EDT
Forensic Engineering & Consulting

How to Write A Forensic Engineering Expert Report

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When a failure analysis investigation by a forensic engineer has progressed to the point that a report is needed, the following methodology may be employed to assist the engineer in the process of documenting the results of the investigation. Note that this methodology is concerned with the process of documenting an investigation. Methods for conducting an investigation are outside the scope of this document and are addressed elsewhere.

1. What action is the client needing to take?
    a. Determine if peril is covered
    b. Determine responsibility/liability

2. Answer the question, "What actionable information does the client need that will allow the client to take appropriate action?" Does the client need to know What happened (the circumstance resulting in loss for 1a)? or Why it happened (the cause of the loss for 1 b above)?.

3. Enter client information, reference information, header information, page 1 synopsis, statement of purpose, and outline of report.

4. Write the Background
    a. This will contain the reason that investigation was initiated
    b. May include date EDT was contacted and date EDT took initial action
    c. May include additional information to improve readability

5. Lay out documents that help tell the story. Examples of these include:
    a. Photographs
    b. Data collected
    c. Field notes
    d. Standards
    e. Calculations
    f. Modeling results
    g. Etc.

6. Write the draft Conclusions regarding "What Happened?"
    a. Use "result, result, result" format
    b. Single sentences
    c. Declarative
    d. Tell story without rest of report

7. If a cause is needed, utilize the Determination of Cause Method journal article[1] and flow chart[2] to write a summary analysis to establish the cause. This analysis may or may not be included in the final report.
    a. Answer each question and provide brief explanation
    b. State the cause
        i. Long-term wear and tear
        ii. Person or entity
        iii. Act of nature
        iv. Unknown

8. Add final draft Conclusion stating cause and establishing "Why it happened?"
    a. Use "result, result, result, cause" format
    b. Single sentences
    c. Declarative
    d. Cause Stated
        i. Long-term wear and tear
        ii. Person or entity
        iii. Act of nature
        iv. Unknown
    e. Tell story without rest of report

Recommend internal peer review/approval prior to further work on report. Revise as needed.

9. Write Work of Investigation
    a. Describe what was done
    b. Include dates, locations, people contacted, etc

10. Write Observations
    a. Facts found, what was seen, heard, measured, etc.
    b. Arrange to assist understanding and readability
    c. Observations should be the result of actions documented in the Work of Investigation.

[1] "Engineering Analysis of Failure: A Determination of Cause Method," M.D. Russell and T.A. Jur, Journal of Failure Analysis and Prevention. *Journal of Failure Analysis and Prevention, 17(1), 8-14.*

[2] Available in poster form or for download from from EDT.

11. Write Discussion
    a. Provide a bridge from facts to conclusions
    b. Each conclusion should be found verbatim in the Discussion (or sometimes elsewhere in the report)

12. Revise Conclusions and make consistent with Discussion

13. Write Other Considerations (if needed)
    a. Use this for information that does not fit elsewhere in report
    b. Theories of others sometimes addressed here

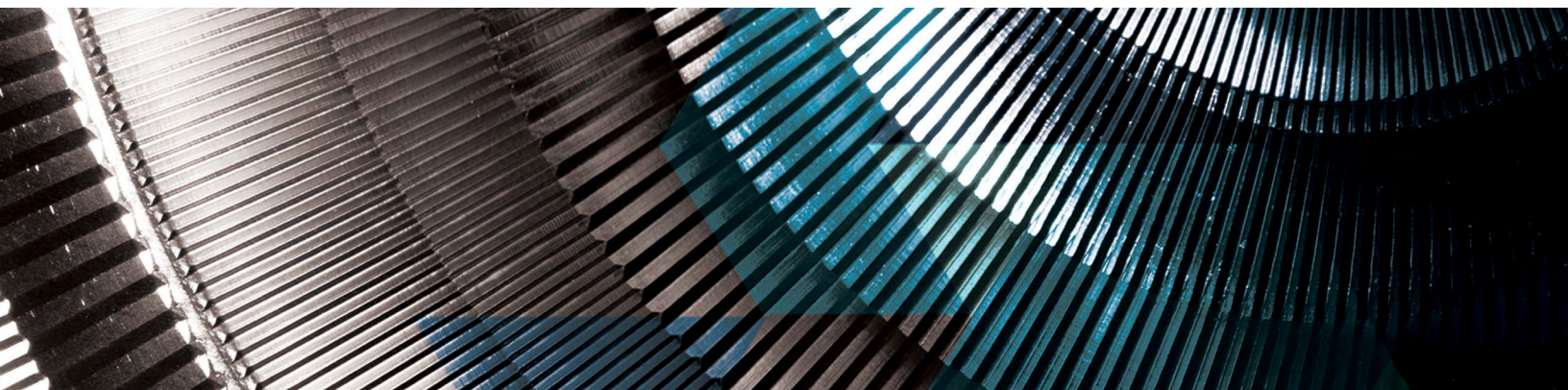
14. Some reports require additional sections
    a. These to be added at the discretion of the investigating engineer
    b. Examples could include
        i. Chronology (inserted before or after the observations)
        ii. Additional background regarding something involved in analysis - for instance how a piece of equipment is used (inserted before or after the observations)

15. Create figures with captions

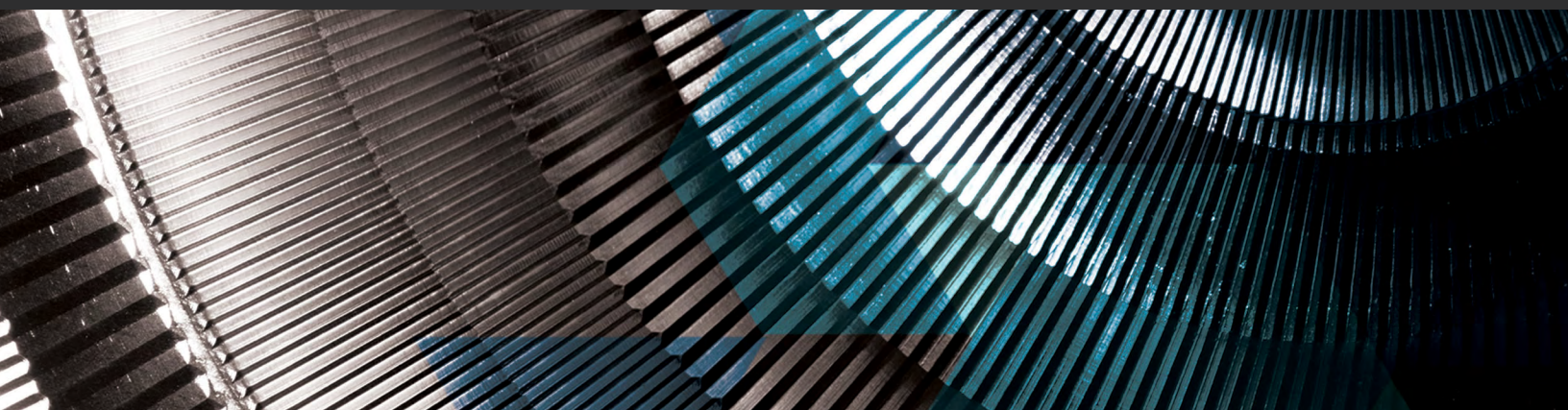
16. Verify that the actionable information detailed in Step 2 has been provided by the report.

17. Limit the use of adverbs (also known as –ly words which often convey lack of certainty or equivocation), words that express absolutes (always, never, must, etc which often are exagerations), and undefined jargon.

Final internal review/approval prior to submission to client. Revise as needed.



Examples of Conclusions and Determination of Cause Questions and Answers



Example Conclusions

1. Pressurization of the enclosure by an internal electrical event resulted in the stripping of bolt threads, the cover bolts pulling out, and the ejection of the enclosure cover.

2. The cover bolt pull oput was the result of thread weakening over time from over tightening of the bolts.

3. Overtightening of the bolts was the result of a lack of specified torque information from the enclosure manufacturer, Electrical Supply Company.

4. Ejection of the enclosure cover was caused by a manufacturing defect attributable to Electrical Supply Company in that they did not provide specified torque values for installation of the enclosure cover.

Example Determination of Cause Questions and Answers

The Scientific Method was utilized to determine the circumstances that resulted what resulted in the enclosure cover being ejected, that is, “What happened?” The methodology presented in “Engineering Analysis of Failure: A Determination of Cause Method,” Journal of Failure Analysis and Prevention, Published January 3, 2017, was utilized to determine the cause of loss and injury, that is, “Why it happened?”

Decision point D1 was considered. Ejection of the enclosure cover is not consistent with reasonable care and use over a period of time. That is, the consequences of the failure as such that a reasonable person would be expected to take measure to prevent the failure. Therefore the answer is, “No.” Decision point D2 was considered. The hazard that was identified that resulted in damage to the enclosure and injury to Mr. Johnson was ejection of the enclosure cover as a result of a electrical event within the enclosure. Therefore the answer is, “Yes.” Decision point D3 was considered. The central purpose of this question is to identify whether or not a lack of reasonableness existed in actions taken prior to the failure that resulted in an increase in the risk associated with the hazard.

1. Reasonable pre-failure actions that were taken:
    i. UL certified explosion-proof enclosure utilized
    ii. Power driver used multiple times to remove and install 22, 3/8-inch bolts to secure cover
2. Unreasonable pre-failure actions:
    i. Documentation of appropriate torque for installation of 22, 3/8-inch bolts not provided by centrifuge manufacturer.

With the identified lack of reasonableness related to the torque specifications, the answer to the question is, “No.” Cause C3a is reached: Defect due to the action of a person or entity. The cause may then be stated as, “Ejection of the enclosure cover was caused by a manufacturing defect attributable to Electrical Supply Company in that they did not provide specified torque values for installation of the enclosure cover.”