EH-funded training team, operated by the DOE Quality Training Resource Center located in Richland, Washington, until funding was eliminated in fiscal year 1995. Now, individual sites, operations offices, and, in some cases, the program offices pay the direct costs for the training they use. Responsibility for developing and funding updated training modules or developing new modules has not been formally assigned. Unless resolved, this lack of assigned responsibility and funding could endanger the long-term future of the training program.

Suspect/counterfeit parts training has not reached some categories of workers with important responsibilities for the program.

In addition to an overall suspect/counterfeit parts training module, job-specific modules have been developed for procurement, vendor development and evaluation, cranes, and engineering design and specification. Observations by study team members who participated in a portion of the program, and reports from personnel in the field interviewed for this study who have participated in the training program, are favorable. Most of the approximately 2,500 persons who have received training in suspect/counterfeit parts to date have been management, procurement, engineering, and QA personnel. All of these categories of personnel who were interviewed during the study were knowledgeable concerning suspect/counterfeit parts within their specific disciplines.

However, few personnel responsible for receipt inspections, warehouse and storage operations, and maintenance and construction activities have received formal suspect/counterfeit parts training. Persons in these job categories who were interviewed during the study generally demonstrated significantly less knowledge and awareness of suspect/counterfeit parts. For example, DOE facilities conduct annual maintenance walkdowns to meet the requirements of DOE Order 4330.4B, Maintenance Management Program. While these provide an excellent opportunity to inspect critical systems, structures, and components for suspect/counterfeit parts, few are actually identified. Receipt inspections have not been effective in identifying suspect/counterfeit parts, primarily bolts, in equipment assembled by offsite manufacturers. At one facility, QA personnel had identified thousands of suspect/ counterfeit parts, while other crafts persons had identified few. Suspect/counterfeit parts training for crafts persons will become even more important as DOE procurement practices become

increasingly distributed, often eliminating the central receiving facility as a check point and placing more reliance for identifying incoming suspect/counterfeit parts on individual workers. Potential enhancements to address this problem are discussed in Section 4.3.

Summary. A large number of persons have received suspect/counterfeit parts training, but important elements of the workforce responsible for the program have not been trained. As a result, the elements of the program that these workers are responsible for have not been nearly as effective as others. In addition, the long-term future of the training program may be in doubt unless provisions are made to update the training modules as needed.

3.4 Independent Oversight

Independent oversight refers to activities performed by the Office of Oversight.

As defined by DOE's guiding principles of safety management, "independent oversight" refers only to activities conducted by the Office of Oversight, and not to assessments conducted by DOE Headquarters and operations office line managers, or to self-assessment activities conducted by contractor line managers. During the period from 1991 to 1994, prior to the formation of the Office of Oversight, EH conducted a number of oversight activities dealing with suspect/counterfeit parts. After a Department-wide realignment and the EH reorganization, QA-suspect/counterfeit parts program oversight activities were resumed under the Office of Oversight, which was created in December 1994.

Independent oversight has recently increased emphasis on the suspect/counterfeit parts program.

During its initial efforts, the evaluations did not review QA/suspect/counterfeit parts programs. However, the Office of Oversight is now conducting independent oversight of the suspect/counterfeit parts program through several means. QA-suspect/counterfeit parts programs are reviewed during regularly scheduled safety management evaluations, which provide ongoing assessments of the program's effectiveness. In addition, the Office of Oversight EH Residents conduct surveillances of the QA-suspect/counterfeit parts programs at facilities for which they are responsible. Rather than duplicate the efforts of the operations offices, the Office of Oversight focuses on line management's effectiveness in establishing and directing programs and in monitoring contractor performance.

3.5 Enforcement

Enforcement is the action taken after suspect/counterfeit parts are discovered and includes two major categories of actions that DOE and its contractors can bring to bear against suppliers that fail to comply with established requirements: (1) legal actions, which include criminal and civil penalties and fines under the Price-Anderson Act; and (2) administrative actions, which are determined by the provisions of contracts and purchase orders and by procurement practices.

The biggest single barrier to enforcement actions is the inability to trace the parts back to a specific vendor.

Enforcement actions are difficult or impossible to initiate when suspect/counterfeit parts are discovered after they have been placed in service. Difficulties in enforcement often result from difficulties in determining the identity of the responsible supplier with the necessary degree of certainty. The earlier suspect/counterfeit parts can be identified (e.g., by performing receipt inspections), the better the chances are that the responsible supplier can be identified and successful actions taken. Some successful enforcement actions have been taken, and several measures would further increase enforcement effectiveness. These include publicizing successes more effectively to increase their value as a deterrent to potential suppliers of suspect/-counterfeit parts in the future, and considering the total cost to the Department of suspect/counterfeit parts programs instead of the cost of the parts alone when establishing threshold values for enforcement actions.

In the period from fiscal year 1990 to fiscal year 1995, the Department processed approximately 1,500 criminal investigation cases, 26 of which primarily involved suspect/ counterfeit parts. Twenty-three of these 26 cases have been closed; five have resulted in criminal convictions, and four have resulted in suspension or debarment. A total of $107 million has been recovered for the government through fines, criminal and civil penalties, and restitution. Over $100 million of this total resulted from a single case against Teledyne, Inc., for falsifying certification test results of relays it sold to DOE, the Department of Defense, the National Aeronautics and Space Administration, and others. However, despite the fact that these results are published through several means, they are not well known in the field. Few of the line manager and QA program personnel interviewed in the field had any knowledge of the extent of enforcement actions initiated or of their outcome. Aside from punishing wrongdoers, one of the principal goals of the enforcement program should be to deter potential suppliers of suspect/ counterfeit parts. However, the deterrent effect is lost if suppliers of suspect/counterfeit parts are not aware of the potential consequences of their actions. Existing information sources should be used to better publicize the results of enforcement actions in order to maximize their value as a deterrent to potential suspect/counterfeit parts suppliers and to demonstrate to DOE workers that their efforts in the suspect/ counterfeit parts program produce tangible results.

Well publicized enforcement actions would have considerable deterrent value.

Some legal enforcement actions have been hampered by thresholds established by local U.S. Attorneys. The actual direct cost of the suspect/counterfeit parts is the primary factor considered, but other factors should also come into play, including the degree of potential hazard presented by the part(s), as well as the supplier's intent. For example, the dollar value threshold at one site visited is $1,500. Discoveries of suspect/counterfeit parts whose value is less than this amount are less likely to receive any further attention from the U.S. Attorney or the DOE IG. Similar situations exist at other sites visited. The fact that a large number of suspect/counterfeit parts discoveries fall far below this amount is a primary reason for the small number of suspect/counterfeit parts cases that the IG investigates. Practices such as "just-in-time" procurement may indirectly contribute to this problem by resulting in smaller purchases, making it more unlikely that any single suspect/counterfeit parts discovery will meet the thresholds. When cost is the primary determining factor in deciding whether to pursue enforcement actions, the potential real cost to the Department of suspect/counterfeit parts is not considered, i.e., the potentially severe consequences should a critical part fail.

Traceability of suspect/counterfeit parts found in service is a concern.

Another barrier to enforcement and prosecution is the inability of the sites to determine who supplied the suspect/counterfeit parts that are discovered. This problem of traceability is the greatest in the cases where parts are discovered in service. The earlier suspect/counterfeit parts can be identified (e.g., by performing receipt inspections), the better the chances are that the identity of the supplier will be known. Once a part is installed, it is difficult to determine where it came from, unless it has a unique identifier such as a serial number, which most parts do not have. Such difficulties are compounded if a facility buys the same type of part from a number of vendors. One approach successfully used by some sites to improve the traceability of suspect/-counterfeit parts is to limit the number of vendors from whom they purchase specific types of parts, thus increasing the likelihood of knowing where a specific part came from.

By their nature, legal remedies for suspect/counterfeit parts discoveries require higher standards of proof that, for the reasons discussed above, cannot be met in many cases. However, there are effective actions that DOE and its contractors can take short of legal actions. These include building incentives and penalties into contracts and purchase orders to discourage companies from supplying suspect/counterfeit parts. Perhaps most effective would be simply refusing to do further business with vendors who are known to have supplied suspect/counterfeit parts. One of the sites visited during the study had a "one strike and you're out" policy stating that the site would not do business with any vendor after a single instance of supplying suspect/counterfeit parts. The study team did not encounter any situations where facilities had not recovered at least the price paid for suspect/counterfeit items they had received when the identity of the supplier was known.

Summary. DOE's enforcement program has led to the successful prosecution of over 20 cases, including one case that resulted in penalties in excess of $100 million. However, the overwhelming majority of suspect/counterfeit parts that are discovered do not lead to any penalties. The inability to trace a specific suspect/ counterfeit part back to the vendor who supplied it is one reason. This problem is primarily related to "legacy" parts. The effectiveness of the enforcement program could be enhanced by improving traceability at the site level and by better publicizing enforcement actions to increase their deterrent value. The deterrent value of well publicized enforcement actions could save the Department much more in program costs than the cost of the parts alone by reducing the overall number of suspect/-counterfeit parts cases.

The Department's enforcement program has successfully prosecuted over twenty cases.

4.0 POTENTIAL ENHANCEMENTS

This section of the report discusses approaches to address problem areas identified during the study.

4.1 Review policies and guidance to ensure the appropriate and consistent application of a graded approach to dealing with suspect/counterfeit parts that is consistent with commercial nuclear industry practice.

When suspect/counterfeit parts are discovered in service, acceptable commercial nuclear industry practice calls for an immediate analysis of the part's suitability for the specific application. Based on the results of that analysis, there are three basic actions that can be taken. If the part is clearly unsuitable for its application and its failure could cause a safety hazard or damage to the environment, operation of the equipment or facility where the part is located should immediately cease, and the part should be replaced before the equipment or facility is placed back into service. If the part is determined to be unsuitable for its application but its failure would not cause a safety hazard or threat to the environment, replacement can be deferred until a later date, normally during scheduled maintenance. Finally, because suspect/counterfeit parts are not always unsuitable for every application, a third option is to leave the part "as is" if the analysis, and in some cases testing, indicates that it is capable of functioning as required. This graded approach provides balance by focusing attention and resources on the actual safety hazards, while not unnecessarily replacing parts that may be suitable for some applications.

When suspect/counterfeit parts are discovered, commercial nuclear industry practice calls for an immediate analysis to determine whether the part is suitable for the application.

The graded approach is readily applicable to bolts, where the engineering analysis of the required characteristics is relatively straightforward, but may not be appropriate for some types of suspect/counterfeit parts, such as refurbished molded case circuit breakers. These types of parts should always be replaced. Also, the graded approach should not be used when suspect/counterfeit parts are discovered during receipt inspections. In these cases, the parts should be rejected and other enforcement actions taken as appropriate.

A graded approach is appropriate for bolts because the analysis of required characteristics is straight-forward.

While the QA order's requirement that "procured items and services meet established requirements and perform as required" does not preclude a graded approach, DOE Order 440.1, concerning the worker protection program, requires facilities to "identify, document, test, and remove counterfeit or suspect parts." This requirement, at least on the surface, seems to require that all suspect/counterfeit parts be removed, regardless of whether they are capable of performing satisfactorily in a given application. If this is actually the intent of the policy, it is requiring DOE facilities to meet standards in excess of commercial nuclear industry practice and may not be promoting the most efficient use of DOE resources. In some cases, replacing suspect/counterfeit parts may actually create hazards, such as the case where personnel must work in high radiation areas to replace a part. In addition, certain codes, such as the ASME Pressure Vessel and Boiler Codes, may not permit non-conforming parts of any type to remain in place. All of these factors should be considered when determining the most appropriate course of action.

The key to the success of a graded approach in responding to suspect/counterfeit parts is to ensure safety while maintaining efficiency. Thus, the quality of the testing and analysis that underlies the decision process is critical. All of the sites visited during this study use some form of graded approach. However, the formality and quality of their testing, analysis, and decision process, and the degree to which the process is documented, vary greatly from site to site. Guidelines should be established to ensure that the graded approach is a disciplined process supported by documentation of all testing and analysis. This will provide a balanced, common-sense approach to dealing with the suspect/counterfeit parts issue.

All sites use some form of graded approach, but the degree of formality varies significantly.

4.2 Improve the accessibility of current, comprehensive information on suspect/counterfeit parts, in cluding lessons learned by other sites, current technical information, and reliabl e vendors.

Both the 1991 IG report and the 1993 Plan recognized the need for a system to share information on suspect/counterfeit parts among DOE Headquarters elements and the field. The 1993 Plan encouraged the use of the Supplier Evaluation and Suspect Equipment (SESE) module of the Safety Performance Measurement System (SPMS) for this purpose. However, the SPMS is no longer active. The ORPS is the only system being widely used to report discoveries of suspect/counterfeit parts; some information can also be found on several Departmental lessons-learned networks. Although some sites have developed informal sources of information, such as trade association information, and most were aware of the Government Industry Data Exchange Program, field personnel interviewed for this study consistently expressed their need for an effective, user-friendly means of sharing information on suspect/counterfeit parts among the sites and Headquarters. While the ORPS is being used to report suspect/counterfeit parts discoveries and corrective actions, it does not provide a means of sharing other useful

information of interest, such as technical information and vendor qualifications.

The Department has several existing resources that could meet this need. These resources include the lessons-learned network maintained by the DOE Office of Quality Management (QM-1), the Success-thru-Sharing (S+S) Web site, and several information-sharing networks maintained by the DOE Lessons Learned Society, an organization of personnel from Headquarters program offices, operations offices, and contractors. Additional efforts to develop a QA-suspect/counterfeit parts information-sharing network have been recently re-initiated after being dormant since October 1994. Program and line managers must work together to meet a need identified five years ago and never completed.

Existing lessons-learned networks could be used to disseminate suspect/counterfeit parts information.

4.3 Ensure that workers responsible for implementing the suspect/counterfeit parts program have the knowledge and skills necessary to perform their jobs.

While much training has been presented, at most sites it has focused primarily on management, engineering, QA, and procurement personnel. As evidenced by a general lack of worker knowledge and awareness of the suspect/counterfeit parts issue observed during interviews and during a review of training records, it appears that there has been little job-oriented training for receipt inspection, warehouse and storage, and maintenance and construction personnel who must be an integral part of an effective program. These personnel form the last line of defense in preventing new suspect/counterfeit parts from being installed in the workplace and in preventing known suspect/counterfeit parts from migrating from one area to another.

Most sites have not developed their own suspect/counterfeit parts training program. They rely instead on a program presented on request by the Hanford Quality Training Resource Center. This training program was developed under EH sponsorship for different categories of site personnel. Single-source training such as this may not be the most efficient way to train the large numbers of personnel across the Department having suspect/ counterfeit parts program responsibilities and to maintain their competence. To ensure that all workers who need the training receive it and that their knowledge remains current, line managers in the field should consider developing site- and job-specific suspect/counterfeit parts training that is integrated into employee initial and refresher training programs.

Suspect/counterfeit parts training should be integrated into each site's initial and refresher training programs for their employees.

Ideally, a central source should provide training materials, including up-to-date technical information, that can be readily adapted for site-specific use. The DOE Central Training Academy uses this approach for many safeguards and security training courses.

Training materials could be provided by a central training resource.

4.4 Identify critical systems, structures, and components to ensure that such elements have been inspected for suspect/counterfeit parts.

The 1993 Plan requires all DOE facilities to inspect and remove suspect/counterfeit parts from existing inventories and from critical safety-related systems, structures, and components whose failure could adversely affect the health and safety of DOE workers, the public, or the environment. However, not all facilities have formally analyzed their facilities to identify such systems, structures, and components that support their mission-essential or other key facilities. Without such analysis and identification, there can be no assurance that a site's suspect/counterfeit parts program is focused on the right areas and that all suspect/counterfeit parts whose failure could present a safety hazard have been located, analyzed, and replaced as necessary.

Identification of all safety-related systems, structures, and components is critical to ensure that all such elements have been inspected for suspect/counterfeit parts.

Given the limited resources available to implement QA-suspect/counterfeit parts programs at DOE sites, an appropriate prioritization is essential to maximizing the results of any effort. Without comprehensive analyses to ensure that all critical safety systems, structures, and components have been identified, there can be no assurance that the Department's resources are being directed towards the most important areas.

4.5 Establish a means to coordinate and integrate elements of the program.

Many of the shortfalls identified during this study can be attributed to the fact that overall responsibility for maintaining the Department's focus on the suspect/counterfeit parts issue has not been adequately defined. For example, there has been no feedback on where the program has been effective and where it needs improvement, because there have been no program-level assessment activities or tracking and trending of suspect/counterfeit parts occurrences. Line managers have little assurance that their programs have the most current technical information on suspect/counterfeit parts, because little information of this type has been disseminated. Elements of policy and guidance are out of date. Headquarters support for the suspect/counterfeit parts training program has been sharply reduced. These problems could have been prevented or reduced if responsibility for maintaining Departmental focus and attention on the program and for coordinating and integrating the QA-suspect/counterfeit parts program's various cross-cutting support functions, such as policy and technical assistance, had been more clearly defined.

Many problems could be prevented if a single organization had responsibility for integrating and coordinating the various elements of the quality assurance-suspect/-counterfeit parts program.

One primary focus of a central coordinating and integrating function should be the development and publication of standards that clearly

define a roadmap for both the operations offices, who are responsible for the program's effectiveness, and their contractors, who are responsible for operating the programs.

The 1991 IG report identified a need within the Department for a central point of responsibility for policy, training, information, and program integration in the QA-suspect/counterfeit parts program. With the devolution of many areas of management responsibility from Headquarters to the field, the subsequent lessening of direct involvement by the lead program offices in this and other areas, and the implementation of other Departmental initiatives (such as the "necessary and sufficient" process) that increase the field's flexibility in meeting performance objectives, designation of responsibility for coordinating and integrating the various program functions and maintaining the necessary degree of focus and attention becomes even more important.

5.0 CONCLUSIONS

The program is partially meeting its performance requirement.

DOE's QA-suspect/counterfeit parts program is partially meeting the performance-based QA requirement for nuclear and non-nuclear programs that "items and services meet established requirements and perform as specified." No reported injuries have been attributed to suspect/counterfeit parts within the Department, and no immediate safety hazards attributable to suspect/counterfeit parts that were serious enough to immediately shut down facility operations were found at the sites reviewed during this study. However, many suspect/counterfeit parts were identified by the study team. Some of these parts were found in systems with important safety-related functions, and the presence of many of these had not been previously identified by the site QA program. In some cases, suspect/counterfeit parts may be adequate for use because their properties are comparable to the design specifications. However, DOE facilities have not adequately evaluated the suitability of such parts for continued use. In addition, some facilities have not adequately identified critical systems and conducted inspections to remove suspect/counterfeit parts that could pose a hazard to workers.

The reactive nature of the quality assurance-suspect/counterfeit parts program has set the stage for most of the problems noted by this study.

Most of the problems that this study identified in DOE's suspect/counterfeit program result from the fact that the program has been largely reactive and has not been fully institutionalized into DOE's corporate culture. Although the Department had known about the suspect/counterfeit parts problem since the mid-1980s, little progress was made until the IG issued its report in 1991 and DOE issued its action plan nearly two years later. These two events led to a flurry of activity that made considerable progress in addressing the problem. Thousands of suspect/counterfeit parts were identified and removed from DOE facilities. However, the job has never been completed, and suspect/counterfeit parts continue to be found in safety-related applications. In recent years, the program lost emphasis and continuity at Headquarters as DOE managers became distracted by other priorities. In contrast, most line managers in the field have taken the

initiative to maintain their programs despite the lack of emphasis and attention from Headquarters.

Interest in this issue at Headquarters is on the rise again, largely as the result of the involvement of the DNFSB and renewed concerns by the IG. The Associate Deputy Secretary for Field Management (FM-1) has been tasked by the Under Secretary to lead a senior-level team to develop recommendations to address suspect/counterfeit parts issues within the Department. An important outcome of this effort must be to ensure that the program is institutionalized and that complacency does not lead to another cycle of gradual degradation.

Policy and guidance are inadequate due to a lack of continued Headquarters emphasis on this issue.

The state of current policy and guidance is an example of how the lack of consistent emphasis has affected the program. DOE QA and other worker protection policies provide a performance-based framework for the suspect/counterfeit parts program, and the 1993 Plan provides fairly detailed implementation guidance to the field. However, as attention waned at Headquarters, the guidance in the 1993 Plan was never incorporated by DOE's official policy base and has not been incorporated by any of the management and operating contractors at the sites visited.

Delegating specific responsibility for coordinating and integrating program functions would address many of the issues raised by this study.

Much of the reason why emphasis on the suspect/counterfeit parts issue has been inconsistent is that the program has been operating as a collection of individual elements, with little effort to integrate or coordinate their activities. No advocate exists for the program to monitor its effectiveness, suggest improvements where needed, and generally maintain an appropriate degree of emphasis on this issue throughout the Department. The delegation of specific responsibility to carry out these integration and coordination functions would go far toward addressing the concerns discussed in this report.

Data Sources for This Study		
Personnel Interviewed	**Types of Facilities and Systems Examined**	**Other Data Sources**
• DOE and Contractor Managers • Procurement Personnel • Crafts Persons • Line Supervisors • Quality Assurance Personnel • Engineering Personnel • Training Personnel • Contracts Specialists • Reactor Operators • Fire Prevention Personnel • Receiving and Warehouse Personnel • Site and Facility Maintenance Personnel	• Nuclear Reactors • Nuclear Accelerators • Uranium Enrichment Facilities • Nuclear and Hazardous Waste Treatment Facilities • Nuclear Weapons Disassembly Facilities • Fire Suppression Systems • Hoisting and Lifting Equipment • High Pressure Steam and Water Systems • High Voltage Electrical Distribution Systems • Emergency Vehicles • Storerooms • Maintenance Shops	• DOE Orders • Inspector General report, "Concerns with the Effectiveness of the Department's Quality Assurance Program Regarding Product Substitution Issues," November 1991 • "Plan for the Suspect/ Counterfeit Products Issue in the Department of Energy," October 1993 • Various Memos and Related Documents • Site-Specific QA Plans and Procedures • DOE Occurrence Reporting and Processing System Reports • Conformance Reports • Various National Codes and Standards (e.g., NQA-1)

The Influence of Non-U.S. Manufacturers on the Problem of Suspect/Counterfeit Bolts

In the early 1980s, non-U.S. manufacturers, particularly those in the high strength fastener market, found that they could successfully compete with established U.S. firms because of their lower production costs. Some of these companies achieved these lower costs by omitting one or more manufacturing steps, such as heat treating, or by using raw materials that did not have the requisite properties, such as corrosion resistance, necessary to meet some types of specifications. These companies would then substitute the lower-quality bolts, while retaining the industry standard high strength Grade 5 and Grade 8 headmark stampings.

Quality Assurance-Suspect/Counterfeit Parts Program
Roles and Responsibilities

- Albuquerque Operations Office continues to have responsibility for weapons program quality assurance (QA).

- Under the former QA order, DOE Order 5700.6B, the DOE Office of Environment, Safety and Health (EH) had sole management responsibility for non-nuclear and non-weapons nuclear QA programs.

- Under the current QA order, DOE Order 5700.6C, issued in 1991, responsibilities for non-nuclear and non-weapons QA programs were divided:
  - The Offices of Defense Programs, Environmental Management, Nuclear Energy, and Energy Research were responsible for program implementation at their facilities.
  - EH was responsible for all aspects of programs at non-nuclear facilities.
  - The Office of Nuclear Energy was responsible for technical assistance and policy at nuclear facilities.
  - The Office of Nuclear Safety was responsible for QA program oversight at nuclear facilities.

- After the DOE reorganization in December 1994, lead program offices technically remained responsible for program implementation at their facilities (although in practice, this responsibility has been primarily assumed by operations offices). EH became the sole Headquarters element with responsibility for cross-cutting QA support functions:
  - EH-2 responsible for independent oversight
  - EH-3 responsible for QA policy, requirements, and guidance
  - EH-5 responsible for technical assistance.

Grade 5 and Grade 8 Bolts

- The designations Grade 5 and Grade 8 have been established by the Society of Automotive Engineers (SAE).
- Other designations have been established by the American National Standards Institute, Inc. (ANSI), the Industrial Fasteners Institute (IFI), and the American Society for Testing and Materials (ASTM).
- Grade 5 and Grade 8 bolts are identified by a series of equally spaced radial lines stamped into the bolt head: three radial lines for Grade 5 and six radial lines for Grade 8.
- Grade 5 bolts, identical to ASTM-A 449 bolts, are made of medium carbon steel, quenched, and tempered.
- Grade 8 bolts are made of medium carbon alloy steel, quenched, and tempered.
- The most common characteristic of suspect/counterfeit Grade 5 and Grade 8 bolts is improper chemical composition of the steel, resulting in a decrease in tensile strength at temperatures above 500 F.
- The second most common characteristic of suspect/counterfeit Grade 5 and Grade 8 bolts is inadequate or improper heat treating, resulting in excessive brittleness.

Guiding Principles of Safety Management,
As Applied to Quality Assurance

1. Line managers are responsible and accountable for QA, including programs to address suspect/counterfeit parts.
2. Comprehensive requirements for QA-suspect/counterfeit parts programs exist, are appropriate, and are executed.
3. The competence of persons responsible for the QA-suspect/counterfeit parts program is commensurate with their responsibilities.
4. Oversight independently verifies the conformance of the QA-suspect/counterfeit parts program to established requirements.
5. Enforcement activities include meaningful penalties for non-compliance with the QA-suspect/counterfeit parts program and formal procedures for imposing appropriate remedies.

Summary of Suspect/Counterfeit Bolt Discoveries*	
Location	**Number of Grade 5 and Grade 8 Bolts**
Emergency Generators	280
Fire Protection Systems	4
Air, Water, and Steam Distribution Systems	381
Hoisting and Lifting Equipment	30
Valves	1683
Air Distribution Systems	457
Storage Areas	137
Pumps	136
Wall and Floor Mounts	700
Transfer Carts	94
Electrical Insulators	16

* This summary includes only the most significant of the over 4,000 suspect/counterfeit bolts identified by the study team.

Supplier Quality Information Group (SQIG)

SQIG is a group of DOE contractor procurement personnel who cooperate on a formal system to share information about suppliers. Participating sites list vendors they have inspected, along with limited information that includes the date the vendor was inspected, the organization that performed the inspection, the evaluation standard (e.g., NQA-1), the type of product the vendor is inspected for, and the certification of the inspectors. SQIG information is available on the Internet at:

http://w3.lanl.gov:8002/sqig/sqighome/html

APPENDIX A

TEAM COMPOSITION

APPENDIX A

TEAM COMPOSITION

Deputy Assistant Secretary, Oversight:	Glenn S. Podonsky
Associate Deputy Assistant Secretary:	Neal Goldenberg
Director, Office of Security Evaluations:	Barbara R. Stone
Review Team Members:	Charles Crabtree
	James Davis
	Vincent DeVito
	John Easterbrooks
	Calvin Irvin
	John Johnson
	Virginia Johnson
	Harry Kohl
	John L. McCabe
	Robert Paullin
	Michael Stalcup

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