

SECTION B - CHAPTER 5: INCIDENT INVESTIGATION

Section 450-8.016 (b) (1) (B) of County Ordinance Code Chapter 450-8, as amended by County Ordinance 2006-22¹ requires Stationary Sources to consider human systems as causal factors in the incident investigation process for Major Chemical Accidents or Releases (MCARs), or for an incident that could reasonably have resulted in a Major Chemical Accident or Release (near miss MCAR)². Stationary Sources must have a process in place to identify near miss MCARs.

The purpose of this chapter is to define “human systems” and “causal factors” and to give guidance on the consideration of human systems when conducting these incident investigations. This chapter does not cover incident investigation or root cause analysis requirements, methodologies or procedures. These requirements are set forth in Section 450-8.016(a)(9) and Section 450-8.016(c) of County Ordinance 2006-22. Guidance for these topics is included in Chapter 7 of the *Contra Costa County CalARP Program Guidance Document* and Section C of this Document respectively.

5.1 DEFINITIONS

5.1.1 HUMAN SYSTEMS

Human Systems are defined as the systems (i.e., written and unwritten policies, procedures, and practices) in effect to minimize the existence/persistence of latent conditions at the Stationary Source. Latent conditions are discussed in Chapters 2 or 3 of this guidance document. Inadequate human systems allow latent conditions to persist and cause or exacerbate an incident. These human systems would include, but are not limited to, those implementing all the elements of the Stationary Source Safety Requirements of Section 450.8.016. Examples of human systems are:

- The overall policy or procedures at a Stationary Source governing the minimum requirements for adequate communications to minimize or prevent latent conditions, such as those included in Attachment As.
- The overall policy or procedures at a Stationary Source affecting and ensuring the proper content and execution of procedures to minimize or prevent latent conditions, such as those included in Attachment A, starting with question 2.1 under Procedures.

Human systems would also include the broad area of the safety culture of a Stationary Source to the extent that it influences the actions of individuals or groups of individuals.

A detailed discussion of safety culture assessments to be conducted by the Stationary Sources in the unincorporated areas of County¹ is provided in Section F of this guidance document. However, all Stationary Sources are encouraged to understand the facilities’ Safety Culture in order to make achievable improvements to Safety Programs.

5.1.2 CAUSAL FACTORS

Causal factors are defined as the events and conditions that are necessary to produce or contribute to an incident. Causal factors include:

- Direct cause – the active failure,
- Contributing causes – the events or conditions that collectively with other causes increase the likelihood of an incident but that individually did not cause the incident, and
- Root causes – the factors that if corrected, would prevent recurrence of the incident (e.g., system deficiencies, management failures, or inadequate organizational communications).

Causal factors seek to answer the basic questions about an incident:

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

5.2 METHODOLOGY

Section 450-8.016(b)(1)(B) actually requires Stationary Sources to conduct two separate activities. First, human systems (as defined in Section 5.1.1) are to be considered causal factors (as defined in Section 5.1.2) in incident investigations of Major Chemical Accident or Releases (MCARs). Second, human systems are to be considered causal factors in investigations of incidents that could reasonably have resulted in an MCAR. Section 450-8.016(c) requires that a root cause analysis be done for all MCARs. The combined effects of Sections 450-8.016(b) and (c) are that:

- Stationary Sources must conduct a root cause analysis for MCARs that considers human systems as causal factors.
- Stationary Sources must also consider human systems as causal factors for an incident that could reasonably have resulted in an MCAR.

These two activities are further described in Sections 5.2.1 and 5.2.2

Causal factors have been defined to include direct, contributing, and root causes of the incident. However, the direct cause of an incident is usually an active failure, therefore, human systems may not apply to the direct cause. Latent conditions and the inadequate human systems that allow them to exist/persist do apply when identifying contributing causes and root causes. For example, the direct cause of an incident may have been an operator adding an inappropriate amount of one reactant to a batch reactor. This in turn resulted in a “runaway” reaction and ultimately an explosion. One of the contributing causes was that the operator did not follow the current procedure that identified the mitigation measures to be initiated during temperature excursions. Upon further investigation, the team discovered that the operator was using an outdated procedure that did not specifically address the temperature excursion. One existing latent condition was the existence and use of inaccurate and

outdated procedures. One of the inadequate human systems was therefore the document control policy governing operating procedures.

In the batch reactor example above, if the “runaway reaction” was brought under control before an explosion happened, the incident was one that could reasonably have resulted in a Major Chemical Accident or Release and the same causal factor analysis should have been performed.

5.2.1 INVESTIGATION OF MAJOR CHEMICAL ACCIDENTS OR RELEASES

Stationary Sources should follow the guidance described in Section C of this document when conducting a root cause analysis of a Major Chemical Accident or Release. Additionally, the Stationary Source must explicitly consider human systems as causal factors for the incident. The purpose of a root cause analysis is to identify all causal factors. Therefore, Stationary Sources may already be considering human systems as causal factors during their root cause analysis.

- Whether Stationary Sources are already considering human systems or not, they may find it beneficial to use the Latent Conditions Checklist in Attachment A as a tool to supplement their existing root cause analysis methodology. The checklist can also be useful to an investigator in forming a line of inquiry for an investigation. CCHMP encourages full use of the checklist associated with incident investigations, however not all questions may be applicable.

The way to use the checklist is to review it in the context of the incident and change the tense or syntax of the question to better fit the circumstances for the incident under investigation. For example, to help determine if experience/knowledge was a factor in an incident, change question 1.1 from “Do employees remain in each unit for a sufficient amount of time to develop the experience and knowledge base necessary to safely operate the unit and respond to emergencies?” to “*were the employees involved in the incident in the unit for a sufficient amount of time to develop the experience and knowledge base necessary to safely operate the unit and respond to emergencies?*” If the answer is negative, a latent condition exists, and the investigator should identify the human system that failed, allowing the latent condition to exist. While going through the checklist in this manner, several of the questions will be recognized as being pertinent to the incident and should be followed up to develop more information. Other questions will be recognized as not being applicable at all to the incident. These can contribute to the basis for questions to ask during interviews and for selecting documents to review. Stationary Sources are encouraged to use the complete set of latent conditions checklists for investigations of MCARs and near miss MCARs. Contra Costa Hazardous Materials Programs (CCHMP) believes that some of the industry recognized root cause analysis techniques may adequately incorporate review of human systems in the incident investigation process, consult with CCHMP for appropriate approval.

5.2.2 INVESTIGATIONS OF AN INCIDENT THAT COULD REASONABLY HAVE RESULTED IN A MAJOR CHEMICAL ACCIDENT OR RELEASE.

Stationary Sources may elect to apply a root cause analysis methodology for an incident that could reasonably have resulted in a Major Chemical Accident or Release to ensure that the investigation considers human systems as causal factors, although this is not a requirement of the ordinance. Stationary Sources electing to apply a root cause analysis methodology for an incident that could reasonably have resulted in a Major Chemical Accident or Release should follow the guidance provided in Section 5.2.1.

Stationary Sources electing to not apply the root cause methodology for an incident that could reasonably have resulted in a Major Chemical Accident or Release must still consider human systems as causal factors in the incident investigation. The questions in Attachment A may be used as a tool to assist in identifying the latent conditions which were contributing factors to, or root causes of, the incident. The human systems that allowed those latent conditions to exist/persist should then be identified by the investigation team. Guidance on applying Attachment A is provided in Section 5.2.1. **NOTE:** Attachment A should be considered a brainstorming tool that should be revised to reflect the conditions at each Stationary Source. It should not be considered a complete list of all latent conditions that may exist at any particular Stationary Source.

¹ Modifications were made to the Contra Costa County's Industrial Safety Ordinance (ISO) in 2006. The definition of an MCAR was modified to include the potential of a combustible vapor cloud as well as a flammable vapor cloud. Since the corresponding City of Richmond's Industrial Safety Ordinance has not been amended, Stationary Sources subject to the City of Richmond's ISO are encouraged to comply with the County ISO amendments.

² "Major Chemical Accident or Release" means 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 CCHMP's Hazardous Materials Incident Notification Policy; or results in the release 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 CCHMP;
- (4) Results in a vapor cloud of flammables and/or combustibles that is more than 5000 pounds.