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GUIDE TO GOOD PRACTICES FOR NOTIFICATIONS AND INVESTIGATION OF ABNORMAL EVENTS

U.S. Department of Energy
Washington, D.C. 20585

AREA MISC

Guide to Good Practices for Notifications and Investigation of Abnormal Events

Page / Section	Change
p. vii / Definitions / first definition	The second sentence was added.
p. vii / Definitions / fourth, fifth, and sixth definitions	The references to DOE Order 5000.3B were updated to DOE Order 232.1A.
p. 5 / Section 3.1 / first paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 5 / Section 3.1 / fourth paragraph	The paragraph was added.
p. 5 / Section 3.2 / first paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 7 / Section 4.1 / fourth paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 7 / Section 4.1.1 / first paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
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p. 11 / Section 4.2.1 / third paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 11 / Section 4.2.2 / third paragraph	The paragraph was added.
p. 12 / Section 4.2.3 / third paragraph	The second sentence was added.
p. 12 / Section 4.2.3	Steps A–D were added. Three paragraphs were deleted.
p. 13 / Section 4.2.4 / second paragraph	The references to DOE Order 5000.3B were updated to DOE Order 232.1A.
p. 14 / Section 4.2.5 / second paragraph	The reference to DOE-STD-1010-92 was removed (document was canceled). The reference to DOE-HDBK-7502-95 was added.
p. 15 / Section 4.2.6 / second paragraph	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 16 / Section 4.2.7	The section was added.

Page / Section	Change
p. 17 / Supplemental Resources	The reference to DOE Order 5000.3B was updated to DOE Order 232.1A.
p. 17 / Supplemental Resources	The reference to DOE-STD-1010-92 was removed, and the reference to DOE-HDBK-7502-95 was added.
Concluding Material	The Preparing Activity was changed from NE-73 to EH-31.

FOREWORD

The purpose of this Guide to Good Practices is to provide Department of Energy (DOE) contractors with information that can be used to validate and/or modify existing programs relative to Conduct of Operations. This Guide to Good Practices is part of a series of guides designed to enhance the guidelines set forth in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

KEYWORDS

Abnormal Event
Near Miss
Report
Root Cause

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DEFINITIONS

Condition	Any as-found state, whether or not resulting from an event, that may have adverse safety, health, quality assurance, security, operational, or environmental implications. A condition is more programmatic in nature; for example, an error in analysis or calculation, an anomaly associated with design or performance, or an item indicating a weakness in the management process are all conditions.
Event	A real-time occurrence happening (e.g., pipe break, valve failure, loss of power, environmental spills).
Near Miss	A situation in which an inappropriate action occurs (or a necessary action is omitted) but is detected and corrected before an adverse effect on personnel or equipment results.
Notification Report	The initial documented report, to the Department of Energy, of an event or condition that meets the reporting criteria defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. A notification report is part of the occurrence report.
Occurrence Report	A documented evaluation of an event or condition that is prepared in sufficient detail to enable the reader to assess its significance, consequences, or implications and to evaluate the actions being proposed or employed to correct the condition or to avoid recurrence. The format for occurrence reports is contained in DOE Order 232.1A.
Reportable Occurrence	Events or conditions to be reported in accordance with the criteria defined in DOE Order 232.1A.
Root Cause	The cause that, if corrected, would prevent recurrence of an abnormal event or a similar occurrence.

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GUIDE TO GOOD PRACTICES FOR NOTIFICATIONS AND INVESTIGATION OF ABNORMAL EVENTS

1. INTRODUCTION

This Guide to Good Practices is written to enhance understanding of, and provide direction for, "Notifications," Chapter VII, and "Investigation of Abnormal Events," Chapter VI, of Department of Energy (DOE) Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The practices in this guide should be considered when planning or reviewing programs for notifications and investigation of abnormal events. Contractors are advised to adopt procedures that meet the intent of DOE Order 5480.19.

"Notifications" and "Investigation of Abnormal Events" are elements of an effective Conduct of Operations program. The complexity and array of activities performed in DOE facilities dictate the necessity for a coordinated notifications program and a consistent method for investigating abnormal events to promote safe and efficient operations.

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2. OBJECTIVES

The objective and criteria are derived from DOE Order 5480.19. They are intended to aid each facility in meeting the intent of the order.

2.1 Notifications

A program is established to provide timely notifications to appropriate DOE personnel and other agencies to ensure that the facility is responsive to public health and safety concerns.

Criteria:

1. Facility procedures are developed to ensure appropriate notifications.

2. Notifications are appropriately documented.

3. Adequate communications equipment is maintained to meet notification requirements.

2.2 Investigation of Abnormal Events

An established and thorough review process ensures that all significant aspects of an abnormal event are identified, investigated, and resolved.

Criteria:

1. Facility guidelines identify specific events and "near miss" situations that require investigation.

2. Responsibilities for investigative tasks are understood by personnel.

3. Personnel performing investigations are qualified in the facility's investigative process through experience and training.

4. Information required for the investigation is collected as soon as possible during and after the occurrence of the event.

5. A structured review is performed to identify the root cause and corrective actions to prevent recurrence of each abnormal event.

6. A timely and comprehensive investigative report is prepared and disseminated, including entry into the Occurrence Reporting and Processing System (ORPS).

7. Events are evaluated to determine what training is appropriate.

8. Follow-up review is performed to evaluate the effectiveness of corrective actions and determine patterns of deficiencies.

9. Acts of known or suspected sabotage are immediately investigated.

3. DISCUSSION

3.1 Notifications

An effective notification program provides a positive means for the facility to respond to public health and safety concerns. Department of Energy policy encourages a positive attitude toward reporting occurrences. Facilities should develop notification guidelines that are directed toward ensuring uniformity, efficiency, and thoroughness of notifications consistent with the requirements of DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

The need for facility-specific notification guidelines is apparent if one considers the situation of a supervisor during, and immediately after, a serious operating event. The supervisor's first priority is to ensure safety. This may involve implementing emergency operating procedures, reassigning operating personnel, and/or personally supervising immediate actions. In the midst of this activity, the supervisor requires concise notification guidelines that clearly indicate the appropriate level of notification for the specific event, based on an evaluation of its potential to impact safety, health, the environment, or operations. The supervisor also needs to know the time available to make the notification within regulatory requirements, the individuals to be notified, and the method to be used to notify each.

Well-designed guidelines will ensure that notifications do not interfere with the immediate actions that are needed in response to abnormal conditions. They should also ensure that notifications are regarded as an integral part of the response, not an action to be considered after conditions have returned to normal.

A manager has overall responsibility for the event investigation process. However, the manager may delegate specific tasks in the investigation process to other personnel as appropriate.

3.2 Investigation of Abnormal Events

Prompt investigation of abnormal events and conditions is important so facilities can assess the impact of each event or condition, determine the root cause, and identify corrective actions to prevent recurrence. Abnormal events and conditions include all occurrences requiring formal notification under DOE Order 232.1A. Additionally,

investigation is appropriate for all events, conditions, "near misses," or other indications of situations within or outside the operations organization that, if uncorrected, can impact safety or reliability. Acts of actual or suspected sabotage represent a special case for investigation.

The investigative process described in this guide is intended to assist the operating organization in evaluating and responding to operational abnormalities. These investigations are not intended to replace the formal Type A, B, or C investigations that are required for certain occurrences in accordance with DOE Order 5484.1, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*, although both investigations have similar objectives. Consider again the situation of a supervisor immediately after a serious operating event. Even though immediate actions have been taken in accordance with appropriate procedures, the event may still impact personnel or facility safety. Therefore, it is important that the operations organization begin the investigative process as soon as possible.

To ensure consistency, facilities should provide written guidelines to address all aspects of the investigative process. Concise instructions will aid the supervisor in properly collecting and/or preserving physical evidence that may be needed in the investigation. Standard forms, or an example format, will aid in documenting statements from the personnel present during the event. Checklists may be useful for ensuring that all appropriate operating records (e.g., recorder charts, round sheets, logs) are collected or copied for use in the investigation. Finally, clear instructions for conducting the investigation will make effective use of time and will aid personnel in evaluating the corrective actions taken and the results of those actions. This process will enable personnel to determine the current safety status of the facility and the capability for continued operation.

4. GOOD PRACTICES

4.1 Notifications

The notification program should ensure that DOE and DOE contractor line management are kept fully and currently informed of all occurrences that could (1) affect the health and safety of the public, (2) seriously impact the intended function of DOE facilities, (3) have a noticeable adverse impact on the environment, or (4) endanger the health and safety of workers.

Responsibility for the occurrence has no bearing on the notification process; the agencies and organizations that must respond to the occurrence require prompt notification so that appropriate emergency procedures can be implemented. Reportable occurrences may result from equipment failures, fires, loss of electric power, or even dangerous weather conditions that are capable of causing a release of hazardous or radioactive materials. Certain classes of security incidents may also require prompt notification.

Another function of the notification program is keeping DOE and facility management informed of conditions that could affect the facility's ability to perform its mission. This is necessary to enable proper allocation of human and material resources. For example, non-availability of spare parts for an aging pump may threaten to disable a critical system. Appropriate notification regarding this condition will alert management to the problem. Management may then initiate an engineering review, leading to a budgetary request for a replacement pump of a newer design, for which spare parts are available.

DOE Order 232.1A provides criteria for evaluating the seriousness of each occurrence and determining the appropriate notification category, i.e., emergency, unusual occurrence, or off-normal occurrence. For each notification category the Order specifies the method, time, and documentation requirements. It also lists examples of occurrences as an aid to facilities in preparing their own specific guidelines for categorizing occurrences.

4.1.1 Notification Procedures

Facilities should establish notification procedures consistent with DOE Order 5480.19, Chapter VII, "Notifications," and DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. These procedures should include:

- Guidelines identifying facility events and conditions that require notifications

- Specific responsibilities for categorizing occurrences and making notifications

- Up-to-date identification of primary and alternate personnel to be notified for various occurrences, including all necessary information for contacting each person (i.e., telephone number, pager number, etc.)

- Time requirements for notifications consistent with the facility emergency plan.

Notifications for some categories of occurrences can be made electronically through the Occurrence Reporting and Processing System (ORPS). DOE Order 232.1A includes specific instructions for completing each data field in the occurrence report.

Facilities should provide training to ensure consistent application of the notification procedures. The training for involved personnel should include categorization, notification, and associated reporting requirements. In addition, training for all personnel should address the philosophy of occurrence reporting to develop a positive attitude toward reporting occurrences and to emphasize the importance of timely reporting and follow-up notification. Persons at the "worker" level in the organization may not have formal responsibilities for the notification program; however, their input through normal reporting to their supervisors is essential to the success of the program. More information concerning reporting of abnormal operating conditions is contained in DOE Order 5480.19, Chapter II, "Shift Routines and Operating Practices."

4.1.2 Documentation

Documentation is an essential part of the notification process. From a practical viewpoint, documenting the reason for the notification, time, and identity of the person(s) notified can prevent confusion and permit more focused attention on the immediate actions necessary to mitigate an ongoing event. In some

situations, the documentation can help persons on the scene of an occurrence determine what type of assistance they may expect and when it should arrive.

All notifications made in accordance with DOE Order 232.1A require formal documentation in a notification report. Facility procedures should establish a format, such as the notification report format, for documenting notifications at all levels. Facilities should consider the use of fill-in-the-blank forms to document notifications for different types of situations. These forms can serve as a checklist for personnel on the scene of an occurrence, helping ensure that all notifications are made as required.

4.1.3 Communication Equipment

Facilities should ensure that adequate communication equipment is accessible to meet notification requirements. They should evaluate their potential for public endangerment or harm to the environment, and determine what alternate methods of notification are needed in the event of primary communications equipment failure. High-risk facilities commonly use dedicated phone lines or data links as the primary method for emergency notifications, backed up by ordinary phone lines, radio networks, and other methods. Low-risk facilities may be adequately served by ordinary phone lines, supplemented by paging devices if notifications may be required for off-shift or roving personnel.

Emergency communication systems for informing on-site personnel of hazards or conditions requiring their immediate attention are addressed in DOE Order 5480.19, Chapter IV, "Communications," and in DOE-STD-1031-92, *Guide to Good Practices for Communications*.

4.2 Investigation of Abnormal Events

Facilities should establish specific guidelines for investigations of abnormal events. The guidelines should help personnel determine when investigation is required, who is responsible for the investigation, how the investigation is to be conducted, and what documentation is required. The guidelines should emphasize that the purpose of investigations is to improve operations.

4.2.1 Events Requiring Investigation

Facilities guidelines should define events that will require investigation. All events that could adversely affect operations or safety should be investigated at an appropriate level. The following examples are typical of events that should be investigated:

- Design limits (e.g., Technical Safety Requirements, Safety Analysis Report, or other limits) have been violated
- Facility safety conditions are abnormal or unexplained
- Safety or system features are improperly positioned
- Equipment failure that could affect facility capability or safety has occurred
- An unplanned shutdown or significant loss of operation has occurred
- A procedural violation or personnel error has occurred that causes, or could have caused, serious personnel or equipment damage or could have affected facility safety
- Radiological or toxic material limits have been exceeded or radioactive or toxic material lost/released
- Facility system performance is unusual, abnormal, or unexplained
- Chemistry or process parameters are out of specification or indicate unexplained trends
- Repetitive problems have occurred
- Actual or attempted sabotage is suspected
- Loss of Special Nuclear Material has occurred or is suspected

- A department head or the facility safety review committee deems an investigation is appropriate.

"Near miss" situations often serve as indicators of underlying problems and should therefore be investigated. The following are some examples of near misses:

- An operator action was not performed, or was performed improperly, but the error was identified and corrected before the process was damaged. The near miss may indicate a problem in the operator's training or the operating procedures.

- A maintenance activity, such as calibration or testing, produced a transient in an operating system; the system was prevented from upset only by the response of an attentive operator. The near miss may indicate a problem in the maintenance procedures or may point to a need for better coordination of operations and maintenance activities.

All events that require notification to DOE (in accordance with DOE Order 232.1A) or reporting to other agencies (e.g., Environmental Protection Agency) should be investigated.

4.2.2 Responsibility and Qualification

Responsibility for investigating, reporting on, and identifying corrective actions for abnormal events rests with management, although specific investigative tasks may be delegated. When the root cause of the event has been determined and documented, management should ensure that appropriate corrective action is initiated to prevent recurrence of this or similar events.

Personnel assigned as investigators should be technically qualified, knowledgeable of factors affecting human performance, and trained in investigative methods, such as root cause analysis and interviewing techniques. They should maintain an unbiased attitude in relation to the event being investigated and the personnel involved at the time of the occurrence.

The operations manager is responsible for event investigations involving plant operations. The operations manager may delegate specific investigations or

portions of investigations to other personnel. For example, the initial review following a plant transient might be conducted by the on-shift shift manager; the results of this investigation will establish the need for further review.

4.2.3 Investigative Process

The process of investigation begins with collecting data. Facility guidelines should identify the types of information that will be needed in an investigation, and the methods that should be used to collect and preserve the information. Operations logs, round sheets, and statements from persons present during the event would typically be required for any investigation. Use of prepared forms for personal statements can aid in obtaining and documenting relevant information for the investigation. A sample personal statement form is shown in Appendix A.

Some events may warrant collection of physical evidence such as: recorder charts, readouts from monitoring equipment, photographs and/or drawings of the area, procedures, technical documents, broken or failed components, and laboratory analyses. In some situations, it may be necessary to quarantine certain equipment or systems until the investigation is finished. As soon as possible after an event, personnel should be assigned responsibility to collect and/or preserve appropriate information and evidence.

A structured review of the abnormal event should be initiated when all data has been collected. The format of the investigation depends on the significance of the event. The steps detailed below should be included in each investigation.

a. Event Reconstruction

The abnormal event should be reconstructed using the collected information. When applicable, this is best accomplished using the sequence of events recorder printout as a basis. A chronological list of events is developed. It is desirable to include the personnel involved in the event in the reconstruction process.

b. Event Analysis and Evaluation

Once the facts have been established, the event may be analyzed to determine the responses of equipment and personnel. During the analysis, actual and expected responses of facility systems, adequacy of procedures,

and factors affecting human performance are compared. An evaluation to identify any detrimental effects on plant equipment should be included. The event should be compared with previous investigations of similar events or transients. If the event was a reactor trip, the acceptability of restart is determined.

c. Root Cause Determination

The root causes of the event should be determined whenever possible. Root causes are those fundamental causes that would have prevented the event from occurring and, if corrected, prevent recurrence. Typically correctable without additional research or analysis, root causes explain why direct causes existed.

d. Corrective Action Determination

Each event investigation results in corrective action being established, and specific personnel are assigned responsibilities for such action. Corrective action can be procedure changes, training, design modifications, and administrative controls changes; and may include better supervisory involvement and oversight of work activities and increased worker accountability. Interim compensatory actions may be used while longer-term corrective actions are being developed. Cognizant managers should agree to each corrective action before it is performed, and the facility manager approves it.

4.2.4 Investigative Report

An essential part of the investigation is informing others, so recurrence of the event can be prevented. A report of the investigation, including discussion and explanation of the results of the analysis and identification of the corrective actions, should be prepared in accordance with facility guidelines. The investigation report should be reviewed by appropriate managers, supervisors, and the safety review committee to ensure that lessons learned from the event are identified and incorporated into applicable facility programs as discussed in section 4.2.5. The final report should be reviewed and approved by the facility manager.

Those occurrences requiring formal notification, in accordance with DOE Order 232.1A, also require a formal occurrence report. Instructions for

entering the information into the Occurrence Reporting and Processing System (ORPS) are contained in DOE Order 232.1A. Facilities should also consider providing information of interest directly to other facilities, as described in the *Root Cause Analysis Guidance Document*, DOE-NE-STD-1004-92.

4.2.5 Further Evaluation

The final phase of the investigation consists of follow-up activities, to determine if the corrective action has been effective in resolving the problem. Facilities should analyze events to determine trends or patterns of deficiencies. A mechanism should be established for periodically summarizing events, causes, and trends, and reporting this information to the facility manager, department heads, and appropriate managers.

DOE-HDBK-7502-95, *Implementing U.S. Department of Energy Lessons Learned Programs, Volume 1*, contains guidelines for evaluating and incorporating operating experience into training programs. In many cases, information related to the event may be used both in the initial training received by all operators, and in the continuing training required periodically to maintain operator qualification. Operating experience should also be incorporated, as appropriate, into other facility programs and documents, e.g., procurement, quality assurance, maintenance practices, procedures, radiation control (Rad Con) manuals, and engineering.

The operations supervisor should evaluate all in-house events to determine whether training is required on an immediate basis for operations personnel. Training on events of immediate concern should be provided before personnel begin work on their next shift. The supervisor may use the following methods to address immediate training requirements:

- Ad hoc training sessions
- Shift briefings conducted by the supervisor or other appropriate personnel (discussed in DOE Order 5480.19, Chapter XII, "Operations Turnover")
- Written instructions to oncoming operating shifts (discussed in DOE Order 5480.19, Chapter XV, "Timely Orders to Operators")

- Required reading materials (discussed in DOE Order 5480.19, Chapter XIV, "Required Reading," and in DOE-STD-1033-92, *Guide to Good Practices for Operations and Administration Updates through Required Reading*).

4.2.6 Sabotage

If an act of sabotage is discovered or suspected, the investigative process is essentially the same as that described for other abnormal events, although different priorities may apply. The following items should be considered when setting priorities in sabotage investigations.

- Investigation should be started immediately to determine the condition of the affected system(s) and the operability of all safety-related systems.

- Personnel should consider the possibility that

  – Multiple acts of sabotage may have been committed

  – Safety-related or other critical systems may have been specifically targeted

  – Deliberate steps may have been taken to prevent discovery.

- The appropriate manager or supervisor should determine the capability for continued operation or safe shutdown. This may include independent verification of lineups for some critical safety systems. Guidelines and techniques for independent verification are identified in DOE Order 5480.19, Chapter X, "Independent Verification."

- Corrective actions should include steps to minimize the impact of the sabotage and steps to deter further acts through enhanced security at the facility.

Specific notification criteria for incidents of sabotage are identified in DOE Order 232.1A.

4.2.7 Human Performance Improvement

Minimizing human performance errors is a key to reducing the frequency and severity of station events. To progress toward excellent human performance, a work environment must exist in which workers, leaders, and the organization routinely exhibit behaviors that promote event-free operations. Station management establishes and reinforces operational practices to promote event-free performance. The document Excellence in Human Performance (Preliminary, November 1995) describes individual, leadership, or organizational behavior characteristics that have proven successful in promoting excellence in human performance. Examples of practices that may be beneficial in enhancing station operations include the following:

- Convey an attitude of trust and an approach that supports teamwork at all levels. Actively solicit, listen to, and (if acceptable) act upon workers' ideas for improving individual and organizational performance.

- Encourage communication and teamwork among groups that operate, maintain, and support the facility.

- Establish administrative practices that reinforce desired behaviors.

- Clearly communicate to all personnel the expectations for conducting work and reporting errors.

SUPPLEMENTAL RESOURCES

The following sources provide additional information pertaining to topics discussed in this Guide to Good Practices:

DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information.*

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter IV, "Communications."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter X, "Independent Verification."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XII, "Operations Turnover."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XIV, "Required Reading."

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XV, "Timely Orders to Operators."

DOE Order 5484.1, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*.

DOE-NE-STD-1004-92, *Root Cause Analysis Guidance Document*.

DOE-STD-1031-92, *Guide to Good Practices for Communications*.

DOE-STD-1033-92, *Guide to Good Practices for Operations and Administration Updates through Required Reading*.

DOE-HDBK-7502-95, *Implementing U.S. Department of Energy Lessons Learned Programs, Volume 1*.

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APPENDIX A
(SAMPLE) PERSONAL STATEMENT

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(SAMPLE) PERSONAL STATEMENT

Subject or Title of Event	
Event Date/Time	Occurrence Report Number

In your own words, write down what happened in the event. Include any relevant information from before the event began until after it was over. Include the following:

1. Facility or system conditions as you know them prior to the event.
2. What you were doing immediately prior to the event.
3. Any indications that a problem existed.
4. Your actions in response to the indications.
5. Any equipment malfunctions.
6. Any inadequacies in the procedures, practices, or training.

Completed By	Signature	Date/Time

If additional sheets are used, each sheet should contain: signature, date, time, event title, and occurrence report number.

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CONCLUDING MATERIAL

Review Activities:

DOE
DP
EH
EM
ER
NE
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Preparing Activity:

DOE-EH-31

Project Number:

MISC-0016