

SECTION C: ROOT CAUSE ANALYSIS AND INCIDENT INVESTIGATION

Section 450-8.016(C)(1) requires that Stationary Sources conduct a Root Cause analysis for each Major Chemical Accident or Release. Section 450-8.016(C)(2) allows CCHS to conduct either a root cause analysis for a Major Chemical Accident or Release that requires certain cooperation from the Stationary Source. This chapter gives guidance on the Stationary Sources responsibilities for both conducting a root cause analysis and cooperating with CCHS when CCHS conducts a root cause analysis or incident investigation.

C.1 DEFINITION OF MAJOR CHEMICAL ACCIDENT OR RELEASE

Section 450-8.014(h) defines a Major Chemical Accident or Release as:

- an incident that meets the definition of a Level 3 or Level 2 Incident in the Community Warning System incident level classification system defined in the September 27, 1997 Contra Costa Guideline for the Community Warning System as determined by the Department; or
- an incident that results in the release including, but not limited to, air, water ,or soil of a Regulated Substance and meets one or more of the following criteria:
 - (1) results in one or more fatalities;
 - (2) results in greater than 24 hours of hospital treatment of three or more persons;
 - (3) causes on and/or off-site damage (including clean-up and restoration activities) initially estimated at \$500,000, or more. On site estimates shall be performed by the Stationary Source. Off-site estimates shall be performed by appropriate agencies and compiled by the Department;
 - (4) results in a flammable vapor cloud of more than 5000 pounds.

C.1.1 INTERPRETATIONS OF DEFINITION

Level 3 or 2 Incidents: Table C.1 describes the September 27, 1997 incident level classification system. Note that if there is any off-site impact, an incident is at least a level 2 incident requiring that the Stationary Source conduct a root cause analysis.

Note that the criteria for conducting a root cause analysis for the effects of a release of a regulated substance are not limited of off-site effects, but include either on-site or off-site effects.

C.2 STATIONARY SOURCE ROOT CAUSE ANALYSIS

C.2.1 CAUSAL FACTOR ANALYSIS

The primary purpose of an incident investigation is to prevent reoccurrence through the identification and correction of the causal factors of the incident. The process of determining of the causal factors seeks to answer the basic questions about an incident:

- What happened?
- How did it happen
- Why did it happen?

A root cause analysis is a systematic process that determines the causal factors, i.e., the events and conditions that are necessary to produce or contribute to an incident. The analysis develops what happened and how it happened, and then focuses on finding the underlying causes for why an incident happened by determining the causal factors of an incident. There are three types of causal factors:

- Direct cause
- Contributing causes
- Root causes

The direct cause of an incident is the immediate events or conditions that caused the incident. The direct cause addresses what happened.

Contributing causes address how and why an incident happened. Contributing causes are causal factors that are events or conditions that collectively with other causes increase the likelihood of an incident but that individually did not cause the incident.

The identification of root causes answers the question of why an incident happened. Root causes are the causal factors that if corrected, would prevent recurrence of the incident. Root causes can include system deficiencies, management failures, inadequate competencies, performance errors, omissions, non-adherence to procedures and inadequate organizational communication. Root causes are generally, not always, attributable to an action or lack of action by a particular group or individual in the line organization. Root causes can be found at more than one level of an organization from management down through the first line supervisors and to the worker.

As stated above, root causes may be found at the worker level. However, CCHS agrees with the guideline set forth in the Department of Energy Accident Investigation Workbook ⁽¹⁾ that a root cause of an accident can be

found at the worker level if, and only if, the following conditions are found to exist:

- Management systems were in place and functioning, and provided management with feedback on system implementation and performance.
- Management took appropriate actions based on the feedback.
- Management, including supervision, could not reasonably have been expected to take additional actions based on their responsibilities and authorities. .

C.2.2.1 Methodology

There are a number of root cause methodologies available to the Stationary Source, both in the public domain and proprietary. In order to establish criteria for acceptable methods, the Industrial Safety Ordinance states that a Stationary Source shall use a root cause analysis methodology recommended by the Center for Chemical Process Safety or one reviewed by CCHS for substantial equivalency. CCPS, in their book “Guidelines for Investigating Chemical Process Incidents” lists seven primary methodologies that CCHS considers acceptable and which CCHS will judge other methods against for substantial equivalency. These are:

- Accident Anatomy Method
- Causal Tree Method
- Fault Tree Analysis
- Multiple-Cause, Systems-Oriented Incident Investigation
- Multilinear Events Sequencing
- Sequentially Timed Events Plot
- TapRoot™ Incident Investigation System

CCHS does not recommend any particular methodology. When the CCPS book cited above was published in 1992, additional methodologies were available and since then, other methodologies have been developed. Most of these will be acceptable to CCHS. The main criteria that CCHS consider in judging equivalency is that a methodology is documented, and is a systematic method for determining causal factors, i.e., the contributing causes and root causes.

C.2.2.2 Team

A team should conduct a root cause analysis. At least one member of the team should have had training in facilitating a root cause analysis team in the

methodology to be used. An employee and employees' representative should be on the team. The remainder of the team should include at least one person knowledgeable in the Covered Process involved, and the rest of the team should be people with appropriate knowledge and experience to thoroughly investigate and analyze the incident. To the extent possible, the team should be individuals from outside the covered process to avoid potential conflict of interest.

C.2.2.3 Report Content

The Industrial Safety Ordinance states that the final report shall contain the root cause analysis, including recommendations to be implemented to mitigate against the release or incident reoccurring, if any, and a schedule for completion of the resulting recommendations. The ordinance does not specify the exact content of the report, nor is it the intention in this guidance document to specify one. CCHS recognizes that report content may vary due to the severity and complexity of an incident, and possibly due to methodology used for the root cause analysis. CCHS suggests that a Stationary Source consider including the following items in a report to the extent consistent with the severity and complexity of an incident.

- Table of Contents
- Executive Summary
- Introduction
- Scope of Investigation
- Description of the incident, including on-site and off-site effects
- Brief description of the process involved
- Facts, including a time line of events
- Casual Factor Analysis, concluding with citing of the direct cause, contributing causes and root causes.
- Recommendations
- Schedule for implementing recommendations
- Glossary: recognizing that the document will be in the public domain with non-technical people reading it.

C.3 CCHS ROOT CAUSE ANALYSIS

C.3.1 SINGLE POINT OF CONTACT

Section 450-8.016(C)(2) sets forth the cooperation requirements of the Stationary Source when CCHS conducts a root cause analysis. In order to facilitate this cooperation, the stationary source should appoint a person to be the single point of contact with CCHS (and any other agencies involved) to coordinate the interface between CCHS and the Stationary Source. This person would be responsible for coordinating such things as:

- Receiving and processing requests from CCHS
- Interview schedules
- Providing documentation
- Document control
- Security and testing of physical evidence
- Office space: depending on the scope of the investigation, CCHS may require secure on-site office space
- Photography permits
- Access to incident site
- Passes to access stationary source

TABLE C.1

DEFINITIONS OF PLANT INCIDENT CLASSIFICATION LEVELS

LEVEL 0 (easily contained and controlled by plant personnel) is defined by any of the following:

1. On-site only.
2. Plant safety is put on alert.
3. Liquid spill contamination.
4. At least 5 unsubstantiated odor complaints within an hour.
5. No federal/state spill or release notification requirements.

LEVEL 1 is defined by any of the following:

1. On-site; possible off-site.
2. Confirmed (greater than or equal to 5 odor complaints within one hour and substantiated by plant personnel as an on-site problem) off-site odor from facility.
3. Fire/smoke which requires a response from workers outside the immediate area, but not visible off-site.
4. Excess flaring.
5. Spill or release incident that meets an RQ (Reportable Quantity) requirement and also meets one or more of the other Level 1 criteria.

LEVEL 2 is defined by any of the following:

1. Off-site impact where eye, skin, nose and/or respiratory irritation may be possible.
2. Explosion with noise/pressure wave impact off-site.
3. Fire/smoke/plume (other than steam) visible off-site (does not include fire training exercises).

LEVEL 3 is defined by any of the following:

1. Off-site impact that is expected to cause eye, skin, nose and/or respiratory irritation in the community (ERPG Level 2 concentration reading or greater).
2. Explosion with off-site damage.
3. Fire, heat or smoke off-site impact.
4. Major fire and/or explosion.
Examples: (a) On a process unit (excluding precipitators and boilers) where mutual aid is requested to mitigate the event and the fire will last longer than 15 minutes; (b) Where the local fire department strikes multiple alarms to mitigate the event.