

# Fact Sheet

## HUMAN HEALTH RISK ASSESSMENT

### For The Pueblo Chemical-Agent Destruction Pilot Plant At Pueblo Chemical Depot, Colorado August 2004



Colorado Department  
of Public Health  
and Environment

#### **Background**

In July 2004, the Colorado Department of Public Health and Environment issued the first phase of a Research Development and Demonstration Hazardous Waste Permit to the Army and Bechtel National, Incorporated. The first phase of the Permit allows initial construction of the Pueblo Chemical Agent-Destruction Pilot Plant.

The Pilot Plant is being built under a Research Development and Demonstration Permit to allow for design, construction, systemization and pilot testing of the process that will destroy the stockpile of chemical weapons currently stored at the Pueblo Chemical Depot near Pueblo, Colorado.

The weapons destruction process at the Pilot Plant will neutralize mustard chemical agent contained in the weapons. After neutralization, the remaining breakdown products of the mustard agent will be further destroyed, or biodegraded by microorganisms in a process similar to that used to treat domestic or industrial wastewater.

The weapons and associated waste generated during the destruction process at the Pilot Plant are considered hazardous wastes. The final permit for the facility will contain conditions for management of hazardous waste at the Pilot Plant in accordance with the

Colorado Hazardous Waste Regulations. These conditions must be specified before any hazardous waste is treated or stored at the facility.

The Multi-Pathway Health Risk Assessment will evaluate health and environmental concerns related to emissions from the Pilot Plant hazardous waste treatment operations.

**A Multi-Pathway Health Risk Assessment** refers to a type of human health risk assessment that considers Exposure to chemicals through both:

- Direct exposure pathways (e.g. through inhalation of chemicals that may be released from a particular facility), and
- Indirect exposure pathways (e.g. as a result of consuming agricultural products that may be impacted by chemicals released from a particular facility).

The state health department will use the Multi-Pathway Health Risk Assessment as a tool to assist in developing permit conditions necessary for ensuring that the facility will be designed and operated in a manner protective of public health.

#### **What is Human Health Risk?**

Human health risk refers to the increased chance or possibility that an individual's health may be affected by exposure to chemicals in the environment.

#### **What is a Human Health Risk Assessment?**

A human health risk assessment is a process to systematically evaluate the human health risk posed by the emission of chemicals from a particular facility.

1. Computer modeling (Chemical Fate and Transport) is used in the risk assessment to evaluate how chemicals may behave in the environment, and
2. Human and animal toxicity studies and biological models are used to help estimate what their potential effects may be on human health.

The type and severity of potential health effects an individual may experience from exposure to a certain chemical depends on the type of chemical, its toxicity, the amount of chemical (the dose), and the duration of chemical exposure.

## ***How is a Human Health Risk Assessment done?***

Human health risk assessment is generally performed in a four-step process. The steps of the process include:

1. Hazard Identification,
2. Exposure Assessment,
3. Toxicity Assessment, and
4. Risk Characterization.

**1. Hazard identification** – The initial step of a risk assessment in which:

- a. Emission sources are identified, and
- b. Maximum emission rates for chemicals of potential concern are estimated.

### **What Are Chemicals Of Potential Concern?**

Chemicals of potential concern are substances that may be emitted from a particular facility and that may affect people or the environment in a negative way.

For facilities employing new or innovative processes, emissions must be estimated until actual emission data for facility sources has been obtained.

**2. Exposure Assessment** - The second step of a risk assessment that evaluates the ways humans can be exposed to chemicals. The exposure assessment is based on:

- a. Current and future land use,
- b. Types of populations that could live and/or work around a particular facility,
- c. Exposure pathways - the way chemicals enter the human body,
- d. Duration of exposure, and

- e. Concentration of chemicals in the environment including the air, water, soil, vegetables/fruits, poultry, meat, pork, and milk).

**Air dispersion modeling** is employed to:

- a. Determine the theoretical location of the reasonably maximum exposed individual. The reasonably maximum exposed individual is considered to reside at the location where emissions from the facility would most likely be inhaled and deposited.
- b. Estimate the amount of emissions the reasonably maximum exposed individual may receive.

### **What is an Exposure Pathway?**

Exposure pathways generally consider:

1. Where a chemical may exist in the environment, and
2. How humans may come in contact with the chemical.

A chemical may move from an emission source into the air, water and/or soil. Humans might eat foods, drink liquids, and/or breathe air that contains the substance. Additionally, humans may come into direct contact with the chemical and experience penetration of the chemical through the skin.

**3. Toxicity assessment** – The third step of a risk assessment that evaluates the type of health effects (cancer and noncancer) that may result from exposure to individual and/or multiple chemicals that may

be released from a particular facility.

Toxicity assessment is performed through extensive review of chemical-specific dose/response relationships. These relationships are based on human population exposure studies and/or experimental animal studies. In general, toxicity values derived by the EPA are used in the assessment.

**4. Risk characterization** – The final step of a risk assessment that estimates human health risk in terms of cancer and any other systemic effects (not related to cancer). Cancer risks are estimated as a probability, or chance, that a person would develop cancer over a lifetime as a result of exposure to emissions from a facility. Non-cancer effects are estimated by comparing emissions to acceptable dose levels.

### **How Much Risk Is “Acceptable?”**

People make judgments about how much risk from various sources is acceptable in our lives. Peoples’ perceptions of risk are often influenced by personal experience and other factors, such as fairness, morality, and control.

We are surrounded by sources of risk:

- risks we choose to take, like driving or smoking, are deemed voluntary risks, and
- risks that we cannot control, like from a hazardous waste processing facility, are deemed involuntary risks.

Voluntary risks are generally more acceptable than risks caused by factors outside of our control.

Some people believe that no level of health risk is acceptable if it comes from a source outside of their control. However, it is seldom technically or economically possible to eliminate all risk.

The regulatory standard for risk posed by emissions that may be generated by the Pilot Plant is described under the Colorado Hazardous Waste Regulations (please see 6 CCR 1007-3, Section 264.342(a)) available on web at: <http://www.cdphe.state.co.us/op/reports/hazwaste/10073264hazwastetsdfpartb.pdf>.

The standard applies to the estimated risk posed by human exposure to both cancer and non-cancer causing chemicals that may be emitted from the Pilot Plant as estimated by a Multi-Pathway Health Risk Assessment approved by the state health department.

### ***What are the benefits of completing a Human Health Risk Assessment?***

Completion of a human health risk assessment is beneficial in evaluating emissions from a facility because it:

- Helps to identify chemical emissions that have the potential to cause adverse health effects.
- Helps to define acceptable chemical emission rates.
- Identifies human receptor locations that may result in a greater potential for risk due to environmental transport of emissions from the facility.
- Identifies potential exposure pathways.

- Estimates risks from exposure to multiple chemicals.
- Considers sub-populations (e.g. children) that may be more susceptible to risk.
- Estimates human exposure level separately for each exposure pathway.

### ***What are some Limitations of Human Health Risk Assessment?***

Human health risk assessment is not an exact science without limitations. A human health risk assessment is limited because:

- Uncertainty exists in the risk assessment methodology.
- Risk assessment cannot be used to determine whether specific individuals will experience an adverse effect.
- Risk assessment cannot identify particular individuals likely to experience health problems due to emissions exposure.

To mitigate these limitations risks are often conservatively over-estimated in a human health risk assessment.

#### **Why Can't a Risk Assessment Estimate a Specific Individual's Risk to an Emission Source?**

Risk assessment focuses on the estimation of risk based on reasonable maximum exposure. Actual effects may vary from one individual to another individual based on factors such as lifestyle. Toxicity effects in humans can vary due to the individuals' nutritional status, family traits, or state of health.

### ***How Will the Results of the Multi-Pathway Health Risk Assessment be used in the Permitting Process for the Pueblo Chemical Agent-Destruction Pilot Plant?***

The state health department will use the Multi-Pathway Health Risk Assessment to evaluate health risk that may be associated with chemicals of potential concern that might be emitted during pilot-testing, operations and closure from the Pueblo Chemical Agent-Destruction Pilot Plant.

The results of the Multi-Pathway Health Risk Assessment will help determine whether the Pilot Plant process will be protective of human health.

Plans for the Pilot Plant must demonstrate that the facility will be designed and operated in a manner that limits exposure to emissions that may be generated by the facility to levels that do not pose an unacceptable risk to human health.

The state health department will use the Multi-Pathway Health Risk Assessment to develop, define, and justify hazardous waste permit conditions that may be necessary to ensure that the Pilot Plant will be designed, constructed, and operated in compliance with the Colorado Hazardous Waste Regulations.

Specifically, the Multi-Pathway Health Risk Assessment is one of the tools that the state health department will use to:

1. Establish operating conditions and stack emission limits in the hazardous waste permit, and (Continue to Page 5)

## *How Is Local Agriculture Considered?*

Agricultural producers often raise concern about the potential for contamination of crops and livestock as a result of chemicals being released into the air from a facility. The Multi-Pathway Health Risk Assessment evaluates the potential risk associated with the consumption of crops and livestock that may come in contact with emissions.

Some chemicals emitted into the air can be taken up by crops and transferred to other food (through the food-chain), leading to an uptake of chemicals in food for humans and feed for livestock.

The Multi-Pathway Health Risk Assessment can evaluate the potential human uptake of chemicals including any uptake related to the ingestion of chemicals through consumption of agricultural products.

Multi-Pathway Health Risk Assessments are typically used to initially determine if agricultural products may be significantly impacted as a result of facility emissions. The impact to agricultural products resulting from a facility's emissions is considered significant if consumption of the agricultural products would result in an unacceptable health risk to humans.

A Multi-Pathway Health Risk Assessment uses both health protective default assumptions and site-specific data to evaluate health risks. Default assumptions are typically more protective than actual conditions.

For example, the Multi-Pathway Health Risk Assessment that will be completed for the Pilot Plant will estimate the risk posed by ingestion of agricultural products that have been grown or raised in the path of the facility emissions near the facility fence line. The following conservative exposure scenarios will be evaluated:

- **Subsistence Farmer** – Assumes that an individual (as a child and adult) resides at the location receiving the maximum facility emissions and that the individual will consume beef, poultry, pork, eggs, milk, and fruits and vegetables that have been raised in the impacted area. The Multi-Pathway Health Risk Assessment assumes that the individual will receive emissions directly (through inhalation) for the operating duration of the facility and indirectly (through ingestions) for a period of 40 years.
- **Subsistence Fisher** – The Multi-Pathway Health Risk Assessment will consider an individual that may also consume fish that may be raised in the impacted area for a period of 30 years.

The level of chemical contamination of crops, feed, and livestock will be estimated by applying biological uptake models developed and approved by EPA.

If a Multi-Pathway Health Risk Assessment indicates that the impact to agricultural products exposed to a particular facility's emissions are unacceptable, then further evaluation of the impact to agricultural products and the associated health risk may be warranted. For example, a site-specific survey may be needed to determine the amount of locally grown food items consumed.

- If the results of the Multi-Pathway Health Risk Assessment indicate that emissions from a particular facility will not pose an increased health risk, then
- It can also be assumed that agricultural products considered in the risk assessment will not be negatively impacted as a result of emissions from a particular facility, and
- Risks to human health from consumption of those products will not be negatively impacted.

2. Facilitate environmental monitoring once the technology is shown to be protective of human health.

In addition, once the Multi-Pathway Health Risk Assessment has estimated risk to human health, the most significant risks will be addressed to ensure that the risk is adequately managed.

***What is the Process for Completing the Pueblo Chemical Agent-Destruction Pilot Plant Multi-Pathway Health Risk Assessment?***

Currently, the Phase I Research Development and Demonstration Hazardous Waste Permit for the Pilot Plant requires the Army and Bechtel National, Inc. to submit a draft Multi-Pathway Health Risk Assessment protocol for state health department approval with the planned Phase II Permit Modification Request.

The Multi-Pathway Health Risk Assessment protocol will define the means for completing the Multi-Pathway Health Risk Assessment for the Pilot Plant in detail. The state health department will review the draft protocol upon receipt. Modification or amendment of the draft protocol may be necessary to refine the protocol or information related to the Pilot Plant engineering design before state health department approval.

Requests for modification of the protocol or additional information will be described in correspondence letters that will become part of the administrative record for the Pilot Plant Permit. The administrative record for the Pilot Plant Permit will be available for public review.

Once acceptable, the state health department will approve the protocol for use in permitting the

Pilot Plant operation. A process flow chart that defines the Multi-Pathway Health Risk Assessment process for the Pilot Plant is attached to this fact sheet. The process flow chart also specifies opportunities for public input on the development of the Multi-Pathway Health Risk Assessment protocol.

The Colorado Department of Public Health and Environment plans on providing education and soliciting input on the Multi-Pathway Health Risk Assessment protocol from the public at the Citizen Advisory Commission Permitting Working Group Meetings. The public is also encouraged to provide input on the Pueblo Chemical-Agent Pilot Plant Multi-Pathway Health Risk Assessment Protocol to the Colorado Department of Public Health and Environment or the permit applicants.

***For more information about the Risk Assessment process, or the permitting process for the Pueblo Chemical Agent-Destruction Pilot Plant, please call or write:***

Jeannine Natterman, Public Information Officer  
Colorado Department of Public Health and Environment  
Hazardous Materials and Waste Management Division  
4300 Cherry Creek Drive South  
Denver, CO 80246-1530  
Toll Free: 1 (888) 569-1831, extension 3303  
Email: [Jeannine.Natterman@state.co.us](mailto:Jeannine.Natterman@state.co.us)

To view the Administrative Record on the Web, Please go to:  
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