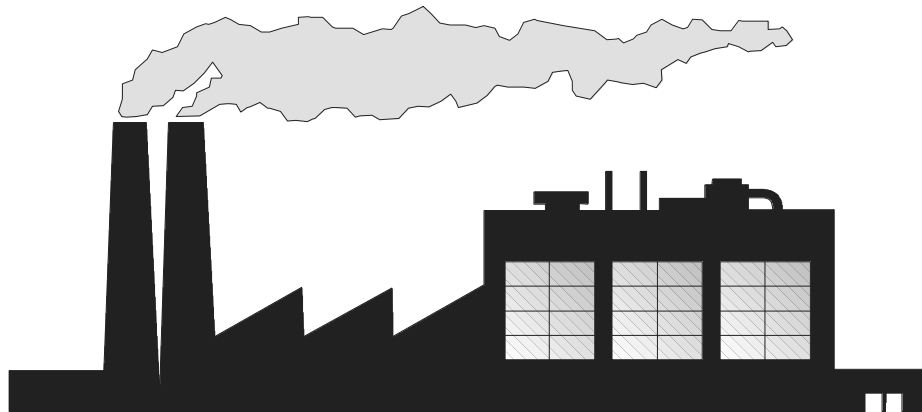


Senate Bill (SB) 1731  
Risk Reduction Audits and Plans



General Checklist for Completion of  
A Risk Reduction Audit and Plan

California Environmental Protection Agency  
 Air Resources Board

Stationary Source Division  
Emissions Assessment Branch

November 1997

## Acknowledgments

In appreciation for their participation in developing this guidance, the Air Resources Board staff extends its thanks to the following members of the Workgroup for the General Checklist:

Valerie Nera	California Chamber of Commerce
Fred Simonelli	California Cast Metals Association
Roger Isom	California Cotton Ginners Association
Clay Freeberg	Chevron State Regulatory Group
Craig Anderson	Industrial Environmental Association / Solar Turbines
Dave Arrieta	DNA Associates
Jeff Sickenger	Western States Petroleum Association
Walt Murray	Manufacturers Council of the Central Valley
Millie Yamada	Northrop Corp
Ted Holcombe	PG&E Environmental Services Department
Jerome Cole / Rosalynd Volpe	International Lead-Zinc Research Organization
Samuel R. Smith	Van Den Bergh Foods Co.
Sandy Tuttle / Maureen Healey	Society of the Plastics Industry
Bill Quan	Formerly of the City and County of San Francisco
Richard Sykes	East Bay Municipal Utility District
Bruce Fallkenhagen	Independent
David Craft	Monterey Bay Unified APCD
Leland Villalvazo	San Joaquin Unified APCD
Mike Donnelley	El Dorado County APCD
Dave Mehl	El Dorado County APCD
Rich Stedman	Santa Barbara County APCD
Scott Lutz	Bay Area AQMD
Mohan Balagopalan	South Coast AQMD
Tom Weeks	San Diego County APCD
Lew Schalit	Western Fire Chiefs Association
Benjamin Fries	Department of Toxic Substances Control
Gary Nolan	Santa Clara County Pollution Prevention Program
Mary Serra	Formerly of the Department of Toxic Substances Control

### Checklist Prepared By:

Carol McLaughlin

### Reviewed and Approved By:

Robert D. Fletcher, Chief, Emissions Assessment Branch  
Cliff Popejoy, Manager, Process Evaluation Section

# General Checklist for Completion of A Risk Reduction Audit and Plan

## Table of Contents

<b>Introduction</b> .....	1
What's the purpose of this Checklist? .....	1
What's a "risk reduction audit and plan"? .....	1
How do I prepare a risk reduction audit and plan? .....	2
<b>Step 1: What causes the risk?</b> .....	3
How much risk do I need to reduce? .....	3
Which pollutants cause the risk? .....	5
Which processes or emission points cause the risk? .....	6
<b>Step 2: How can I reduce the risk?</b> .....	9
How can I change the process to reduce the risk? .....	9
What control equipment can I use to reduce the risk? .....	11
Emission collection systems .....	11
Control equipment .....	12
What other options will reduce the risk? .....	13
Distance to the receptors .....	15
<b>Step 3: Which of the options will work for me?</b> .....	16
How do I figure risk reductions for the options? .....	18
How do I evaluate the plan? .....	21
How do I figure whether the remaining risk is below the significance level? ..	21
How do I estimate the cost to implement the plan? .....	23
How do I figure how long it will take to implement the plan? .....	24
<b>Step 4: How do I write the risk reduction plan?</b> .....	26
Part 1 - Summary .....	27
Part 2 - Risk reduction measures to be implemented .....	28
Part 3 - Risk reduction options considered and rejected .....	29
Part 4 - Ten year analysis .....	30

- Appendix A - Calculations Associated with the Cancer Risk**
- Appendix B - Calculations Associated with Chronic Non-cancer Risk**
- Appendix C - Calculations Associated with Acute Non-cancer Risk**
- Appendix D - Evaluating Risk Reduced by Process-based Measures**
- Appendix E - Evaluating Risk Reduced by Emission Control Measures**
- Appendix F - Evaluating Risk Reduced by Other Measures**
- Appendix G - Evaluating Plans with Multiple Options that Affect the Same Pollutants, Processes, or Emission Points**

**California Environmental Protection Agency  
Air Resources Board**

**GENERAL CHECKLIST FOR COMPLETION OF A  
RISK REDUCTION AUDIT AND PLAN**

**Introduction**

This document presents a Checklist for auditing a facility and developing a risk reduction plan. The instructions are designed to lead the facility operator through the process of relating the risk identified in their AB 2588 risk assessment to the processes and emission points at the facility that contribute to the risk, identifying and evaluating risk reduction measures, and developing and documenting the plan.

The Checklist is organized into four steps incorporating a number of worksheets. The appendices contain supplementary instructions that would not apply to all facilities.

**What's the purpose of this Checklist?**

This Checklist is designed to help facilities comply with Senate Bill (SB) 1731. This law requires certain facilities to reduce their risk of causing adverse health effects (like cancer) due to toxic air contaminant emissions. It requires the facility owner/operator to figure out what to do to reduce risk from their facility, and then develop and carry out a plan to reduce the risk. This Checklist can be followed to perform a risk reduction audit and develop a risk reduction plan. The air pollution control or air quality management district (district) must review the plan, so the facility owner should consult with their district before using these guidelines to do an audit and plan.

This Checklist is designed for a simple facility and as an overall framework for an audit and plan. Supplementary instructions for more complex facilities are in Appendices A to G. There is a companion document -- the General Guidance for Preparing Risk Reduction Plans -- that has more detailed information on risk assessment, risk reduction options, and other sources of information. You can request a copy from the Air Resources Board Public Information Office at (916) 322-2990, or you can mail or fax the order form attached at the end of the Checklist.

**What's a "risk reduction audit and plan"?**

A risk reduction audit and plan is an analysis of the activities that emit toxic air contaminants, an evaluation of options to reduce emissions and risk, and a list of steps (with a schedule) to be taken to reduce the risk. The first two steps are the "audit" part, and the last two are the "plan."

## How do I prepare a risk reduction audit and plan?

This Checklist describes four steps that you can use to put together a risk reduction audit and plan for your facility. These steps are:

1. Identifying what causes the risk;
2. Identifying how you can reduce the risk;
3. Determining which of the options will work for you; and,
4. Writing and filing the risk reduction plan.

The information to do the first step should come from the Assembly Bill (AB) 2588 risk assessment for your facility. In steps two and three, you evaluate the processes or activities that cause the risk to see how they can be changed or controlled to reduce the risk. The fourth step is putting down on paper a list of actions and a schedule that you will carry out to reduce the risk. You will file the plan with the district. The district will review the plan and notify you within three months whether it is approved or disapproved. If they disapprove your plan, you will have 90 days to revise and resubmit it.

## **Step 1: What causes the risk?**

In this step, you'll establish the amount (or degree) of risk reduction you'll need to reduce the risk from the facility below the district-defined significant risk level. Risk assessments usually list the relative cancer risk or non-cancer hazard index for each pollutant for the whole facility. The non-cancer hazard index expresses the relationship between exposure from the facility and an 'acceptable' level of exposure, the reference exposure level (REL). If your facility has multiple pollutants and emission points that cause risk, it may be important to identify which emissions points and processes contribute most to the risk -- because it's most often at the emission point or process where some action is taken to reduce emissions and risk. In this Checklist, when we say 'emission point' we mean the point (door, vent, stack, etc.) where the pollutant is released to the ambient air. When we say 'process,' we mean an industrial activity that releases the pollutant to the air, or to an emission stream captured by an emission collection system.

### How much risk do I need to reduce?

The law requires that the risk be reduced to below the significant risk level. The district sets the significance levels. Because cancer risks are evaluated differently than non-cancer hazards, there are significance levels for each. The district can tell you what the significance levels are, or they may include that information when they notify you that the risk from your facility is significant. In addition, the risk may be calculated for the maximally exposed individual resident (MEIR), the maximally exposed individual (off-site) worker (MEIW), or both. If you need to reduce risks for both types of receptors, you should check with the district to determine whether risks to off-site workers were adjusted to account for a reduced period of exposure. If this is the case and one of two other conditions apply, you may need to do the audit separately for each type of receptor. This would be necessary if you have multiple emission points, or if you choose a risk reduction measure that requires that the dispersion modeling be redone. If neither of these conditions apply, both the MEIR and the MEIW will be reduced by the same percentage.

Cancer risks are expressed as the probability that an individual will contract cancer as a result of a given level of exposure to a pollutant or pollutants. The following notations can be used to describe cancer risks:  $1.0 \times 10^{-6}$  means 1 in a million;  $1.0 \times 10^{-5}$  means 10 in a million;  $1.0 \times 10^{-4}$  means 100 in a million; and so forth. For non-cancer risks, a hazard index of 1 represents exposure equal to the REL for that pollutant. Individual hazard indexes are calculated for each pollutant. The total hazard index is calculated by adding the individual hazard indexes for all pollutants that affect the same organ or system (toxicological endpoint). Consequently, a

facility can have more than one significant non-cancer hazard index. The following are notations used in this Checklist for the toxicological endpoints for which total hazard indexes are calculated:

- CV/BL means cardiovascular and blood,
- CNS/PNS means central nervous system and peripheral nervous system,
- IMMUN means immune system,
- KIDN means kidney,
- GI/LV means gastrointestinal and liver,
- REPRO means reproductive system,
- RESP means respiratory system, and
- SKIN means skin irritation and other effects.

In Worksheet 1, list the district-designated significance levels, the risk or hazard levels given in your risk assessment, and calculate the risk reduction goals for your plan using the following equation:

$$(\text{facility risk} - \text{significant risk}) \times 100 / \text{facility risk} = \text{percent risk reduction needed.}$$

**Worksheet 1: Risk levels and goals**

District-designated significant cancer risk: _____ in a million				
Facility cancer risk (from the AB 2588 risk assessment): _____ in a million				
Cancer risk reduction goal: _____ percent				
District-designated non-cancer significance levels: chronic _____ acute _____				
Facility total hazard indexes and risk reduction goals:				
Toxicological endpoint	Chronic hazard index	Reduction goal (percent)	Acute hazard index	Reduction goal (percent)
CV/BL				
CNS/PNS				
IMMUN				
KIDN				
GI/LV				
REPRO				
RESP				
SKIN				



### Which pollutants cause the risk?

Some risk reduction options apply to a single pollutant, and others to more than one pollutant, coming from a process or an emission point. So that you can choose the best options for you, in terms of cost-effectiveness and practicality, you may want to prioritize the pollutants, processes, and emission points in terms of both the risk they cause and your risk reduction goals. The risk will be reported in the risk assessment by pollutant because each pollutant has the potential to cause different health effects.

There are three reasons to calculate the fraction of the risk or hazard index for a toxicological endpoint that each pollutant contributes: 1) to evaluate risk reduction options that affect a single pollutant; 2) to figure out which pollutants contribute substantially to the risk or hazard index; and 3) to calculate risks from processes or emission points.

You calculate the fractional contribution for each pollutant by dividing the risk due to the pollutant by the total risk or total hazard index for the toxicological endpoint. You may want to use Worksheet 2 to organize the data. If you do, you will need one copy for each health effect. You can include just those health effects that are over the significance levels.

Information on the pollutants emitted and their health effects is contained in your AB 2588 emission inventory and risk assessment. General information on the health effects of pollutants is published in the CAPCOA Air Toxics “Hot Spots” Program Revised 1992 Risk Assessment Guidelines by the California Air Pollution Officers Association (CAPCOA).<sup>1</sup> It is available for purchase by calling (916) 676-4323, or writing to:

CAPCOA  
3232 Western Drive  
Cameron Park, California 95682.

The district or the ARB may also be able to provide information on health effects for a limited number of pollutants. In addition, the Office of Environmental Health Hazard Assessment (OEHHA) provides information on health effects on its web site at: <http://calepa.cahwnet.gov/oehha>.

---

<sup>1</sup> As required by SB 1731, the Office of Environmental Health Hazard Assessment (OEHHA) is currently preparing official Hot Spots Program risk assessment guidelines. Contact OEHHA at (916) 454-7572, (510) 540-3324, or <http://www.calepa.cahwnet.gov/oehha/> for information on the guidelines' availability.

**Worksheet 2: Pollutants that cause the risk**

- Cancer
- Chronic non-cancer for \_\_\_\_\_ (Endpoint)
- Acute non-cancer for \_\_\_\_\_ (Endpoint)

**NOTE: Use one worksheet for each health effect**

Pollutant	Contribution -Fraction of the facility risk due to this pollutant	Pollutant	Contribution -Fraction of the risk due to this pollutant

You may limit your effort in the following steps by excluding pollutants that each cause less than one percent of the risk. When you have completed the audit, you may have to include these minor contributors if you have not been able to identify sufficient risk reductions to achieve your risk reduction goal(s).

Which processes or emission points cause the risk?

Many risk reduction options, like process changes or control devices, are applied at the process or emission point. Because of this, you may want to prioritize processes and emission points with regard to the risk they represent and the risk reduction goals you have identified. The instructions for Worksheet 3 show how to calculate the fraction of the facility risk a process represents. The instructions for Worksheet 4 show how to calculate the fraction of the risk an emission point represents.

**Worksheet 3: Prioritizing processes**

Instructions

Note: use one copy for each health effect.

1. If one, or more than one, pollutant is emitted from more than one emission point or more than one process, use Appendix A (for cancer), Appendix B (for chronic non-cancer), or Appendix C (for acute non-cancer) to generate a list of the risk associated with each combination of pollutant, process, and emission point, and go to number 2, below.
2. List all processes that emit one or more of the pollutants listed in Worksheet 2 for the same health effect.
3. To calculate the fraction of the risk each process contributes, add the fraction of risk for each pollutant that is emitted from this process and affects this health effect. Use the fraction from appendices A, B, or C, or from Worksheet 2 if the pollutant is not emitted by any other process. Calculate this separately for each non-cancer toxicological endpoint.
5. Use this data to decide which processes you will evaluate for risk reduction options. If you finish the audit and have not identified sufficient risk reductions, you may need to consider options for additional processes or emission points.

**Cancer**

**Chronic non-cancer for** \_\_\_\_\_ (Endpoint)

**Acute non-cancer for** \_\_\_\_\_ (Endpoint)

Process	Contribution - fraction of the facility risk due to this process	Comments

**Worksheet 4: Prioritizing emission points**

Instructions

NOTE: Use one worksheet for each health effect

1. If one, or more than one, pollutant is emitted from more than one emission point or more than one process, use Appendix A (for cancer), Appendix B (for chronic non-cancer), or Appendix C (for acute non-cancer) to generate a list of the risk associated with each combination of pollutant, process, and emission point, and go to number 2, below.
2. List all emission points that vent one or more of the pollutants that contribute to this health effect and are listed in Worksheet 2.
3. To calculate the fraction of the risk each emission point contributes, add the fraction of risk for each pollutant that is released from this emission point, and affects this health effect. Use the fractions from appendices A, B, or C, or from Worksheet 2 if the pollutant is not released from more than one emission point. Calculate this separately for each non-cancer toxicological endpoint.
4. Use this data to decide which emission points you will evaluate for risk reduction options. If you finish the audit and have not identified sufficient risk reductions, you may need to consider options for additional processes or emission points.

**Cancer**

**Chronic non-cancer for** \_\_\_\_\_ (Endpoint)

**Acute non-cancer for** \_\_\_\_\_ (Endpoint)

Emission point	Contribution-fraction of the facility risk due to this emission point	Process associated with the emission point

## **Step 2: How can I reduce the risk?**

We recommend that in this step you develop a list of risk reduction options.

The General Guidance for Preparing Risk Reduction Plans gives information about various types of risk reduction options. Process changes (such as materials substitutions or operational changes) that reduce the amount of pollution generated are called pollution prevention. Pollution prevention approaches can result in cost savings from reduced use of raw materials and reduced waste disposal costs. Emission capture and removal options are very effective but can increase operating and waste disposal costs. Other options (such as increasing the stack height or distance to receptors) reduce the impact of emissions without reducing the quantity or toxicity of the emissions.

Health and Safety Code Section 49330 specifically states that air toxic risk reduction measures do not include measures that will increase risk from exposure to the pollutant in another media, or that will increase the risk to workers and consumers. Otherwise, you have wide latitude to choose measures that suit your situation.

The options you identify in this step will be evaluated in the next step to see whether the options achieve the necessary risk reductions. As you identify them, we suggest you note them on Worksheet 9 - Evaluation of preliminary risk reduction options. Worksheet 9 is found at the beginning of Step 3.

### **How can I change the process to reduce the risk?**

Process-based risk reductions can be achieved by reducing the amount of the pollutant that is released and/or reducing the toxicity of the emissions. Worksheets 5 and 6 are designed to help identify opportunities for process changes.

Fill out a copy of Worksheet 5 for each pollutant. Fill out a copy of Worksheet 6 for each process you have targeted for risk reduction. Every "Yes" represents one option to be evaluated in the next step. Enter this option on Worksheet 9.

Other process-based risk reduction options may be developed by consulting the directory of resources in Appendix B of the General Guidance for Preparing Risk Reduction Plans, from process-specific guidelines published by ARB, or from discussions with the district, your suppliers, an industry association, or your employees.

**Worksheet 5: Options for individual pollutants**

<b>Pollutant _____ Process _____</b>	<b>YES</b>	<b>NO</b>
Is there a non-toxic substitute available?		
Is there a less toxic substitute available?		
Can the amount or concentration of the pollutant used in the process be reduced?		
Can you use the pollutant in a form less likely to be emitted?		
Other options:		
Other options:		

**Worksheet 6: Process-based options**

<b>Process _____</b>	<b>YES</b>	<b>NO</b>
Is there an alternate process that will serve the purpose?		
Can the process be eliminated?		
Can the process be re-configured to reduce handling losses?		
Can the physical or chemical conditions of the process be modified to reduce the production or release of the pollutant(s)?		
Is there processing equipment that emits less?		
Can the emissions be reduced through increased maintenance and/or better housekeeping?		
Other options:		
Other options:		
Other options:		

## What control equipment can I use to reduce the risk?

Control equipment includes both emission collection systems and control devices. Emission collection systems capture the emissions from a process and convey them to a control device or an emission point. Control devices either remove the pollutant from the gas stream or convert it to a non-toxic form. Ducting the captured emissions to a control device can produce large reductions in emissions and risk. In addition, capturing fugitive emissions and venting them to a stack may reduce risk by increasing dilution of the pollutants in the atmosphere (dispersion).

### Emission collection systems

Emission collection systems can collect and convey contaminated air to a control device or “air cleaner,” or can convey the contaminated air to an emission point like a roof vent without removing any of the pollutant. The use of emission collection systems can reduce the cost of removing the pollutants from the gas stream by producing a gas stream of smaller volume and with higher pollutant concentrations. Emission collection systems also may reduce employee exposure by removing the pollutant from the workplace air. Finally, emission collection systems can reduce the risk if they move pollutants to a lower-exposure emission point.

To be effective, an emission collection system must be designed and operated properly. For instance, the hoods or vents must be adequately sized for the specific situation, and air flows/speeds into the hood must be sufficient to collect the emissions. There are published guidelines for industrial ventilation. One recommended guidance document is Industrial Ventilation, Manual of Recommended Practice (published by the American Conference of Governmental Industrial Hygienists at 6500 Glenway Avenue Building D-7, Cincinnati, Ohio 45211-4438). If all of the processes that cause the risk are served by emission collection systems that are designed and operated in conformance with the specifications, skip to the section on control equipment.

The general effects of stack parameters on the results of dispersion modeling are discussed in Section I of the General Guidance for Preparing Risk Reduction Plans. Because the stack from the control device and/or the emission collection system is likely to have different release parameters than an uncontrolled process, a revised modeling study may be needed.

If the risk is due to emissions from fugitive sources (uncaptured emissions which usually occur close to ground level), increasing the collection efficiency of an existing emission collection system or installing a new emission collection system will generally reduce the risk, even if no control equipment is added. This is true if the collection system moves pollutants from a high-exposure emission point (for example, close to people) to a low-exposure emission point. However, if any emission release parameters will be changed, you will need to redo your dispersion modeling to evaluate the risk reduction.

Control equipment

If the processes or emission points that cause the risk do not have emission control equipment, installing control equipment can reduce your risk. If the processes or emission points that cause the risk have emission control equipment, one or more of the following options may reduce the risk.

1. Increase the removal efficiency of the existing control equipment (e.g., change the operating parameters or improve maintenance).
2. Add other equipment in series with the existing control equipment (installing additional equipment in parallel will increase the treatment capacity but not necessarily control efficiency).
3. Replace the existing equipment with higher efficiency equipment.

The choice of appropriate control equipment requires some specific knowledge about the emissions. Some important qualities are given in Worksheet 7, below. If you are considering installing control equipment for more than one emission stream, make one copy for each emission stream. You may also want to consider the ease of operation and maintenance for the technology under consideration.

**Worksheet 7: Gas stream characteristics**

<p><b>Emission point</b> _____</p> <p>Components of the gas stream (check as many as apply):</p> <ul style="list-style-type: none"><li><input type="checkbox"/> gases</li><li><input type="checkbox"/> particulate matter</li><li><input type="checkbox"/> corrosive gases</li><li><input type="checkbox"/> moisture</li></ul> <p>Gas stream temperature:</p> <ul style="list-style-type: none"><li><input type="checkbox"/> ambient</li><li><input type="checkbox"/> other (please specify) _____</li></ul> <p>Variability:</p> <ul style="list-style-type: none"><li><input type="checkbox"/> gas concentrations</li><li><input type="checkbox"/> particulate matter concentrations</li><li><input type="checkbox"/> emission stream temperatures</li><li><input type="checkbox"/> particle size distribution</li></ul>
---

For most control technology, the most important cost considerations are the volume of air to be cleaned, the concentration of the pollutant, and the desired pollutant removal efficiency.



Appendix A of the General Guidance for Preparing Risk Reduction Plans reviews specific types of control technology and the characteristics that affect their applicability, effectiveness, and cost.

Identified options should be listed on Worksheet 9.

What other options will reduce the risk?

There are risk reduction approaches that can reduce the public exposure even though the amount emitted stays the same. In some cases, increasing the stack height, gas velocity, temperature, or the distance between the emission point and the receptors, or changing the relationship between the stack and the surrounding buildings will increase dispersion, and therefore reduce the estimated risk. Evaluating these sorts of changes will require dispersion modeling to be done because the interaction of these factors with local meteorology and population distribution is highly variable and site-specific. Dispersion modeling is discussed in section I of the General Guidance for Preparing Risk Reduction Plans. Enter any options you will consider on Worksheet 9.

If the district completes your risk assessment as part of an industrywide risk assessment, you may wish to compare your facility to the 'typical' facility used to prepare the risk assessment. If the pollutant is emitted at your facility in a significantly different way than from the typical case, a facility-specific risk assessment might yield a different result. Contact the district for information on the assumptions used in the industrywide risk assessment for comparison with your facility. The General Guidance for Preparing Risk Reduction Plans document gives a general overview of the effect of various modeling parameters.

Your answers to the following questions may generate some other options for consideration. These options are applicable to a specific emission point, or to the facility as a whole.

## Instructions for generating additional options to reduce risk

1. Is the emission point a stack?
  - Yes, continue
  - No, go to question 2
    - a. Is the stack outlet vertically oriented?
      - Yes, continue
      - No, consider changing the direction of your stack outlet to increase dispersion and reduce risk.
    - b. Does the stack have a "rain hat" or some other device that would impede upward movement of the exhaust?
      - Yes, consider removing it.
      - No, continue.
    - c. Is the stack height consistent with good engineering practices (GEP)? (see discussion of rules for good engineering practice stack heights in the General Guidance for Preparing Risk Reduction Plans).
      - Yes, go to the section on receptors.
      - No, consider increasing the stack height, then go to the section on receptors.
2. Is the emission point a building with a forced air exhaust?
  - Yes, consider one of the following:
    - putting an emission control device on the vent.
    - collecting the emissions from specific processes and conveying them to a stack rather than allowing them to mingle with the general building air.
    - increasing collection efficiency if emitting processes are currently vented by an emission collection system.
    - changing the height or location of the release point to increase dispersion of the pollutants (For more information on dispersion modeling, please see the discussion in the General Guidance for Preparing Risk Reduction Plans).
  - No, continue
3. Is the emission point a building without forced air ventilation?
  - Yes, consider one of the following:
    - adding ventilation -- this may result in risk reduction depending on vent orientation and air velocity (For more information on dispersion modeling, please see the discussion in the General Guidance for Preparing Risk Reduction Plans).
    - collecting emissions from specific processes and conveying them to a stack.
    - increasing collection efficiency if emitting processes are already vented by an emission collection system.
    - changing the height or location of the release point to increase dispersion of the pollutants (for more information on dispersion modeling, please see the discussion in the General Guidance for Preparing Risk Reduction Plans).
  - No, continue.
4. Is this emission point an area source? (Examples include a materials pile, a pond, an unenclosed process or a group of small point sources, a device, a conveyor, or a similar open area.)
  - Yes, consider the following:
    - enclosing the area.
    - covering the area.
    - screening the area to reduce air movement.
    - using dust suppressants.
    - reducing physical disturbances (e.g., restricting traffic).
  - No, consult your district for suggestions with regard to this emission point.

Distance to the receptors

A number of factors affect the extent to which facility emissions can result in public exposure. One of them is the distance the pollutant travels before it reaches a receptor (a person breathing the pollutants). The greater the distance, the more dilution can occur. Moving the emission point or establishing a buffer zone around the facility to increase the distance may reduce the public exposure to the emissions. The district may require that additional modeling studies be performed to determine whether this reduces the facility risk. You can use Worksheet 8 to develop options related to changing the distance between the emission points and the receptors.

**Worksheet 8: Distance to the receptors**

Instructions

1. Examine the map in your risk assessment that shows risk isopleths. Using the line that corresponds to the significance level, identify the distances and directions where the significant risk area extends beyond the facility fence line. Enter this information below.

Distance	Direction

2. Can the emission point be moved so that the area in which significant concentrations are found is within the fence line?  
 No, continue  
 Yes, enter this option on Worksheet 9. (Moving an emission point nearer to a building or hill may result in downwash and increase the exposure. See the discussion of downwash and good engineering practices for stack heights in the General Guidance for Preparing Risk Reduction Plans.)
3. Can the fence line be expanded to include the entire area over which significant concentrations are found?  
 No, continue to Step 3.  
 Yes, enter this option on Worksheet 9.

### **Step 3: Which of the options will work for me?**

The intent of this step is to evaluate those risk reduction options you have identified, and to choose measures to include in the plan. The factors to consider for each measure are the amount or degree of risk reduction, the time it will take to implement, and the cost. There may be a single option that is adequate, or you may need to consider various combinations of options.

Worksheet 9 should now contain a set of options that will reduce the risk. Once you have estimated the amount of risk reduction you can get from each of these options, you can decide which you want to evaluate further in the context of an overall plan. If you find that the plan doesn't meet your risk reduction goals, you can go back to this list and select additional options to include in the plan. Each option you choose to implement becomes a measure in the plan.

**Worksheet 9: Evaluation of preliminary risk reduction options**

List options developed in the facility audit. (use additional sheets if needed)

---

---

---

---

---

---

---

---

---

---

---

1. Eliminate any options that reduce emissions not included in your risk assessment. Some emission estimation techniques (such as the mass balance method) may include many small sources that were not quantified individually. If you have identified additional or previously unknown toxic emissions, please contact the district for instructions about updating your emission inventory and risk assessment.
  
2. Are there any technical or economic considerations that would make any of the options infeasible?  
 Yes, If you are unable to meet the risk reduction goals within five years, you will need to enter the rejected option(s) on Part 3 of the risk reduction plan along with the reason for rejecting the option.  
 No, continue.

How do I figure risk reductions for the options?

The risk or hazard reductions for each option will depend on the effectiveness of the option, and the pollutants it affects. If the option results in a change to any stack parameter (e.g. stack height, gas temperature, or gas velocity), revised modeling will likely be required to evaluate the risk reduction. However, you can use Worksheets 10 and 11 to evaluate the emission reduction(s) and determine whether to do the revised modeling based on the emission reductions. Worksheet 10 explains how to evaluate risk reductions achievable from process-based options. Use one copy for each option. Worksheet 11 explains how to evaluate risk reductions from collection and control options. Use one copy for each option. If you need help evaluating other types of options, Appendix F contains instructions or you may need to consult the district. Ultimately, the district must approve your estimates of risk reduced.

Worksheet 12 provides a format for comparing the risk reduction from individual options.

**Worksheet 10: Risk reduction from a process change**

<p>1. Will this option reduce all the pollutants from this process to the same extent?</p> <p><input type="checkbox"/> Yes, continue.</p> <p><input type="checkbox"/> No, use Appendix D to evaluate risk reductions for this option.</p> <p>2. Will this option result in an increase in the emissions of any toxic pollutant, or emission of any new toxic pollutant (e.g.. due to substitution)?</p> <p><input type="checkbox"/> Yes, use Appendix D to evaluate risk reductions for this option.</p> <p><input type="checkbox"/> No, continue.</p> <p>3. Do you know the removal efficiency (percent removed) for this option?</p> <p><input type="checkbox"/> Yes, multiply the fraction of the risk from this process by the removal efficiency to calculate the risk or hazard reduction. Complete a copy of Worksheet 12 for this option if it affects more than one of the health effects of concern.</p> <p><input type="checkbox"/> No, use Appendix D to evaluate risk reductions for this option.</p>
--

**Worksheet 11: Risk reductions from collection and control options**

1. Will this option reduce all the pollutants from this process by the same percentage?  
 Yes, continue.  
 No, use Appendix E to evaluate risk reductions for this option.
2. Will this option result in the transfer of any toxic pollutant from one emission point to another?  
 Yes, use Appendix E to evaluate risk reductions for this option.  
 No, continue.
3. Does the process or emission point currently have emission control equipment?  
 Yes, use Appendix E to evaluate risk reductions for this option.  
 No, continue.
4. Will the option result in any new or increased emissions of pollutants with toxic effects?  
 Yes, use Appendix E to evaluate risk reductions for this option.  
 No, continue.
5. Do you know the removal efficiency (percent removed) for this option?  
 Yes, multiply the fraction of the risk from this process by the removal efficiency to calculate the fractional reduction. Complete a copy of Worksheet 12 for this option.  
 No, use Appendix E to evaluate risk reductions for this option.

## Worksheet 12: Option evaluation

### Instructions for Worksheet 12

1. In column A, enter the health effects affected by this option.
2. Subtract the entry in column C from the entry in column B and enter the result in column D.
3. If the entry in column D is negative, this is a net increase in risk for this health effect.
4. If the entry in column D is positive, this is a net decrease in risk for this health effect.
5. If the measure results in any new risks, enter the new risks below.
6. To evaluate the option, you can compare the overall fractional reductions to your risk reduction goals (from Worksheet 2). For fractional increases, multiply the initial facility risk by the value of the fractional increase, add the result to the initial risk, and compare the result to the significant risk level.
7. Compare new risks to the significance level.

**Option** \_\_\_\_\_ **Process** \_\_\_\_\_ **Emission point** \_\_\_\_\_

A. Health effect*	B. Fractional reduction	C. Fractional increase	D. Overall fractional reduction or increase

\* Cancer, non-cancer chronic (with toxicological endpoints), acute non-cancer (with toxicological endpoints)

### Increases in risk

New health effect	New risk



The risk reduction for a plan will be the sum of the risk reductions (and increases, if applicable) for each option unless the plan contains two or more risk reduction measures that act sequentially on the same pollutant-process-emission point. As you start to develop your plan, you need to consider the long term costs and benefits of the choices. Whether you develop several tentative plans and compare them to choose the best, or approach the process by starting with the best option(s), and adding more options as needed to meet the risk reduction goals, you should consider a pollution prevention approach whenever you can. Pollution prevention may appear more difficult to implement than “end of pipe” control technology but may be more cost effective in the long term. Some pollution prevention approaches such as substitutions may result in increases in some impacts. To evaluate whether increases in risk result in risks over the significance levels, add the additional risk from individual options to the original risk unless the increase is offset by reductions from other options.

### How do I evaluate the plan?

The object of the plan evaluation process is to answer the following three questions:

1. Is the remaining risk below the significance levels for all health effects?
2. How much will it cost to implement the plan?
3. How long will it take to implement the plan?

### How do I figure whether the remaining risk is below the significance level?

If the preliminary plan consists of only one measure, the risk reduction for the plan will be the same as the risk reduction for the measure. Subtract reductions from the original risk (on Worksheet 1), add increases (from Worksheet 12) to the original risk, summarize the remaining risk on Worksheet 13 and go to the section on cost estimates.

If the plan consists of more than one measure, the risk or hazard reduction will also depend on whether any of the measures affects an emission point venting a process or a pollutant from a process that is affected by another measure. The following instructions will guide you through plan evaluation.

If the plan includes any measure(s) that affects an emission point for a process or a pollutant from a process that is also affected by another measure, use Appendix G to calculate the risk and/or hazard reduction from the plan. If not, use the following instructions to calculate the risk reduction for the plan and summarize the results on Worksheet 13.

### **Instructions for calculating risk reductions**

Note: Use Appendix G if any of the measures affect an emission point for a process or pollutant from a process that is also affected by another measure.

1. To calculate cancer risk reduction, sum the fractional reductions and fractional increases for all the measures included in the plan as listed in column D of Worksheet 12. The fractional reduction is the effectiveness of the measure times the fraction of the risk from any pollutant, process, or emission point affected by it.
2. To calculate the reduction in chronic non-cancer effects for this plan, add the fractional reductions and fractional increases for all the measures that affect the same toxicological endpoint as listed in column D of Worksheet 12. The fractional reduction is the effectiveness of the measure, times the fraction of the risk from any pollutant, process, or emission point affected by it.
3. To calculate the reduction in acute non-cancer effects for this plan, add the fractional reductions and fractional increases for all measures that affect the same toxicological endpoint as listed in column D of Worksheet 12. The fractional reduction is the effectiveness of the measure, times the fraction of the risk from any pollutant, process, or emission point affected by it.

How do I estimate the cost to implement the plan?

The following chart gives cost elements to consider when evaluating the plan(s). Enter the result of this analysis on Worksheet 13.

<b>If implementing the measure involves:</b>	<b>Consider these cost factors:</b>
equipment purchase and installation.	<ul style="list-style-type: none"> <li>* the cost of purchase and installation, including any site preparation and financing,</li> <li>* the salvage value of equipment being replaced,</li> <li>* the cost of obtaining a permit for the equipment,</li> <li>* the remaining useful life of the equipment being replaced, and</li> <li>* operation and maintenance.</li> </ul>
changes in operation and maintenance procedures.	* incremental increases or decreases over current costs.
changes in quantity or type of materials used.	* incremental increases or decreases over the current cost of materials.
a change in the pollutant or amount of pollutant emitted.	* incremental increases or decreases in emission fees (if applicable).
a change in waste disposal practices or amounts.	* incremental increases or decreases over current waste disposal costs.
a process modification.	* the cost of product testing to validate the process change.
documentation of new or changed emission rates.	* the cost of source testing.
additional or revised dispersion modeling.	* additional modeling costs.
new or revised permits from the air district, cities, or other agencies such as water and sewer districts.	* costs for obtaining the necessary permits.
establishing a buffer zone.	<ul style="list-style-type: none"> <li>* acquiring additional property (if necessary), and</li> <li>* additional property taxes.</li> </ul>
moving a stack or changing the emission release parameters (including installing a bigger air mover).	<ul style="list-style-type: none"> <li>* obtaining a revised permit from the district,</li> <li>* equipment and/or construction costs, and</li> <li>* revised dispersion modeling.</li> </ul>
building covers or enclosures to reduce fugitive emissions.	* construction materials and labor.

How do I figure how long it will take to implement the plan?

The following factors may affect the time it takes to implement a plan. If possible, identify intermediate steps for each measure; for instance, the date you will apply for a permit, the date you will install equipment or complete process changes (if applicable), and dates for demonstrating the effectiveness of the risk reduction measure(s). Enter the result of this analysis on Worksheet 13.

- \* The availability of capital.
- \* The time needed to test a new process or new production equipment.
- \* The time needed to obtain permits or approval for permit modifications.
- \* The time to complete source testing, if needed.
- \* The time needed to buy and/or install new equipment or property.

**Worksheet 13: Plan summary**

<b>Risk summary</b>				
<b>A</b> <b>Health effect</b>	<b>B</b> <b>Overall fractional risk reduction (or increase)</b>	<b>C</b> <b>Initial facility risk</b>	<b>D</b> <b>Remaining risk or new risk</b>	<b>E</b> <b>Measure(s)</b>

1. List all health effects affected by this plan.
2. List the total risk reduction or increase the plan is expected to achieve for each health effect (as calculated using the instructions for calculating risk reduction or the instructions in Appendix G).
3. List new risks in column D.
4. Subtract the risk reduction from 1 (or 100%) and multiply by the original facility risk for the health effect. Enter the result in column D.
5. Multiply the absolute value of the fractional risk increases by the initial facility risk and add the resulting risk increases to the original risk for each health effect.
6. Compare the remaining risk or new risks in column D with the significance level(s) to determine whether the plan complies with SB 1731.

<b>Summary of measures and resources needed</b>		
<b>Risk Reduction Measure</b>	<b>Implementation cost</b>	<b>Implementation time</b>

The next step is filling out the plan to file with the district. The following pages contain forms and instructions.

## **Step 4: How do I write the risk reduction plan?**

The following pages are forms you can fill out and forward to the district as your plan, if acceptable by the district. Answer the following questions to determine which forms to include. Complete the forms on the following pages and file them with attachments as noted on the forms. (Check with the district before you use these forms because some district requirements may vary.)

The plan must be reviewed and certified as meeting the requirements of Chapter 6 (commencing with section 44390), Part 6, of Division 26 of the Health and Safety Code. This certification must be made by one of the following:

- \* an engineer who is registered as a professional engineer in accordance with Section 6762 of the Business and Professions Code,
- \* an individual who is responsible for the processes and operations of the site, or
- \* an environmental assessor registered pursuant to Section 25570.3.

### **QUESTION 1.**

Does this risk reduction plan result in a residual risk below the significant risk level?

- Yes, continue to Question 2.
- No, continue to Question 3.

### **QUESTION 2.**

Can this plan be implemented within five years of the date it is filed with the district?

- Yes, complete Parts 1 and 2 of the Risk Reduction Plan (Include Part 3 if the district policy/rule requires you to consider all available risk reduction measures)
- No, complete Parts 1, 2, and 3 of the Risk Reduction Plan. If district policy/rule allows an extension, continue to Question 3. Otherwise, contact the district for guidance.

### **QUESTION 3.**

Can this plan be implemented within ten years of the date it is filed with the district?

- Yes, complete Parts 1, 2, 3, and 4 of the Risk Reduction Plan
- No, complete Parts 1, 2, 3, and 4 of the Risk Reduction Plan. If the analysis shows that the Risk Reduction Plan cannot achieve the significant risk level within ten years, contact the district for guidance.

# RISK REDUCTION PLAN

## PART 1 - SUMMARY

Facility Name \_\_\_\_\_

Facility Location \_\_\_\_\_

\_\_\_\_\_

Standard Industrial Classification (SIC) Code \_\_\_\_\_

Date this plan will be fully implemented \_\_\_\_\_

Supplemental pages \_\_\_\_\_ to \_\_\_\_\_ give details of the risk reduction measures to be implemented.

Facility Status (check A or B)

- A.  This plan will reduce the risk to below the significant risk level within 5 years.
- B.  This plan will not reduce the risk to below the significant risk level within 5 years. The facility will implement all technically feasible and affordable risk reduction measures by \_\_\_\_\_ (date). These will reduce the risks to the levels shown in Worksheet 13. The facility will implement additional risk reduction measures that will result in risks below the significant risk level by \_\_\_\_\_ (date).

I certify that this plan meets the requirements of Health & Safety Code Sections 44390 - 44394.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

\_\_\_\_ Title: \_\_\_\_\_

\_\_\_\_\_

- registered professional engineer (Section 6762 Business and Professions Code)
- individual responsible for site processes and operations
- registered environmental assessor (section 25570.3 Health & Safety Code)

Attachments:

- Part 2 - Risk reduction measures to be implemented.
- Part 3 - Risk reduction measures considered and rejected.
- Part 4 - Ten year analysis.
- Worksheets 3, 4, and 13.

**PART 2 - RISK REDUCTION MEASURES TO BE IMPLEMENTED**

(Use an additional sheet for each measure)

- Five years or less compliance       Ten years or less compliance

Measure: \_\_\_\_\_

Description: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

This measure reduces the following: \_\_\_\_\_,  
(health effects)

from the following: \_\_\_\_\_.  
(process and/or emission point)

Implementation schedule:

<u>Action</u>	<u>Date</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____



**PART 3 - RISK REDUCTION OPTIONS CONSIDERED AND REJECTED**

(Use additional sheets if necessary)

- Five years or less compliance           Ten years or less compliance

Option: \_\_\_\_\_

Description: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

This option was determined to be  technically infeasible  economically impractical.

Details of analysis: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

#### PART 4 - TEN YEAR ANALYSIS

Will any of the options in PART 3 that were rejected in the five years analysis be feasible within ten years?

- Yes. Will they be sufficient to reach the risk reduction goals?
  - Yes. Complete PART 2 and check the Ten Years Compliance box.
  - No. Complete PART 3 and check the Ten Years Compliance box.
- No. Contact your district for guidance.

Please send me a copy of the General Guidance for Preparing Risk Reduction Plans at the following address:

---

---

---

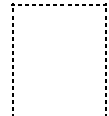
---

---

---

Fax this form to (916) 327-5621, or fold and mail it to the following address.

-----



Ms. Sonia Villalobos  
Stationary Source Division  
Air Resources Board  
P.O. Box 2815  
Sacramento, CA 95812

## APPENDIX A

### CALCULATIONS ASSOCIATED WITH THE CANCER RISK

This appendix provides supplemental information for completing the Checklist for a more complex facility to calculate how much each process or emission point contributes to the risk. It is designed to be used when one, or more than one, pollutant is emitted from more than one process or from more than one emission point. The results of this calculation are to be used in Worksheets 3 and 4 of the Checklist to prioritize the processes and emission points to help you figure out the best way to get the necessary risk reductions, and in Step 3 of the Checklist as the baseline for calculating risk reductions.

You may need to consult with the district, the ARB, or a modeling expert to complete this calculation if both of the following conditions are true.

1. There are two or more separate areas with cancer risks greater than the significant risk level.  
 True     False
2. More than one emission point was included in the risk assessment.  
 True     False

You can use Worksheet A-1 on the next page to show the fractional risk for each pollutant, process, and emission point. This information on the fractional risk from each pollutant, process and emission point is then used in Worksheets 3 and 4 of the Checklist to calculate how much of the risk comes from each process or emission point.

Complete the following calculations for cancer-causing pollutants you listed in Worksheet 2 of the Checklist. Each pollutant will fit into one of the following three groups based on the way the pollutant is emitted.

1. Pollutants that are emitted from only one emission point that vents only one process can be entered directly on Worksheet A-1. On Worksheet A-1, enter the pollutant, emission point, process, and fraction of the risk (from Worksheet 2) for each pollutant.
2. Complete Part A of this appendix for any of the pollutants that are emitted from more than one process that is vented to a single emission point.
3. For pollutants emitted from more than one emission point, you will need to complete Part B of this appendix.

When you have completed the calculations, return to Worksheet 3 or 4.

**Worksheet A-1: Fractional risk by pollutant, process, and emission point**

**Cancer risk**

Use additional copies if needed.

<b>A Pollutant</b>	<b>B Process</b>	<b>C Emission point</b>	<b>D Fractional facility risk</b>

## Part A: Pollutants emitted from multiple processes vented to a single emission point

For each pollutant that is emitted from a single emission point that vents emissions from multiple processes, complete Worksheet A-2.

When multiple processes emitting the same pollutant are vented by the same emission point, each process contributes a part of the risk. In some instances, the fractional impact of each process is directly proportional to the relative emission rates of the processes. This is a good approximation if all the processes are vented either continuously, or randomly throughout the workday. Whether this approximation accurately reflects your risk assessment will depend on how the emissions were modeled. If the emissions from each process were modeled separately, you should complete Part B of this appendix instead. (This modeling technique might be used if the emission rate, temperature, or emission velocity is different for each process or to account for meteorological conditions that routinely occur at a specific time of day.) The person that did your modeling will be able to tell you whether any emissions from this emission point were modeled with different release parameters.

**Worksheet A-2: Calculating fractional risk for a pollutant emitted from more than one process and vented to a single emission point**

**Cancer risk**

Instructions for Worksheet A-2

1. In the spaces at the top of Worksheet A-2, put the pollutant and the associated fractional risk that you calculated in Worksheet 2 of the Checklist.
2. In column A, list each process that emits this pollutant to the emission point. (Except those processes that were modeled separately, as discussed above).
3. In column B, enter the rate at which this pollutant is emitted from this process. Use the rate that was used for your risk assessment even if the emission rate has since changed.
4. In column C, enter the rate at which the pollutant is emitted from all the processes you listed. Use the same units (i.e. pounds/year or pounds/hour) for all the emission rates entered in the worksheet. This will be the same number in all rows.
5. Divide the entry in column B by the entry in column C then multiply by the fractional risk for this pollutant (from the top of the worksheet). Enter the result in column D. This is the fractional risk attributable to the pollutant and process.
6. Enter the pollutant, process, emission point, and fractional risk in Worksheet A-1.

**Emission point** \_\_\_\_\_

**Pollutant** \_\_\_\_\_ **Fractional risk (from Worksheet 2)** \_\_\_\_\_

<b>A Process</b>	<b>B Process emission rate</b>	<b>C Cumulative emission rate</b>	<b>D Fraction of facility risk</b>

## Part B: Pollutants emitted from multiple emission points

When two or more emission points emit the same pollutant, each may account for a different amount or fraction of the estimated risk. Even if they both emit the same pollutant at the same rate, the fractional risk may differ due to the dispersive characteristics of the emission release conditions. Worksheet A-3 allocates the risk to the separate emission points. The risk is directly related to the concentration of the pollutant that reaches a member of the public. The dispersion model predicts the concentration based on the release conditions and meteorology so you may need to consult with your modeler to obtain the data to complete Worksheet A-3. Fill out one copy of Worksheet A-3 for each pollutant that is emitted from more than one emission point.

If an emission point vents more than one process, each process contributes part of the risk. In most instances, the fractional impact of multiple processes vented by a single emission point is directly proportional to the relative emission rates of the processes. Use Worksheet A-4 to calculate the fractional risk for this pollutant, process, and emission point.



**Worksheet A-3: Calculating fractional risk for a pollutant emitted from one or more processes and vented to more than one emission point**

**Cancer risk**

Instructions for Worksheet A-3

Make one copy for each pollutant emitted by multiple emission points or separately modeled processes.

1. In the spaces at the top of this worksheet, enter the pollutant and the fractional risk from Worksheet 2 of the Checklist.
2. In column A, enter each emission point or process modeled like a separate emission point that emits the pollutant.
3. In column B, enter the concentration of the pollutant due to the emissions from the emission point.
4. In column C, enter the concentration of the pollutant from all the listed emission points.
5. Divide the entry in column B by the entry in column C and put the result in column D.
6. If any of the emission points vents more than one process that emits this pollutant, multiply the fraction of the risk from the top of this worksheet by column D to calculate the fractional risk for this pollutant and emission point and continue the analysis on Worksheet A-4.
7. For all others, multiply the fractional risk from the top of this worksheet by the entry in column D and enter the result in Column E.
8. Enter the pollutant, process, emission point, and fractional risk on Worksheet A-1.

**Process** \_\_\_\_\_

**Pollutant** \_\_\_\_\_ **Fractional risk (from Worksheet 2)** \_\_\_\_\_

A Emission point	B Concentration from this emission point	C Concentration from all emission points	D Contribution factor B/C	E Contribution fractional risk

**Worksheet A-4: Calculating fractional risk for a pollutant emitted from more than one process and emitted to more than one emission point**

**Cancer risk**

Instructions for Worksheet A-4

Make one copy of this worksheet for each emission point.

1. In column A, enter the fractional risk for this emission point and pollutant as calculated in step 6 of the instructions for Worksheet A-3.
2. In column B, enter each process that emits this pollutant and is vented by this emission point.
3. In column C, enter the rate at which the pollutant is emitted from each process. The emission rates entered in columns C and D must all be expressed in the same units (i.e., pounds/year or pounds/hour).
4. In column D, enter the rate at which the pollutant is emitted from all processes vented by this emission point.
5. Divide the entry in column C by the entry in column D and enter the result in column E.
6. To calculate the fractional risk due to emissions of this pollutant from this emission point and process, multiply the entry in column A by the entry in column E and enter the result in column F.
7. Enter the pollutant, process, emission point, and fractional risk on Worksheet A-1.

**Pollutant** \_\_\_\_\_ **Emission point** \_\_\_\_\_

<b>A</b> <b>Fraction of</b> <b>risk</b>	<b>B</b> <b>Process</b>	<b>C</b> <b>Process</b> <b>emission</b> <b>rate</b>	<b>D</b> <b>Cumulative</b> <b>emission</b> <b>rate</b>	<b>E</b> <b>Adjustment</b> <b>C/D</b>	<b>F</b> <b>Fractional</b> <b>risk</b> <b>A x E</b>

## APPENDIX B

### CALCULATIONS ASSOCIATED WITH CHRONIC NON-CANCER RISK

This appendix provides supplemental information for completing the Checklist for a more complex facility to calculate how much each process or emission point contributes to the risk. It is designed to be used when one, or more than one, pollutant is emitted from more than one process or from more than one emission point. The results of this calculation are to be used in Worksheets 3 and 4 of the Checklist to prioritize the processes and emission points to help you figure out the best way to get the necessary risk reductions, and in Step 3 of the Checklist as the baseline for calculating hazard reductions.

You may need to consult with the district, the ARB, or a modeling expert to complete this calculation if both of the following conditions are true.

1. There are two or more separate areas with non-cancer hazard indexes greater than the significant risk level.  
 True     False
2. More than one emission point was included in the risk assessment.  
 True     False

You can use Worksheet B-1 on the next page to show the fractional hazard for each pollutant, process, and emission point. This information on the fractional hazard from each pollutant, process and emission point is then used in Worksheets 3 and 4 of the Checklist to calculate how much of the hazard comes from each process or emission point.

Complete the following calculations for pollutants you listed in Worksheet 2 of the Checklist that cause chronic non-cancer effects. You will need to complete one set of worksheets for each toxicological end point. Each pollutant will fit into one of the following three groups based on the way the pollutant is emitted.

1. Pollutants that are emitted from only one emission point that vents only one process can be entered directly on Worksheet B-1. On Worksheet B-1, enter the pollutant, emission point, process, and fraction of the hazard (from Worksheet 2) for each pollutant.
2. Complete Part A of this appendix for any of the pollutants that are emitted from more than one process that is vented to a single emission point.
3. For pollutants emitted from more than one emission point, you will need to complete Part B of this appendix.

When you have completed the calculations, return to Worksheet 3 or 4.

**Worksheet B-1: Fractional hazard by pollutant, process, and emission point**

**Chronic non-cancer for \_\_\_\_\_ (Endpoint).**

Use additional copies if needed.

<b>A Pollutant</b>	<b>B Process</b>	<b>C Emission point</b>	<b>D Fractional facility hazard</b>

## Part A: Pollutants emitted from multiple processes vented to a single emission point

For each pollutant that is emitted from a single emission point that vents emissions from multiple processes, complete Worksheet B-2.

When multiple processes emitting the same pollutant are vented by the same emission point, each process contributes a part of the risk. In some instances, the fractional impact of each process is directly proportional to the relative emission rates of the processes. This is a good approximation if all the processes are vented either continuously, or randomly throughout the workday. Whether this approximation accurately reflects your risk assessment will depend on how the emissions were modeled. If the emissions from each process were modeled separately, you should complete Part B of this appendix instead. (This modeling technique might be used if the emission rate, temperature, or emission velocity is different for each process or to account for meteorological conditions that routinely occur at a specific time of day.) The person that did your modeling will be able to tell you whether any emissions from this emission point were modeled with different release parameters.

**Worksheet B-2: Calculating fractional risk for a pollutant emitted from more than one process and vented to a single emission point**

**Chronic non-cancer for** \_\_\_\_\_ (Endpoint).

Instructions for Worksheet B-2

1. In the spaces at the top of Worksheet B-2, put the pollutant and the associated fractional hazard that you calculated in Worksheet 2 of the Checklist.
2. In column A, list each process that emits this pollutant to the emission point. (Except those processes that were modeled separately, as discussed above).
3. In column B, enter the rate at which this pollutant is emitted from this process. Use the rate that was used for your risk assessment even if the emission rate has since changed.
4. In column C, enter the rate at which the pollutant is emitted from all the processes you listed. Use the same units (i.e. pounds/year or pounds/hour) for all the emission rates entered in the worksheet. This will be the same number in all rows.
5. Divide the entry in column B by the entry in column C then multiply by the fractional risk for this pollutant (from the top of the worksheet). Enter the result in column D. This is the fractional hazard attributable to the pollutant and process.
6. Enter the pollutant, process, emission point, and fractional hazard in Worksheet B-1.

**Emission point** \_\_\_\_\_

**Pollutant** \_\_\_\_\_ **Fractional risk (from Worksheet 2)** \_\_\_\_\_

A Process	B Process emission rate	C Cumulative emission rate	D Fraction of facility risk

## Part B: Pollutants emitted from multiple emission points

When two or more emission points emit the same pollutant, each may account for a different amount or fraction of the estimated risk. Even if they both emit the same pollutant at the same rate, the fractional risk may differ due to the dispersive characteristics of the emission release conditions. Worksheet B-3 allocates the hazard to the separate emission points. The hazard is directly related to the concentration of the pollutant that reaches a member of the public. The dispersion model predicts the concentration based on the release conditions and meteorology so you may need to consult with your modeler to obtain the data to complete Worksheet B-3. Fill out one copy of Worksheet B-3 for each pollutant that is emitted from more than one emission point.

If an emission point vents more than one process, each process contributes part of the hazard. In most instances, the fractional impact of multiple processes vented by a single emission point is directly proportional to the relative emission rates of the processes. Use Worksheet B-4 to calculate the fractional hazard for this pollutant, process, and emission point.

**Worksheet B-3: Calculating fractional risk for a pollutant emitted from one or more processes and vented to more than one emission point**

**Chronic non-cancer for** \_\_\_\_\_ (Endpoint).

Instructions for Worksheet B-3

Make one copy for each pollutant emitted by multiple emission points or separately modeled processes.

1. In the spaces at the top of this worksheet, enter the pollutant, process, and the fractional hazard from Worksheet 2 of the Checklist.
2. In column A, enter each emission point or process modeled like a separate emission point that emits the pollutant.
3. In column B, enter the concentration of the pollutant due to the emissions from the emission point.
4. In column C, enter the concentration of the pollutant from all the listed emission points.
5. Divide the entry in column B by the entry in column C and put the result in column D.
6. If any of the emission points vents more than one process that emits this pollutant, multiply the fraction of the hazard listed below by column D to calculate the fractional risk for this pollutant and emission point and continue the analysis on Worksheet B-4.
7. For all others, multiply the fractional hazard from the top of this worksheet by the entry in column D and enter the result in Column E.
8. Enter the pollutant, process, emission point, and fractional hazard on Worksheet B-1.

**Processes** \_\_\_\_\_

—  
**Pollutant** \_\_\_\_\_ **Fractional hazard (from Worksheet 2)** \_\_\_\_\_

A Emission point	B Concentration from this emission point	C Concentration from all emission points	D Contribution factor B/C	E Contribution fractional risk



**Worksheet B-4: Calculating fractional risk for a pollutant emitted from more than one process and emitted to more than one emission point**

**Chronic non-cancer for** \_\_\_\_\_ (Endpoint).

Instructions for Worksheet B-4

Make one copy of this worksheet for each emission point.

1. In column A, enter the fractional hazard for this emission point and pollutant as calculated in step 6 of the instructions for Worksheet B-3.
2. In column B, enter each process that emits this pollutant and is vented by this emission point.
3. In column C, enter the rate at which the pollutant is emitted from each process. The emission rates entered in columns C and D must all be expressed in the same units (i.e., pounds/year or pounds/hour).
4. In column D, enter the rate at which the pollutant is emitted from all processes vented by this emission point.
5. Divide the entry in column C by the entry in column D and enter the result in column E.
6. To calculate the fractional hazard due to emissions of this pollutant from this emission point and process, multiply the entry in column A by the entry in column E and enter the result in column F.
7. Enter the pollutant, process, emission point, and fractional hazard on Worksheet B-1.

**Pollutant** \_\_\_\_\_ **Emission point** \_\_\_\_\_

<b>A</b> <b>Fraction of</b> <b>hazard</b>	<b>B</b> <b>Process</b>	<b>C</b> <b>Process</b> <b>emission</b> <b>rate</b>	<b>D</b> <b>Cumulative</b> <b>emission</b> <b>rate</b>	<b>E</b> <b>Adjustment</b> <b>C/D</b>	<b>F</b> <b>Fractional</b> <b>hazard</b> <b>A x E</b>

## APPENDIX C

### CALCULATIONS ASSOCIATED WITH THE ACUTE NON-CANCER RISK

This appendix provides supplemental information for completing the Checklist for a more complex facility to calculate how much each process or emission point contributes to the risk. It is designed to be used when one, or more than one, pollutant is emitted from more than one process or from more than one emission point. The results of this calculation are to be used in Worksheets 3 and 4 of the Checklist to prioritize the processes and emission points to help you figure out the best way to get the necessary risk reductions, and in Step 3 of the Checklist as the baseline for calculating risk reductions.

You may need to consult with the district, the ARB, or a modeling expert to complete this calculation if both of the following conditions are true.

1. There are two or more separate areas with acute non-cancer hazard index greater than the significant risk level.  
 True     False
2. More than one emission point was included in the risk assessment.  
 True     False

You can use Worksheet C-1 on the next page to show the fractional hazard for each pollutant, process, and emission point. This information on the fractional hazard from each pollutant, process and emission point is then used in Worksheets 3 and 4 of the Checklist to calculate how much of the risk comes from each process or emission point.

Complete the following calculations for pollutants you listed in Worksheet 2 of the Checklist that caused acute non-cancer effects. You will need to complete one set of worksheets for each toxicological endpoint. Each pollutant will fit into one of the following three groups based on the way the pollutant is emitted.

1. Pollutants that are emitted from only one emission point that vents only one process can be entered directly on Worksheet C-1. On Worksheet C-1, enter the pollutant, emission point, process, and fraction of the hazard (from Worksheet 2) for each pollutant.
2. Complete Part A of this appendix for any of the pollutants that are emitted from more than one process that is vented to a single emission point.
3. For pollutants emitted from more than one emission point, you will need to complete Part B of this appendix.

When you have completed the calculations, return to Worksheet 3 or 4.

**Worksheet C-1: Fractional hazard by pollutant, process, and emission point**

Acute non-cancer for \_\_\_\_\_ (Endpoint).

Use additional copies if needed.

<b>A Pollutant</b>	<b>B Process</b>	<b>C Emission point</b>	<b>D Fractional facility hazard</b>

Part A: Pollutants emitted from multiple processes vented to a single emission point

For each pollutant that is emitted from a single emission point that vents emissions from multiple processes, complete Worksheet C-2.

When multiple processes emitting the same pollutant are vented by the same emission point, each process contributes a part of the risk. In most instances, the fractional impact of each process is directly proportional to the relative emission rates of the processes.

**Worksheet C-2: Calculating fractional risk for a pollutant emitted from more than one process and vented to a single emission point**

**Acute non-cancer for** \_\_\_\_\_ (Endpoint).

Instructions for Worksheet C-2

1. In the spaces at the top of Worksheet C-2, put the pollutant and the associated fractional hazard that you calculated in Worksheet 2 of the Checklist.
2. In column A, list each process that emits this pollutant to the emission point.
3. In column B, enter the rate at which this pollutant is emitted from this process. Use the rate that was used for your risk assessment even if the emission rate has since changed.
4. In column C, enter the rate at which the pollutant is emitted from all the processes you listed. Use the same units (i.e. pounds/year or pounds/hour) for all the emission rates entered in the worksheet. This will be the same number in all rows.
5. Divide the entry in column B by the entry in column C then multiply by the fractional hazard for this pollutant listed below. Enter the result in column D. This is the fractional hazard attributable to the pollutant and process.
6. Enter the pollutant, process, emission point, and fractional hazard in Worksheet C-1.

**Emission point** \_\_\_\_\_

**Pollutant** \_\_\_\_\_ **Fractional hazard (from Worksheet 2)** \_\_\_\_\_

A Process	B Process emission rate	C Cumulative emission rate	D Fraction of facility hazard

## Part B: Pollutants emitted from multiple emission points

When two or more emission points emit the same pollutant, each may account for a different amount or fraction of the estimated hazard. Even if they both emit the same pollutant at the same rate, the fractional hazard may differ due to the dispersive characteristics of the emission release conditions. Worksheet C-3 allocates the hazard to the separate emission points. The risk is directly related to the concentration of the pollutant that reaches a member of the public. The dispersion model predicts the concentration based on the release conditions and meteorology so you may need to consult with your modeler to obtain the data to complete Worksheet C-3. Fill out one copy of Worksheet C-3 for each pollutant that is emitted from more than one emission point.

If an emission point vents more than one process, each process contributes part of the hazard. In most instances, the fractional impact of multiple processes vented by a single emission point is directly proportional to the relative emission rates of the processes. Use Worksheets C-3 and C-4 to calculate the fractional hazard for this pollutant, process, and emission point.

**Worksheet C-3: Calculating fractional hazard for a pollutant emitted from one or more processes and vented to more than one emission point**

**Acute non-cancer for** \_\_\_\_\_ (Endpoint).

Instructions for Worksheet C-3

Make one copy for each pollutant emitted by multiple emission points or separately modeled processes.

1. In the spaces at the top of this worksheet, enter the pollutant and the fractional hazard from Worksheet 2 of the Checklist.
2. In column A, enter each emission point or process modeled like a separate emission point that emits the pollutant.
3. In column B, enter the concentration of the pollutant due to the emissions from the emission point.
4. In column C, enter the concentration of the pollutant from all the listed emission points.
5. Divide the entry in column B by the entry in column C and put the result in column D.
6. If any of the emission points vents more than one process that emits this pollutant, multiply the fraction of the listed below by column D to calculate the fractional hazard for this pollutant and emission point and continue the analysis on Worksheet C-4.
7. For all others, multiply the fractional hazard from the top of this worksheet by the entry in column D and enter the result in Column E.
8. Enter the pollutant, process, emission point, and fractional hazard on Worksheet C-1.

**Process** \_\_\_\_\_

**Pollutant** \_\_\_\_\_ **Fractional risk (from Worksheet 2)** \_\_\_\_\_

A Emission point	B Concentration from this emission point	C Concentration from all emission points	D Contribution factor B/C	E Contribution fractional hazard

**Worksheet C-4: Calculating fractional hazard for a pollutant emitted from more than one process and emitted to more than one emission point**

**Acute non-cancer for** \_\_\_\_\_ (Endpoint).

Instructions for Worksheet C-4

Make one copy of this worksheet for each emission point.

1. In column A, enter the fractional hazard for this emission point and pollutant as calculated in step 6 of the instructions for Worksheet C-3.
2. In column B, enter each process that emits this pollutant and is vented by this emission point.
3. In column C, enter the rate at which the pollutant is emitted from each process. The emission rates entered in columns C and D must all be expressed in the same units (i.e., pounds/year or pounds/hour).
4. In column D, enter the rate at which the pollutant is emitted from all processes vented by this emission point.
5. Divide the entry in column C by the entry in column D and enter the result in column E.
6. To calculate the fractional hazard due to emissions of this pollutant from this emission point and process, multiply the entry in column A by the entry in column E and enter the result in column F.
7. Enter the pollutant, process, emission point, and fractional hazard on Worksheet C-1.

**Pollutant** \_\_\_\_\_ **Emission point** \_\_\_\_\_

<b>A</b> <b>Fraction of</b> <b>hazard</b>	<b>B</b> <b>Process</b>	<b>C</b> <b>Process</b> <b>emission</b> <b>rate</b>	<b>D</b> <b>Cumulative</b> <b>emission</b> <b>rate</b>	<b>E</b> <b>Adjustment</b> <b>C/D</b>	<b>F</b> <b>Fractional</b> <b>hazard</b> <b>A x E</b>



## APPENDIX D

### EVALUATING RISK REDUCED BY PROCESS-BASED MEASURES

The following questions are designed to help you calculate risk reductions and increases from some common types of process-based risk reduction options. It also contains instructions for comparing pollutants with different health effects to evaluate substitutions.<sup>1</sup> You can use the worksheets and questions that follow to estimate the percent risk or hazard reduction for an individual risk reduction option. Worksheet D-1 provides a format for putting it all together.

1. Will the option reduce emissions of some pollutants from the process more than others?
  - Yes, complete one copy of Worksheet D-1 for each health effect that will be affected by this risk reduction option.
  - No, complete Worksheet D-1 using the process and fraction of risk or hazard from the process rather than the pollutant, and continue.

---

<sup>1</sup> If you are considering a risk reduction measure that involves substitution, you may need to check with the district to find out if the substance you are considering switching to has other effects of concern.

## Worksheet D-1: Risk reduction by pollutant

### Instructions for Worksheet D-1

Use one copy for each health effect.

1. Enter all pollutant/process pairs that will be affected by this option.
2. Enter the fractional reduction for each pollutant. You can use the instructions for calculating reductions on page D-3 to find the fractional reduction for some common types of process changes.
3. Enter the fraction of the risk contributed by the pollutant/process pair. You may enter "all" in the Pollutant column and use the fraction of the risk for the process if all the pollutants are affected the same.
4. Multiply the fractional reduction from column C by the fraction of risk from column B, and enter the result in column D.
5. To find the fraction of the facility risk reduced for this option and health effect, sum column D for all pollutants.
6. Enter the risk reductions (for each health effect) on Worksheet 12 of the Checklist.

Cancer

Chronic non-cancer for \_\_\_\_\_ (Endpoint)

Acute non-cancer for \_\_\_\_\_ (Endpoint) Risk reduction option \_\_\_\_\_

Emission point \_\_\_\_\_

A		B Fraction of facility risk*	C Fractional reduction	D Fraction of risk reduced
Pollutant	Process*			
<b>Total</b>				

\* From Worksheets 2, A-1, B-1, or C-1, unless all pollutants from a process are affected equally.

## Instructions for calculating reductions

You can use these instructions to estimate the fractional reduction for some common types of process-based risk reduction options. Use these estimates of fractional reduction in Worksheet D-1.

- a. Will this option eliminate the use of a pollutant from this process?
  - Yes. The fractional reduction will be 1. The reduction will be 100% of the emissions of this pollutant from this process.
  - No, continue.
  
- b. Will this option eliminate a process?
  - Yes, the fractional reduction will be 1 for all the pollutants emitted from this process.
  - No, continue.
  
- c. Will this option substitute a formulation with a lower concentration of the pollutant?
  - Yes. If there is no increase in use, the fractional reduction will be proportional to the reduction in the concentration of the pollutant. For example, if the formulation is reduced to 25 percent from 50 percent, the fractional reduction is 0.50 for this pollutant from this process.
  - No, continue.
  
- d. Is this option a change in the operating parameters of the process?
  - Yes. Source testing or re-measuring the components of your mass balance may be necessary to determine the fractional reduction of this type of change.
  - No, continue.
  
- e. Is this option a change in processing equipment?
  - Yes. Source testing or re-measuring the components of your mass balance may be necessary to determine the fractional reduction for this change. You can calculate the emission reduction if you know: 1) the emission rate of the old equipment, and 2) the emission rate of the new equipment.
  - No, continue.

2. Will this option result in new or increased emissions from this or another process or emission point?
  - Yes, continue to calculate the effect of new or increased emissions.
  - No, return to the Checklist.
  
3. Will the option result in increased emissions of any toxic pollutant currently emitted from this process?
  - Yes, use Worksheet D-2 to calculate the increased risk from increased emissions of a toxic pollutant.
  - No, continue.

**Worksheet D-2: Risk increase due to increased emissions**

Instructions for Worksheet D-2

1. Complete one copy for each pollutant and process with increased emissions.
2. Enter each health effect affected by the pollutant and the fraction of risk or hazard this pollutant contributes to each health effect (from Worksheets A-1, B-1, or C-1).
3. Divide the new emission rate by the previous emission rate and put the result in column C.
4. Multiply columns B and C. Put the result in column D. This is the fractional increase in risk due to this increase in emissions.
5. Enter the increase in column D of Worksheet D-1.

**Pollutant** \_\_\_\_\_ **Process** \_\_\_\_\_

A Health effect	B Fraction of risk*	C Emission comparison factor	D Fractional increase in risk or hazard

\* From Worksheets 2, A-1, B-1, or C-1.

4. Will this option result in the emission of any pollutants that cause cancer or non-cancer health effects and weren't previously emitted from this process (i.e. replace a toxic pollutant with another toxic pollutant)?
- Yes, continue.
  - No, go to question 12.
5. Will both the pollutant you are switching to, and the pollutant you are switching from, be emitted at the same emission point?
- Yes, continue.
  - No, in addition to calculating the difference in risk due to the different pollutant(s), there will be a difference due to the difference in emission points. You will need to do new dispersion modeling to evaluate this option. There is a discussion of the effect of emission parameters on pollutant dispersion in the General Guidance for Preparing Risk Reduction Plans.
6. Do both the pollutant you are switching to, and the pollutant you are switching from, cause cancer?
- Yes, continue.
  - No, go to question 9.
7. Is the pollutant you are switching from listed on Table D-1?
- Yes. You will need to calculate the non-inhalation risk factor before completing the toxicity comparison in Worksheet D-3. If your risk assessment shows total risk and inhalation risk for this pollutant from this emission point, divide the total risk (the sum of the inhalation and non-inhalation risk) by the inhalation risk to derive a non-inhalation risk factor. Put this factor in column A in Worksheet D-3, and continue.
  - No, continue.
8. Is the pollutant you are switching to listed on Table D-1?
- Yes, you will need to have the non-inhalation risk calculated using an appropriate model before completing the toxicity comparison in Worksheet D-3. (Models for calculating non-inhalation risk use as input the annual average concentration derived from the dispersion modeling.) Total the inhalation risk and the non-inhalation risk. Divide the total by the inhalation risk. Put this factor in the correct row of Column B in Worksheet D-3, below. Complete Worksheet D-3, and continue.
  - No, complete Worksheet D-3 and continue.

**Table D-1: Substances For Which Non-inhalation Risks Are Calculated**  
(From CAPCOA 1992 Risk Assessment Guidelines)

Arsenic	Beryllium
Cadmium	Chlorobenzene
Chlorinated dioxins & dibenzofurans	2-Chlorophenol
Hexavalent Chromium	Hexachlorobenzene
p - Dichlorobenzene	Lead
Hexachlorocyclohexanes	Nitrosamines
Mercury	Polychlorinated biphenyls (PCBs)
PAH (polycyclic aromatic hydrocarbons)	2, 4, 6-Trichlorophenol
Pentachlorophenol	2, 4, 5-Trichlorophenol

**Worksheet: D-3: Toxicity comparison for pollutants that cause cancer**

Instructions for Worksheet D-3

1. In column A, below, enter the pollutant, emission rate, unit risk factor, and non-inhalation risk factor calculated above (if applicable) for the pollutant you are switching from.
2. In column B, enter the pollutant, projected emission rate, unit risk factor, and non-inhalation risk factor (if applicable) for the pollutant you are switching to.
3. Multiply the unit risk factor, non-inhalation risk factor (if any), and emissions to calculate the toxicity factor for each column.
4. Subtract the toxicity factor in column B from the toxicity factor in column A and divide the difference by the toxicity factor in column A to calculate a fractional increase or reduction. Enter the reduction or increase on Worksheet D-1. (Note: positive numbers are reductions and negative numbers are increases).

**Process** \_\_\_\_\_ **Emission point** \_\_\_\_\_

	<b>A (from)</b>	<b>B (to)</b>
<b>Pollutant</b>		
<b>Emissions (lb/yr)</b>		
<b>Unit risk factor*</b>		
<b>Non-inhalation risk factor (if applicable)**</b>		
<b>Toxicity factor</b>		

**Fractional decrease or increase** \_\_\_\_\_

\* from the CAPCOA Risk Reduction Guidelines, district, or OEHHA

\*\* The non-inhalation risk factor will always increase the effective risk and applies only to pollutants listed on Table D-1.

9. Does the pollutant you are switching to cause cancer or non-cancer health effects?
  - Yes. When you switch from one pollutant that causes cancer or non-cancer health effects to another, they might not affect the same toxicological endpoints. Follow the instructions in Worksheet D-4 to organize the analysis.
  - No, go to question 12.

**Worksheet D-4: Comparing pollutants with different health effects**

Process \_\_\_\_\_ Emission point \_\_\_\_\_

A Health effect(s)	B From	C To	<u>Instructions</u>
cancer			<p>Put a check next to any health effect(s) caused by either the pollutant you are switching from (in column B) or the pollutant you are switching to (in column C).</p> <p>For health effects with a check in column B and not in column C, use the instructions for calculating reductions to calculate the fractional decrease. Enter it on Worksheet D-1.</p> <p>For any non-cancer health effects with a check in column C and not in column B, complete Worksheet D-5 using the instructions for calculating non-cancer hazard.</p> <p>To calculate the increase in risk from switching to a carcinogen complete Worksheet D-5 using the instructions for calculating cancer risk.</p> <p>For any non-cancer health effects with checks in both columns B and C, calculate the fractional increase and decrease, and enter both on Worksheet D-1.</p>
chronic non-cancer CV/BL			
chronic non-cancer CNS/PNS			
chronic non-cancer IMMUN			
chronic non-cancer KIDN			
chronic non-cancer GI/LV			
chronic non-cancer REPRO			
chronic non-cancer RESP			
chronic non-cancer SKIN			
acute non-cancer CV/BL			
acute non-cancer CNS/PNS			
acute non-cancer IMMUN			
acute non-cancer KIDN			
acute non-cancer GI/LV			
acute non-cancer REPRO			
acute non-cancer RESP			
acute non-cancer SKIN			



### **Instructions for calculating cancer risk**

If the carcinogen you are switching to is listed on Table D-1, you will need to calculate the noninhalation risk and add it to the risk calculated below.

1. To calculate the additional risk, you must first know the airborne concentration that would result from the emissions. You can do additional dispersion modeling or you can estimate the concentration for this emission point using the instructions for estimating concentration based on your answers to questions 10 and 11.
2. Multiply the estimated concentration by the unit risk factor for the pollutant you are switching to. Enter this in column C of Worksheet D-5.

### **Instructions for calculating non-cancer hazard**

1. Estimate the concentration for this emission point either by dispersion modeling or using the instructions for estimating concentration based on your answers to questions 10 and 11.
2. Divide the estimated concentration by the reference exposure level (REL) for the pollutant you are switching to. (If the pollutant has both chronic and acute non-cancer effects, be sure you are using the appropriate REL for the health effect)
3. Enter the increased hazard in column C of Worksheet D-5.

**Worksheet D-5: Risk increases by pollutant**

Instructions for Worksheet D-5

Use one copy for each health effect.

1. In column A, enter all pollutant/process pairs for which there will be new or increased emissions as a result of this option.
2. In column B, enter the facility risk or hazard for this health effect. If there was no previous risk or hazard for this health effect (this is a new risk), enter a 0.
3. Enter the risk calculated using either the instructions for calculating cancer risk or the instructions for calculating non-cancer hazard.
4. Divide the entry in column C by the entry in column B and enter the result in column D. If this is a new risk, write "new" in column D.
5. Enter new effects on Worksheet 12. Sum relative risk increases and enter on Worksheet 12.

Cancer

Chronic non-cancer for \_\_\_\_\_ (Endpoint)

Acute non-cancer for \_\_\_\_\_ (Endpoint)

Emission point \_\_\_\_\_ Risk reduction option \_\_\_\_\_

A		B	C	D
Pollutant	Process	Facility risk for this health effect*	Absolute risk	Fractional increase
<b>Total</b>				

\* If there was no previous facility risk (or hazard index) for this health effect, enter a 0 and list the absolute risk as new risk on Worksheet 12.

10. Do you know the airborne concentration that would result from the emissions?
- Yes, go to worksheet D-5.
  - No, continue.
11. Does one of the following conditions apply?
- a. You are estimating risk for a carcinogen and the emission point emits another pollutant that is a carcinogen or causes chronic non-cancer effects, or
  - b. You are estimating risk for a pollutant with chronic non-cancer effects and the emission point emits another pollutant that is a carcinogen or causes chronic non-cancer effects, or
  - c. You are estimating risk for a pollutant that causes acute non-cancer effects and the emission point emits another pollutant with acute non-cancer effects.
- Yes. You can use the instructions below for estimating concentration to estimate the concentration to use in Worksheet D-5.
  - No. You will need to do additional dispersion modeling to estimate a concentration to use in worksheet D-5.

#### **Instructions for estimating concentration\***

If you are using a carcinogen to estimate the concentration, divide the risk due to the emission of the pollutant from this emission point (if the carcinogen is listed on Table D-1, use the inhalation risk not the total risk) by the unit risk factor for the carcinogen. Then divide by the annual emission rate. This gives you the estimated concentration per pound emitted. The new concentration is calculated by multiplying this value by the new annual emission rate.

If you are using a pollutant that causes chronic non-cancer effects to estimate the concentration, multiply the risk due to the emission of the pollutant from this emission point by the REL for the pollutant. Then divide by the annual emission rate. This gives you the estimated concentration per pound emitted. The new concentration is calculated by multiplying this value by the new annual emission rate.

If you are using a pollutant that causes acute non-cancer effects to estimate the concentration, multiply the risk due to the emission of the pollutant from this emission point by the REL for the pollutant. Then divide by the maximum hourly emission rate. This gives you the estimated concentration per pound emitted. The new concentration is calculated by multiplying this value by the new annual emission rate.

\* This calculation is based on a linear relationship of concentration to emissions which is true if no changes have been made in the stack height or location, stack gas temperature, or flow rate.

12. Does the pollutant you are switching to cause either high-level ozone depletion or ground-

level ozone formation?

- Yes, check with the district to see if there are other regulations regarding the use of these pollutants.
- No, return to Worksheet D-1.

## APPENDIX E

### EVALUATING RISK REDUCED BY EMISSION CONTROL MEASURES

This appendix was developed to evaluate the following options:

- \* installing a collection system and/or control device on one or more processes that were not previously controlled,
- \* installing a control device on an emission point that was not previously controlled,
- \* increasing the collection efficiency of an existing collection system,
- \* increasing the control efficiency of an existing control device or system,
- \* replacing an existing emission collection system with a more efficient system,
- \* replacing an existing control device with a more efficient device, or
- \* adding another control device to the existing system.

You can use the following questions and worksheets to estimate the effectiveness of an emission control risk reduction option. If the installation or modification of the emission collection or control system will change the gas temperature or flow rate, you will need to do additional dispersion modeling to evaluate risk reduced by the option. To use these instructions to estimate the risk reduction from installing or upgrading control equipment, you will need to know the control efficiency of the new equipment and of any existing control equipment.

#### Estimating risk reductions from control equipment.

The emission reduction achieved by any emission control system depends on the removal efficiency of the control device and the collection efficiency of the emission collection system. For example, if you install a collection system that captures 90 percent of the pollutant(s) emitted and a control device that removes 99 percent of the pollutant(s) from the captured emission stream, the actual emission reduction will be around 89 percent. Ten percent will be released as fugitive emissions and about one percent from the control device stack. Because the release conditions for fugitive emissions are likely to result in higher risk per pound of emissions, fugitive emissions can represent a larger portion of the risk than of the emissions. Both collection efficiency and removal efficiency can vary from pollutant to pollutant.

Information on the projected removal efficiency of control equipment can be obtained from the equipment manufacturer, ARB, U.S. EPA, or the district. To derive an estimate of the cost and efficiency of the equipment, you will need to know the physical characteristics of the emission stream. You can use Worksheets E-1 and E-2 to calculate the net control efficiency from installation or replacement of a collection and control system. You can use Worksheet E-7 to calculate the risk from any new or increased emissions.

1. Will this risk reduction option result in a change in any of the stack parameters (stack height, location, gas temperature, or gas flow rate)?
  - Yes, new dispersion modeling will be necessary to determine the risk reduction. However, you can use the following instructions to estimate the emission reductions if there was no existing control equipment or you know the removal efficiency of the existing control equipment.
  - No. You can use the following instructions to estimate the risk reduction if there is no existing control equipment or you know the removal efficiency of the existing control equipment. If you do not know the removal efficiency of the existing equipment (for instance, if the emission estimate was based on source tests of the emission point), the estimate of emission reductions will need to be based on additional source testing.
  
2. Will this option reduce all the pollutants emitted from this emission point by the same amount (percentage)?
  - Yes, use the fraction of the risk from the emission point in Worksheet E-2.
  - No, use the fraction of the risk for each pollutant in Worksheet E-2.
  
3. Will this option result in new or increased emissions of any pollutant with toxic effects?
  - Yes. Besides calculating fractional reductions, you will need to calculate the fractional increase in risk using Worksheet E-7.
  - No, continue.

**Instructions for calculating “baseline” entries in Worksheet E-1**

The baseline is the conditions represented in the district approved risk assessment.

1. Was this process vented by an emission collection system?
  - Yes, enter the collection efficiency in the column for baseline collection efficiency for each pollutant. (Collection efficiencies for ventilation systems are given in Industrial Ventilation, a Manual of Recommended Practice, published by the American Conference of Governmental and Industrial Hygienists (ACGIH))
  - No, enter 0 in the columns for baseline collection efficiency.
2. Were the emissions from this process ducted to an air cleaner?
  - Yes, enter the removal efficiency in the column for baseline removal efficiency (Some emission estimates are based on end-of-stack tests and therefore do not include an estimate of removal efficiency. In those cases, the evaluation of percent reduction may require new source testing).
  - No, enter 0 in the column for baseline removal efficiency.

### Instructions for calculating “following implementation” entries in Worksheet E-1

1. Will a new collection system be installed for this process?
  - Yes, enter the collection efficiency in the column for collection efficiency following implementation for each pollutant and go to question 3.
  - No, continue.
2. Will the efficiency of the existing emission collection system (if any) be improved?
  - Yes, enter the new collection efficiency in the column for collection efficiency following implementation and continue.
  - No, enter the same value in the column for collection efficiency following implementation as is in the column for baseline collection efficiency and continue.
3. Will the new collection system or increased collection efficiency reduce the emissions from another emission point that was included in your risk assessment?
  - Yes, calculate the net change using Worksheet E-1, then use Worksheet D-3 to calculate the risk reduction from transferring the pollutants to this emission point.
  - No, continue
4. Will a new air cleaner be installed?
  - Yes, continue.
  - No, go to question 6.
5. If there was already an air cleaner on the emission point, will the new device be used in series with the original air cleaner (e.g. a HEPA filter after a baghouse or catalytic converter after a reclamation system)?
  - Yes, the calculation of the level of control to be expected must use the emission parameters (e.g. concentration, and/or particle size distribution) at the outlet of the previous device as the basis for estimating the removal efficiency of the subsequent device.
  - No, enter the removal efficiency of the new air cleaner in the column for removal efficiency following implementation.
6. Will the removal efficiency of the existing air cleaner be improved?
  - Yes, enter the new removal efficiency in the column for removal efficiency after implementation. (Improved operational control and maintenance practices can move the efficiency from the lower end of the ranges shown in Appendix D to the upper end as long as the device is properly sized).
  - No, enter the same thing in the column for removal efficiency following implementation as was entered in the column for baseline removal efficiency and calculate the net change using the instructions for filling out Worksheet E-1.

**Worksheet E-1: Net change from changes in collection and control equipment**

Instructions for Worksheet E-1

Make one copy for each health effect of concern and each process affected by this risk reduction option.

1. In column A, enter each pollutant that would be affected by the risk reduction option (or emission point if all pollutants are affected equally). You may exclude pollutants that do not contribute more than 1 percent each of the risk.
2. If emissions of any pollutant(s) are ducted to an existing control device, use the instructions for calculating baseline entries for Worksheet E-1 to develop entries for columns B and C, then multiply columns B and C and enter the result in column D.
3. To calculate the system efficiency expected following implementation of this option, use the instructions for calculating entries following implementation to develop entries for columns E and F then multiply columns E and F and enter the result in column G.
4. Subtract the baseline system efficiency (column D) from the system efficiency following implementation (column G) and put the result in column H.
5. Continue to Worksheet E-2.

**Cancer**

**Chronic non-cancer for** \_\_\_\_\_ (Endpoint)

**Acute non-cancer for** \_\_\_\_\_ (Endpoint)

**Emission point** \_\_\_\_\_ **Option** \_\_\_\_\_ **Process** \_\_\_\_\_

	Baseline			Following implementation			Difference
A Pollutant	B Collection efficiency	C Removal efficiency	D System efficiency	E Collection efficiency	F Removal efficiency	G System efficiency	H Net change



**Worksheet E-2: Risk reductions from collection and control equipment**

Instructions

Make one copy for each health effect.

1. Enter the pollutant(s) or emission point(s) you listed on Worksheet E-1.
2. In column B, enter the associated fraction of risk or hazard. You calculated this in Step 1 of the audit process (from Worksheet 4).
3. In column C, enter the net change calculated in Worksheet E-1.
4. Multiply columns B and C and put the result in column D. This will be the risk reduced for each pollutant (or the emission reduction if the emission release parameters are changed). If you will be shifting emissions to another emission point and the stack parameters (gas temperature or flow rate) will not be changed, go on to Worksheet E-3 on transferring pollutants to another emission point to continue the analysis.
5. Sum column D for each health effect.
6. Calculate the removal efficiency for this option (for each health effect). If no additional pollutants were moved to this emission point, this will be the sum of column D divided by the sum of column B. If pollutants were moved to this emission point, add the sum of column F from Worksheet E-3 to the sum of column J and divide by the sums of columns B from Worksheet E-2 and C from Worksheet E-3. Summarize the results on Worksheet 12 of the Checklist.

Cancer

Chronic non-cancer for \_\_\_\_\_ (Endpoint)

Acute non-cancer for \_\_\_\_\_ (Endpoint)

Emission point \_\_\_\_\_ Option \_\_\_\_\_ Process \_\_\_\_\_

A Pollutant (or emission point)	B Fraction of risk	C Net change*	D Fraction of risk reduced**

\* from Worksheet E-1

\*\* if emission release parameters are not changed

**Worksheet E-3: Risk reduction from pollutant transfer**

Instructions for Worksheet E-3

Make one copy for each health effect.

1. List all pollutants that will be moved from one emission point to another.
2. In column B, enter the associated fraction of risk from step 1 of the audit process.
3. Multiply the collection efficiency of the system that will be used to move the pollutant(s) by the fraction of risk in column B. Enter the result in column C.
4. Calculate the dispersion comparison factor using the instructions for comparing dispersion between two existing emission points. If the dispersion comparison factor is greater than one, moving these pollutants will result in an increase in risk. This can be offset if additional control equipment will be installed on the emission point.
5. If you answered “yes” to question 2, return to Appendix D and complete the analysis using the dispersion comparison factor.
6. If new or improved control equipment is to be installed, transfer the net change from column I of Worksheet E-1 to column E.
7. Multiply columns C, D, and E and put the result in column F. Sum column F for each health effect. If this option also involves installing new or improved control equipment, add the sum of column F to the sum of column D in Worksheet E-2 and the sum of column C to the sum of column B in Worksheet E-2 and complete step 6 of the instructions for Worksheet E-2. Otherwise, calculate the removal efficiency for this option (for each health effect) by dividing the sum of column F by the sum of column B. Summarize the results on Worksheet 12 of the Checklist.

Cancer

Chronic non-cancer for \_\_\_\_\_ (Endpoint)

Acute non-cancer for \_\_\_\_\_ (Endpoint)

<b>A</b> <b>Pollutant</b>	<b>B</b> <b>Fraction of risk</b>	<b>C</b> <b>Fraction transferred</b>	<b>D</b> <b>Dispersion comparison</b>	<b>E</b> <b>Net control efficiency</b>	<b>F</b> <b>Risk reduction*</b>

\* If the sum of column F is larger than the sum of column B, this is an increase in risk. Subtract the increase from the sum of column D on Worksheet E-2.

## Instructions for comparing dispersion between two existing emission points

If you can not use these instructions to calculate a dispersion comparison factor, you will need to get revised dispersion modeling to evaluate this option.

The reduction due to the fraction transferred must be adjusted to account for the differences between the two emission points. Under some conditions, you may be able to calculate the change in impact due to the differences in emission release parameters without doing additional modeling.

You can compare the dispersion for two existing emission points to evaluate the effect of moving a pollutant from one emission point to another under the following conditions:

- \* both emission points emit a pollutant with acute non cancer effects. (Use this factor only to evaluate the effect of moving a pollutants with acute non-cancer effects from one emission point to another.), or
- \* both emission points emit a pollutant with chronic non-cancer effects or a carcinogen not listed on Table D-1. (If a carcinogen is listed in Table D-1 you can complete the comparison if you use inhalation risk rather than total risk from the pollutant.)

First, calculate a dispersion factor for each emission point. Worksheet E-4 is for calculating a dispersion factor using a carcinogen. Worksheet E-5 is for calculating a dispersion factor using a pollutant with chronic non-cancer effects. Worksheet E-6 is for calculating a dispersion factor using a pollutant with acute non-cancer effects.

Divide the dispersion factor for the emission point the pollutant will be moved to by the dispersion factor for the emission point the pollutants will be moved from to calculate a comparison factor for Column D of Worksheet E-3. (You can not compare factors for pollutants with acute non-cancer effects with factors for pollutants with chronic non-cancer effects or carcinogens). If the comparison factor calculated above is greater than one the pollutant will cause a greater risk at this emission point.

### Worksheet E-4: Calculating a dispersion factor from cancer risk

List Risk (inhalation) \_\_\_\_\_.  
List Pounds per year emitted \_\_\_\_\_.  
List unit risk factor \_\_\_\_\_.

1. Divide the risk by the pounds per year emitted.
2. Divide the result from step 1 by the unit risk factor.

**Worksheet E-5: Calculating a dispersion factor using chronic non-cancer effects**

List fraction of hazard _____.
List pounds per year emitted _____.
List reference exposure level _____.
1. Divide the hazard by the pounds per year emitted.
2. Multiply the result of step 1 by the reference exposure level.

**Worksheet E-6: Calculating a dispersion factor using acute non-cancer effects**

List fractional hazard _____.
List pounds per hour emitted (Max.) _____.
List reference exposure level (for acute effects) _____.
1. Divide the fractional hazard by the pounds per hour emitted.
2. Multiply the result by the reference exposure level.

- 4. Will this option result in increased emissions of a toxic pollutant?
  - Yes, complete worksheet E-7 using the instructions for calculating risk increases due to increased emissions.
  - No, continue.
  
- 5. Will this option result in emissions of a new pollutant (one that was not previously emitted?)
  - Yes, complete Worksheet E-7 using the instructions for calculating cancer risk or the instructions for calculating non-cancer hazard.
  - No, continue.
  
- 6. Will this option result in new or increased emissions of a pollutant that causes either high-level ozone depletion or ground-level ozone formation?
  - Yes, check with the district to see if there are other regulations regarding the use of these pollutants.
  - No, continue.

**Worksheet E-7: Risk increases by pollutant**

Instructions for Worksheet E-7

Use one copy for each health effect.

1. In column A, enter all pollutant/process pairs for which there will be new or increased emissions as a result of this option.
2. In column B, enter the facility risk or hazard for this health effect. If there was no previous risk or hazard for this health effect (this is a new risk), enter a 0.
3. Enter the risk calculated using either the instructions for calculating cancer risk or the instructions for calculating non-cancer hazard.
4. Divide the entry in column C by the entry in column B and enter the result in column D. If this is a new risk, write "new" in column D.
5. Enter new effects on Worksheet 12. Sum relative risk increases and enter on Worksheet 12.

Cancer

Chronic non-cancer for \_\_\_\_\_ (Endpoint)

Acute non-cancer for \_\_\_\_\_ (Endpoint)

Emission point \_\_\_\_\_ Risk reduction option \_\_\_\_\_

A		B	C	D
Pollutant	Process	Facility risk for this health effect*	Absolute risk	Fractional increase
<b>Total</b>				

\* If there was no previous facility risk (or hazard index) for this health effect, enter a 0 and list the absolute risk as new risk on Worksheet 12.

### **Instructions for calculating cancer risk**

If the new pollutant is listed on Table D-1, you will need to calculate the noninhalation risk and add it to the risk calculated below.

1. To calculate the additional risk, you must first know the airborne concentration that would result from the emissions. You can do additional dispersion modeling or you can estimate the concentration for this emission point using the instructions for estimating concentration based on your answers to questions 7 and 8.
2. Multiply the estimated concentration by the unit risk factor for the pollutant you are switching to. Enter this in column C of Worksheet E-7.

### **Instructions for calculating non-cancer hazard**

1. Estimate the concentration for this emission point either by dispersion modeling or using the instructions for estimating concentration based on your answers to questions 7 and 8.
4. Divide the estimated concentration by the reference exposure level (REL) for the pollutant you are switching to. (If the pollutant has both chronic and acute non-cancer effects, be sure you are using the appropriate REL for the health effect)
3. Enter the increased hazard in column C of Worksheet D-5.

### **Instructions for calculating risk increases due to increased emissions**

1. Calculate the new risk by dividing the new emission rate by the previous emission rate then multiply the result by the risk for the pollutant, process, and emission point.
2. Subtract the original risk from the new risk calculated in step 1. This is the absolute risk to be entered in column C of Worksheet E-7

7. Do you know the airborne concentration that would result from the emissions?
- Yes, go to worksheet E-7.
  - No, continue.
8. Does one of the following conditions apply?
- a. You are estimating risk for a carcinogen and the emission point emits another pollutant that is a carcinogen or causes chronic non-cancer effects, or
  - b. You are estimating risk for a pollutant with chronic non-cancer effects and the emission point emits another pollutant that is a carcinogen or causes chronic non-cancer effects, or
  - c. You are estimating risk for a pollutant that causes acute non-cancer effects and the emission point emits another pollutant with acute non-cancer effects.
- Yes. You can use the instructions below for estimating concentration to estimate the concentration to use in Worksheet E-7.
  - No. You will need to do additional dispersion modeling to estimate a concentration to use in Worksheet E-7.

**Instructions for estimating concentration\***

If you are using a carcinogen to estimate the concentration, divide the risk due to the emission of the pollutant from this emission point (if the carcinogen is listed on Table D-I, use the inhalation risk not the total risk) by the unit risk factor for the carcinogen. Then divide by the annual emission rate. This gives you the estimated concentration per pound emitted. The new concentration is calculated by multiplying this value by the new annual emission rate.

If you are using a pollutant that causes chronic non-cancer effects to estimate the concentration, multiply the risk due to the emission of the pollutant from this emission point by the REL for the pollutant. Then divide by the annual emission rate. This gives you the estimated concentration per pound emitted. The new concentration is calculated by multiplying this value by the new annual emission rate.

If you are using a pollutant that causes acute non-cancer effects to estimate the concentration, multiply the risk due to the emission of the pollutant from this emission point by the REL for the pollutant. Then divide by the maximum hourly emission rate. This gives you the estimated concentration per pound emitted. The new concentration is calculated by multiplying this value by the new annual emission rate.

\* This calculation is based on a linear relationship of concentration to emissions which is true if no changes have been made in the stack height or location, stack gas temperature, or flow rate.

## APPENDIX F

### EVALUATING RISK REDUCED BY OTHER MEASURES

Two of the three types of risk reduction measures reduce risks by reducing emissions. This section discusses other risk reduction approaches. Some can reduce the public exposure to the existing level of emissions. In some cases, increasing the stack height, gas velocity, temperature, or the distance between the emission point and the receptors, or changing the relationship between the stack and the surrounding buildings will reduce the estimate of risk. Evaluating these options will likely require some amount of dispersion modeling because the interaction of these factors with local meteorology and population distribution is site-specific. Dispersion modeling is discussed in section I of the General Guidance for Preparing Risk Reduction Plans.

#### Release conditions

Any risk reduction option that changes the emission release conditions will have to be evaluated on the basis of revised dispersion modeling. Because the interaction of release conditions and local meteorological conditions is so complex, it is not possible to make generalizations with any acceptable degree of accuracy.

Federal law does not allow credit for the use of dispersion methods in establishing emission limitations for Prevention of Significant Deterioration (PSD), or New Source Prevention Standards (NSPS) regulations, or to avoid exceedances of the National Ambient Air Quality Standards (NAAQS). Among the prohibited activities are stack heights over the Good Engineering Practices (GEP) stack height. The GEP stack height regulation allows credit for stack heights up to 65 meters above ground level. Taller stacks must be justified based on a formula that takes into account surrounding structures and terrain or modeling studies.

#### Receptors

The effect of a risk reduction measure that changes the location of an emission release point with respect to the receptors may be estimated under certain conditions. It must not change the relationship to buildings or hills to the extent that it introduces the possibility of downwash. (See the General Guidance for Preparing Risk Reduction Plans for a discussion of downwash). It may not change the stack height, or stack gas temperature or velocity. If the change meets these limitations, shifting the stack will shift the area of impact an equal amount.



Increasing the distance from the emission point to the receptors without moving the emission point (establishing a buffer zone) can be evaluated on the basis of the existing dispersion modeling. To figure out how large a buffer you would need, plot the modeled receptors on a map and note the calculated risk at each point that is over the significance level then draw a line enclosing all areas with significant risks.

### Area Sources

You can reduce the risk from area sources by enclosing the area, covering the area, screening the area to reduce air movement, using dust suppressants, or reducing physical disturbances (e.g., restricting traffic). These do not fit easily into the other two categories. It is difficult to measure the effect of these risk reduction measures. However, the magnitude of the risk from these emissions is directly related to the associated release conditions. Generally these measures will produce small emission reductions (5 to 50 percent) but may result in large risk reductions because of the disproportionate impact ground level release can have on receptors.

## APPENDIX G

### EVALUATING PLANS WITH MULTIPLE OPTIONS THAT AFFECT THE SAME POLLUTANTS, PROCESSES, OR EMISSION POINTS

The risk reduction from a plan will not be the sum of the risk reduction from the measures included if two or more of the measures affect the same pollutant or the process from which it is emitted or the emission point at which it is released to the air. That is because the analysis of risk reduced for individual options uses the initial risk as the baseline from which the risk reduction is calculated. When that baseline is changed by a risk reduction measure, the risk reduction from subsequent measures that affect the same pollutant, process, or emission point is reduced. Risk reduction options that affect a sequence of pollutant/process/emission point must be evaluated in the following order: first, process-based measures; second, emission control measures; third, “other” measures.

The following questions and worksheets will allow you to account for these effects and calculate the net risk reduction for use in Worksheet 13 of the Checklist. Worksheet G-1 provides a format for estimating the overall risk reduction when some pollutants or processes are affected by more than one option and other pollutants or processes are affected by only one option.

1. Do all of the measures that affect a sequence of pollutant/process/emission point affect all of the pollutant(s) from the process(es) equally?
  - Yes, use the process and the fraction of the risk from the process as the starting point for the analysis in Worksheet G-2.
  - No, use the pollutant and the fraction of the risk from the pollutant as the starting point for the analysis in Worksheet G-2. You may need to complete separate copies of Worksheet G-2 for each pollutant.

**Worksheet G-1: Plan evaluation**

Instructions

1. Enter each measure that does not affect a sequence of pollutant/process/emission point, the pollutants and processes it affects, and the fraction of the risk reduced by the measure.
2. Enter each set of measures evaluated on Worksheet G-2 as part of a set of overlapping measures, the pollutants and/or processes affected, and the fraction of the risk reduced.
3. Enter any measures that affect other pollutants or processes that were not included in the evaluation of its effect on the sequence of pollutant, process and emission point. The fraction of risk reduced must exclude the portion of the risk included in the evaluation on Worksheet G-2.
4. Sum the fraction of the risk reduced. Subtract risk increases listed on Worksheet 12 of the Checklist. Enter the results on Worksheet 13 of the Checklist.

**Cancer**

**Chronic non-cancer for** \_\_\_\_\_ (Endpoint)

**Acute non-cancer for** \_\_\_\_\_ (Endpoint)

Measure	Affected pollutant/process	Fraction of the risk reduced	Evaluated as part of sequence?	
			Yes	No

**Worksheet G-2: Evaluation of overlapping options**

Instructions

1. In column A, enter the first of the control options that will affect this pollutant/process. (Be sure to evaluate them in order, i.e. process changes, control equipment, other).
2. In column B, enter the beginning fraction of the risk for this pollutant/process/emission point (from step 1).
3. In column C, enter the estimated removal efficiency (from Worksheet 12) expected from this option.
4. Multiply column C by column B and enter the result in column D.
5. Subtract column D from column B and enter the remainder in column E.
6. Transfer the remainder from column E to the next line of column B.
7. Enter the next measure that will affect this pollutant/process/emission point sequence and repeat steps 3-6 until all measures in this plan that affect this pollutant/process/emission point have been evaluated.
8. Sum the entries in column D to determine the risk reduction for these measures. Enter the result in the appropriate place in Worksheet G-1.

**Cancer**

**Chronic non-cancer for** \_\_\_\_\_ (Endpoint)

**Acute non-cancer for** \_\_\_\_\_ (Endpoint)

A Control option	B Fraction of risk	C Percent reduction	D Fraction of the risk reduced	E Remaining risk

Total \_\_\_\_\_