EMS Risk Control Framework	
Document Identification Number:	CCD-202
Version:	2.0
Revision Date:	December 23, 2008
Document Owner:	EMS Program Administrator (Kurt Schlomberg)
Controlled Copy Location:	Not applicable

1.0 Introduction

This guidance document describes the procedure for assessing Risk Controls for significant environmental aspects and impacts associated with CCD activities, products and services. Significant aspects and impacts are determined through *CCD-204-R Environmental Aspects and Impacts Assessment*, and a current list is maintained in the most recent CCD-*201* report. **The Risk Control process can be applied to the significant environmental aspects at CCD at the discretion of the EMS manager as necessary to meet the needs of the various agencies of CCD.**

Risk Controls are composed of a pair of tools, a Risk Control Framework (RCF or "bow-tie") and a corresponding table that summarizes the RCF and includes quantitative data on the various controls that cannot be included directly on the RCF. Because of the dependency of these two tools, they are created and revised simultaneously, and are generally referred to only as "Risk Control Frameworks" (RCFs).

This document also includes a catalog of all current Risk Control Frameworks (and corresponding tables) in place at CCD. This catalog also includes pertinent information on the CCD responsible party for that RCF.

Appendix A provides additional background guidance regarding the initial development of RCFs, and presents a template Risk Control Framework and corresponding table. If a completely new RCF is required, the Appendix materials should be consulted.

2.0 Process

The following process should be followed when assessing CCD's Risk Control Frameworks (and corresponding tables). Each RCF is evaluated as determined in the annual review of CCD's Aspects and Impacts, as documented in the most recent *CCD-201* report.

1. Perform initial RCF assessment: The CCD Responsible Party for the RCF (as documented in the RCF Catalog and on the RCF itself) will perform an assessment of the RCF to identify new and obsolete controls, changes to the corresponding Risk Control Table, and any weaknesses in the overall control strategy applied to that aspect.

2. Update RCF: The CCD Responsible Party for the RCF will update the RCF with proposed changes, as required by the initial assessment. Proposed changes should be handwritten on a printed copy of the RCF.

3. Assemble assessment team: The CCD Responsible Party for the RCF will bring together a representative group of CCD staff for a one-hour meeting.

4. Review proposed RCF changes: Review the proposed changes to the RCF generated by the CCD Responsible Party. Discuss the reasons for conducting the RCF review, as determined in the most recent *CCD-201* report.

5. Brainstorm additions and changes: Review any changes to CCD's activities, products and services, as related to the aspect of concern, since the last Risk Control assessment was performed. Discuss the following:

   - Potentially obsolete controls,
   - New threats or consequences created by changes to CCD's activities, products or services related to the aspect of concern,
   - New barriers or controls required by changes to CCD's activities, products or services, or to newly recognized barriers or controls,
   - The effectiveness of each barrier or control,
   - The responsible Party for each barrier or control,
   - The references (documents associated with the threats, barriers, controls or consequences) for the RCF,
   - Any Corrective Actions associated to the threats, barriers, controls or consequences for the RCF, and
   - Any weaknesses in the overall control strategy applied to the aspect.

6. Finalize updates to the RCF: The CCD Responsible Party for the RCF is responsible for completing updates to the Risk Control Framework and corresponding table, and updating the EMS.

Appendix A – Background on the Risk Control Process

The Risk Control Process allows CCD to evaluate the measures currently in place to provide management control over significant environmental risks in Denver. These risks are identified through the Environmental Aspects and Impacts Identification and Assessment Process (*CCD-204-R Environmental Aspects and Impacts Assessment*). As necessary, a very detailed approach will be taken to evaluate significant aspects of special concern. **The level of detail for each RCF will be determined by the EMS Manager based on the situation and the needs of the various agencies involved. For example to due concerns of water quality in the South Platte, a detailed Risk Control Process was developed.**

Risk Controls are composed of a pair of documents, a Risk Control Framework (RCF or "bow-tie") and a corresponding table that summarizes the RCF and includes quantitative data on the various controls that cannot be included directly on the RCF. Because of the dependency of these two documents, they are created and revised simultaneously, and are generally referred to only as "Risk Control Frameworks" (RCFs).

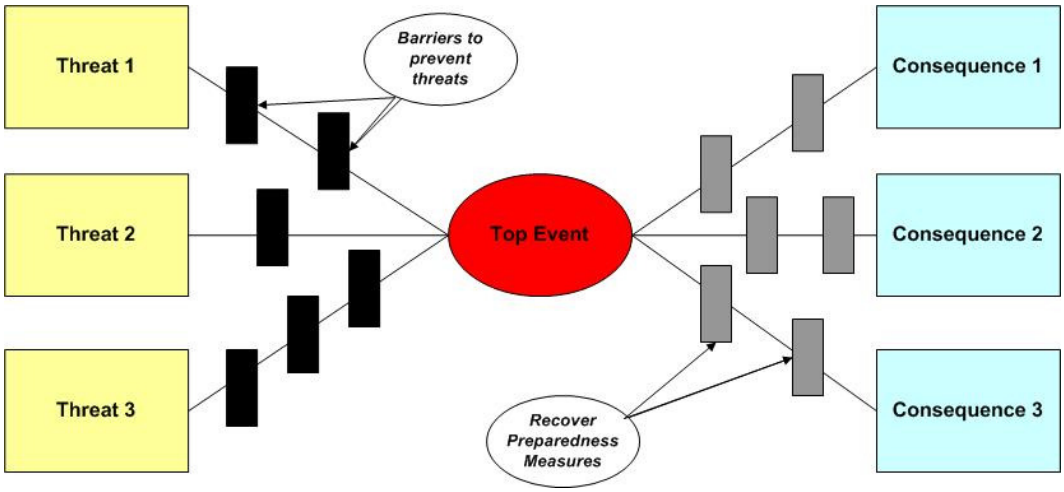
Risk Control Framework

The Risk Control Framework (RCF) below has been called a "bow-tie" diagram. It provides a visual tool for evaluating how significant environmental aspects are being controlled to ensure the management of these significant aspects. For any aspect to have an impact upon the environment a "top-event" must occur. A "top event" is defined as a reasonably likely event that would allow the potential impact of that environmental aspect to occur. For example, the top event for a "liquid fuels" aspect might be "fuel spill."

From a risk management perspective, it is imperative to identify the threats that may cause such top events and the consequences of that event occurring. Understanding the threats and consequences allows for controls, or barriers, to be put into place as part of the EMS to minimize the probability of the top event. Should the barriers fail and a top event occur, there must also be controls in place to minimize the impacts, or consequences, of the event.

Many barriers also have "escalation factors" associated with them that could increase the probability of a barrier to fail. When appropriate, these failures must be controlled as well. For example, a barrier such as "Automatic Monitoring Equipment" could be overcome by "Monitoring Equipment Failure;" this threat could then be blocked by "Monitoring Equipment Testing Program."

All barriers, controls, and escalation factor controls are assigned an effectiveness rating. Effectiveness is judged on a +/- scale (++, +, 0, -, - -) where a control with a ++ rating would be considered very effective. Accountabilities are also assigned to the barriers, controls, and escalation factor controls in order to clearly identify the parties that are expected to perform them.



Risk Control Development Process

The intent of the Risk Control Development Process is to brainstorm all the elements needed to manage the significant environmental aspects of CCD operations, identify elements that need to be reinforced or improved, and provide a tool for corrective action planning should a top event occur. The information that is developed describes many facets of the EMS, primarily the operational control function, and also extends into the greater organization to describe central functions such as legal support. It is typically presented in bow-tie format to facilitate an understanding of the entire *system* of controls, and in tabular format to clearly identify accountabilities and effectiveness factors, and provide references to documents that compose pieces of the control system.

Using the questions below, a "bow-tie" diagram is composed, and then translated into tabular format to capture all the information generated (a template diagram and table are included after the questions). The elements of the diagram are then discussed in terms of the appropriate level of effectiveness for preventing the top event. As appropriate, existing control measures are then reinforced or additional control measures developed and implemented.

- What activities are related to the aspect?
- What is the top event related to the aspect? (Release, exceedance of permitted discharge, etc.)
- What is the location of the top event or scenario(s) it could occur in?
- What is the hazard posed by the top event?
- What are the threats that could cause the top event?
- What are the consequences that would result from the top event?
- For each threat, what are the barriers CCD has in place to stop it from occurring?
- For each consequence, what controls are in place to mitigate the impact to CCD?

- What are the escalation factors that could render a barrier or control ineffective?
- What are the barriers and controls for escalation factors?
- Who is accountable for the application of each barrier and control (by title)?
- Who is responsible for the upkeep and maintenance of barriers and controls?
- What constitutes the barriers and controls? (SOP's, guidelines, staff resources, process/program, etc.)
- How effective are the barriers and controls (using the [++, +, 0, -, - -] system)

Scale	Value	Description
++	5	Excellent. Control is in place, implemented and effectively managing risk.
+	4	Good. Control is in place but may not be fully implemented or effective.
0	3	Fair. Control exists but effectiveness is unknown.
-	2	Poor. Control may exist but is not effective.
--	1	Unacceptable. Control does not exist.

- Are references are available for any documents that constitute barriers and controls?
- What are the major shortcomings in controlling the aspect?

Risk Control Table - Template

Threats to the Top Event	**Barriers to Prevent Top Event**					**Escalation Factors**					
Threats	**Barrier**	**Resp. Party**	**Eff. Factor**	**Ref. #**	**C.A. #**	**Escalation Factor**	**Escalation Control**	**Resp. Party**	**Eff. Factor**	**Ref. #**	**C.A. #**
List of threats that may allow the Top Event to occur.	*List of Barriers that will help prevent the associated Threat.*	*A position title that is responsible for the associated Barrier.*	*The effectiveness rating of the barrier*	*see Ref. list below*	*see C.A. list below*	*List of associated factors that could make the Barriers ineffective (I.e. cause them to fail).*	*List of barriers that help prevent or control the associated Escalation Factor.*	*A position title that is responsible for the associated Escalation Control.*	*The effectiveness rating of the escalation barrier*	*see Ref. list below*	*see C.A. list below*
Consequences of Top Event	**Controls Mitigating Consequence**					**Escalation Factors**					
Consequence	**Control**	**Resp. Party**	**Eff. Factor**	**Ref. #**	**C.A. #**	**Escalation Factor**	**Escalation Control**	**Resp. Party**	**Eff. Factor**	**Ref. #**	**C.A. #**
List of consequences that may occur given that the Top Event happens.	*List of controls that control (or help manage/mitigate) the associated consequence.*	*A position title that is responsible for the associated Control.*	*The effectiveness rating of the Control*	*see Ref. list below*	*see C.A. list below*	*List of associated factors that could make the Controls ineffective (i.e. cause them to fail).*	*List of controls that help prevent or control the associated Escalation Factor.*	*A position title that is responsible for the associated Escalation Control.*	*The effectiveness rating of the escalation control*	*see Ref. list below*	*see C.A. list below*

References		**Corrective Actions**	
Ref #	**Name**	**C.A. #**	**Name**
1	*A list of documents that are associated with this Environmental Aspect and the Threats, Barriers, Consequences, and Controls described herein.*	*1*	*A list of corrective actions associated with any breakdowns in controlling the Aspect.*

Risk Control Framework - Template