



## Project Background

In parts of Auburn and Algonia, groundwater– the water that flows under the ground through the soil – is contaminated with a degreaser called trichloroethene (TCE) and its breakdown products. It is believed that the chemicals originated from the Boeing Auburn facility.

The contaminated groundwater (called a plume) flows north and northwest away from the Boeing property into portions of southwest Auburn and northeast Algonia. To date, the chemicals found are at low levels that are not expected to pose a risk to human health and the environment. If chemicals are found to be an immediate risk, Ecology will direct Boeing to implement interim actions to reduce risk.

## What Is Trichloroethene (TCE)?

- An industrial degreaser, which was once used at the Boeing Auburn Fabrication Site.
- A volatile organic compound (VOC), also found in common household products like paints, glues, spot removers and pepper spray.
- Able to break down into other chemicals, such as vinyl chloride (VC) and less toxic by-products.

## What Can You Do To Stay Involved?

- Join our list serve by emailing the inbox: [BoeingAuburnSite@ecy.wa.gov](mailto:BoeingAuburnSite@ecy.wa.gov)
- Participate in public comment periods
- Call our hotline: (253) 219-7645
- Visit Ecology's website: [www.ecy.wa.gov/programs/hwtr/cleanupSites/boeing-fabn/index.html](http://www.ecy.wa.gov/programs/hwtr/cleanupSites/boeing-fabn/index.html)



# Antecedentes del Sitio

En áreas de Auburn y Algona, el agua subterránea—el agua que fluye bajo la superficie a través del suelo—está contaminada con un tipo de desengrasador llamado tricloroetileno (TCE, por sus siglas en inglés) y sus productos de degradación. Se sospecha que éstos químicos se originaron en las facilidades de Boeing en Auburn. El agua contaminada (masa de agua contaminada) fluye hacia el norte y noroeste alejándose de la propiedad de Boeing hacia las áreas del suroeste de Auburn y el noreste de Algona. Hasta el día de hoy, los químicos se encuentran en concentraciones bajas de las cuales no se esperan riesgos para la salud humana o al medio ambiente. Si se determina que éstos químicos presentan un riesgo inmediato, Ecología le ordenará a Boeing que implemente una acción provisional para reducir el riesgo. El Departamento de Ecología (Ecología) está supervisando la investigación de la contaminación conducida por la Compañía Boeing y cotejará y seleccionará el plan de limpieza.



## La Investigación Correctiva

El agua contaminada (masa de agua contaminada) fluye hacia el norte y noroeste alejándose de la propiedad de Boeing hacia las áreas del suroeste de Auburn y el noreste de Algona. La Investigación Correctiva es necesaria para entender el origen o la fuente y la extensión de la contaminación en el sitio.

Los químicos pueden entrar al cuerpo de tres maneras:

**Respirando**

**Tocando**

**Tragando**

A esto se le llama exposición. Hasta el día de hoy, las muestras ambientales que se han tomado demuestran que la exposición a los químicos fugados es muy baja.

### Para más información

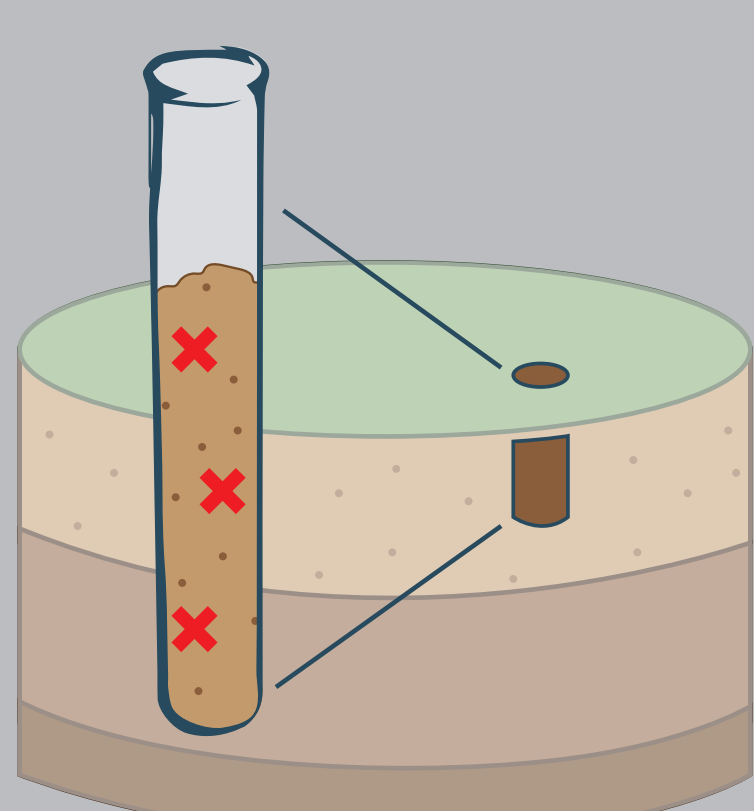
- Llame a nuestra línea directa: (253) 219-7645
- Envíenos un correo electrónico: [BoeingAuburnSite@ecy.wa.gov](mailto:BoeingAuburnSite@ecy.wa.gov)
- Visite nuestro sitio web: [Bit.ly/EcyBoeingAuburn](https://bit.ly/EcyBoeingAuburn)



# The Cleanup Process – Why Is This Taking So Long?

Boeing's cleanup must follow the Washington State Model Toxics Control Act (MTCA) cleanup regulations. This requires a robust investigation of the contamination and potential cleanup options. Currently, the project is in the Remedial Investigation phase.

## Remedial Investigation



A Remedial Investigation defines the nature, extent, and magnitude of pollution at a site in order to identify the best method for cleanup.

## Interim Action

If the contaminants are found to pose a risk to human health or the environment, Ecology will direct Boeing to take immediate action to reduce this risk. **This happened on the Boeing property in 2004, when an Interim Action was taken to contain a known source for the plume.** Since that time, chemicals found have been at low levels and not expected to pose a risk to human health or the environment.



## Feasibility Study



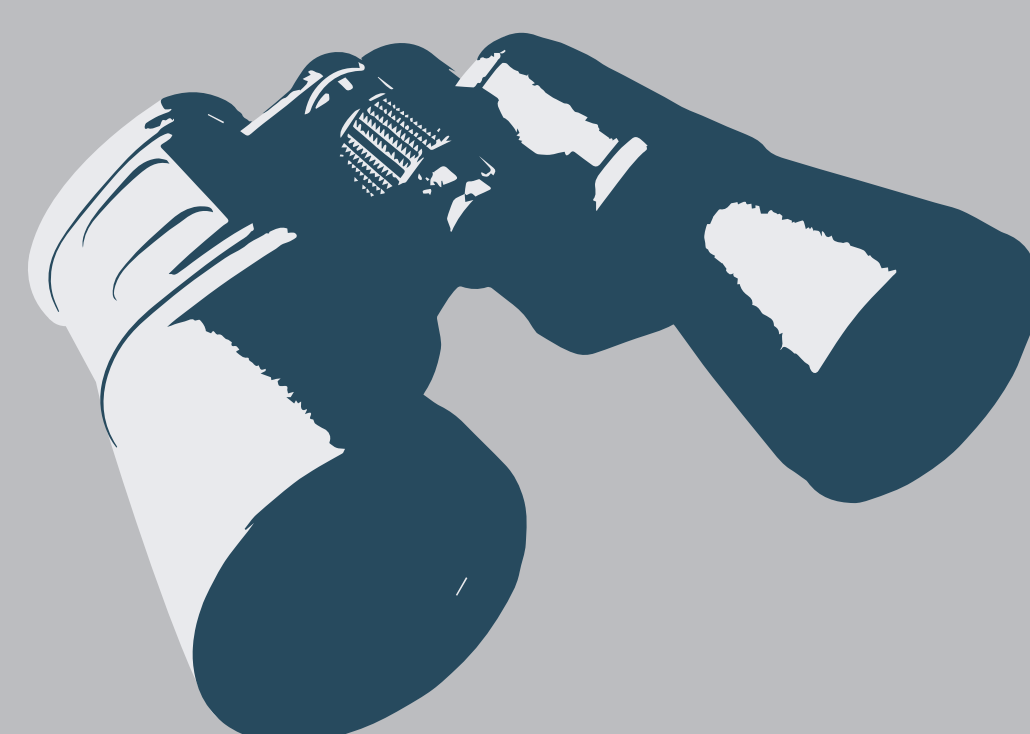
The Feasibility Study takes the information from the Remedial Investigation to identify and evaluate cleanup alternatives. Then an optimal alternative will be selected and incorporated into the Cleanup Action Plan.

## Cleanup Action Plan



The Cleanup Action Plan specifies cleanup standards, methods, and schedule, describes the steps to be taken, and includes any additional environmental monitoring required during and after the cleanup.

## Cleanup & Monitoring



Implementation of the Cleanup Action Plan includes design, construction, operations and monitoring.

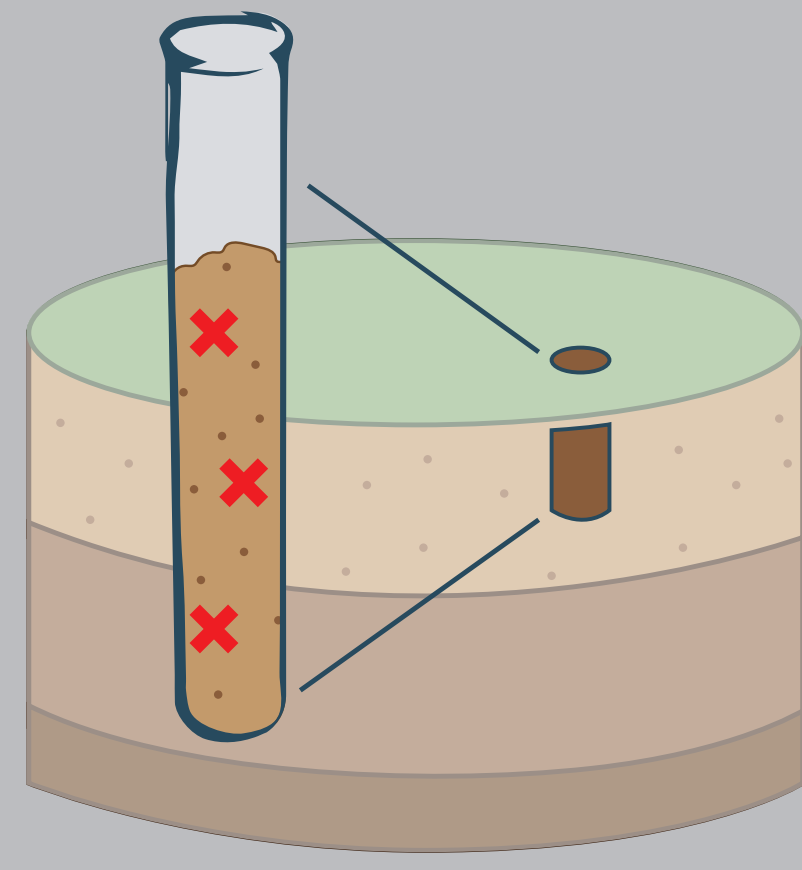
- Opportunities for public comment  
Ecology encourages feedback from the community. Public comment periods are held at key points throughout the cleanup process.



# El proceso de limpieza

La limpieza que Boeing realizará tendrá que seguir las leyes de limpieza de la Ley Modelo para el Control de Sustancias Tóxicas (MTCA, por sus siglas en inglés). En la actualidad, el proyecto se encuentra en la fase de Investigación Correctiva.

## Investigación Correctiva



Una Investigación Correctiva define la naturaleza, la extensión, y la magnitud de la contaminación en un sitio para así determinar el mejor método de limpieza.

## Acción Provisional

Pare si se determina que los contaminantes presentan un riesgo a la salud humana o al medio ambiente, Ecología le ordenará a Boeing a que implemente una acción inmediata para reducir el riesgo. **Esto pasó en la propiedad de Boeing en el 2004 cuando se condujo una acción provisional para contener una fuente conocida de contaminantes a la masa de agua contaminada.** Desde entonces, los químicos se encuentran en concentraciones bajas de las cuales no se esperan riesgos para la salud humana o al medio ambiente.



## Estudio de Viabilidad



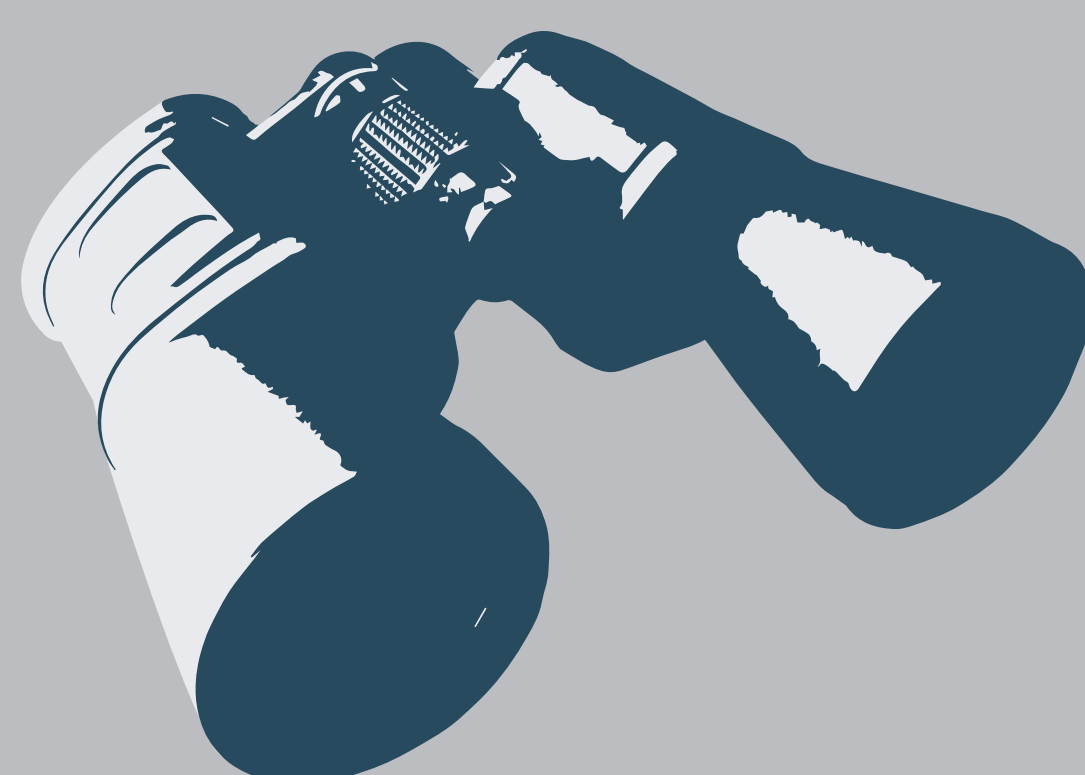
El Estudio de Viabilidad utiliza la información de la Investigación Correctiva para identificar y evaluar las alternativas de limpieza. Así, la alternativa óptima será seleccionada e incorporada en el Plan de Acción para la Limpieza.

## Plan de Limpieza



El Plan de Acción para la Limpieza especifica las normas de limpieza, los métodos y el calendario, describe los pasos a seguir, e incluye cualquier monitoreo adicional que sea requerido durante y luego de la limpieza.

## Limpieza y monitoreo



La implementación del Plan de Acción para la Limpieza incluye diseño, construcción, operación y monitoreo.

 Oportunidades para comentario público

## ¿Qué está siendo investigado?

### Agua subterránea

Una extensa red de pozos se han instalado a través del sitio para monitorear la localización y concentraciones de los contaminantes a través del tiempo. El Departamento de la salud monitorea los suministros de agua potable con regularidad, los cuales están localizados a una distancia segura de la contaminación.

### Agua Superficial

Muestras de agua son tomadas de zanjas y patios para determinar si los químicos están presentes.

### Calidad del aire

El aire interior y el aire sobre aguas superficiales son analizadas para determinar si los químicos se pasan del agua subterránea al aire como vapor.\*



## Is The Drinking Water Safe?

**YES!** Public drinking water is regularly monitored by the Washington Department of Health. Ecology continues to evaluate the boundaries of the contaminated groundwater and has determined that it is a safe distance from the cities' water supplies and is not affecting the drinking water.

Private wells are not monitored like public drinking water. Please call Ecology if you have a private well.



## Can You Eat Vegetables And Fruits From Your Garden?

**YES!** Studies have been done on gardens sites with higher levels of the chemicals found at the Boeing site. Those studies suggest fruit and vegetables from gardens using well or groundwater containing these chemicals are safe for adults and children. The chemicals do not build up in the plant or fruit tissue.



## Are Your Pets At Risk?

Ecology compared the results of samples taken from surface water in Algona to a study conducted by the National Park Service on impacts of TCE on wildlife. None of the samples Ecology evaluated are high enough to harm wildlife or domestic pets.





# Who is responsible for the cleanup?

## Department of Ecology

Directs site investigations, cleanup planning, and cleanup implementation

## Boeing

Conducts and pays for the site investigations and cleanup as the Potentially Liable Party

## State and Federal Health Agencies

Identify potential health risks related to the site and make recommendations to reduce those risks

## Stakeholders (local governments, residents and business owners)

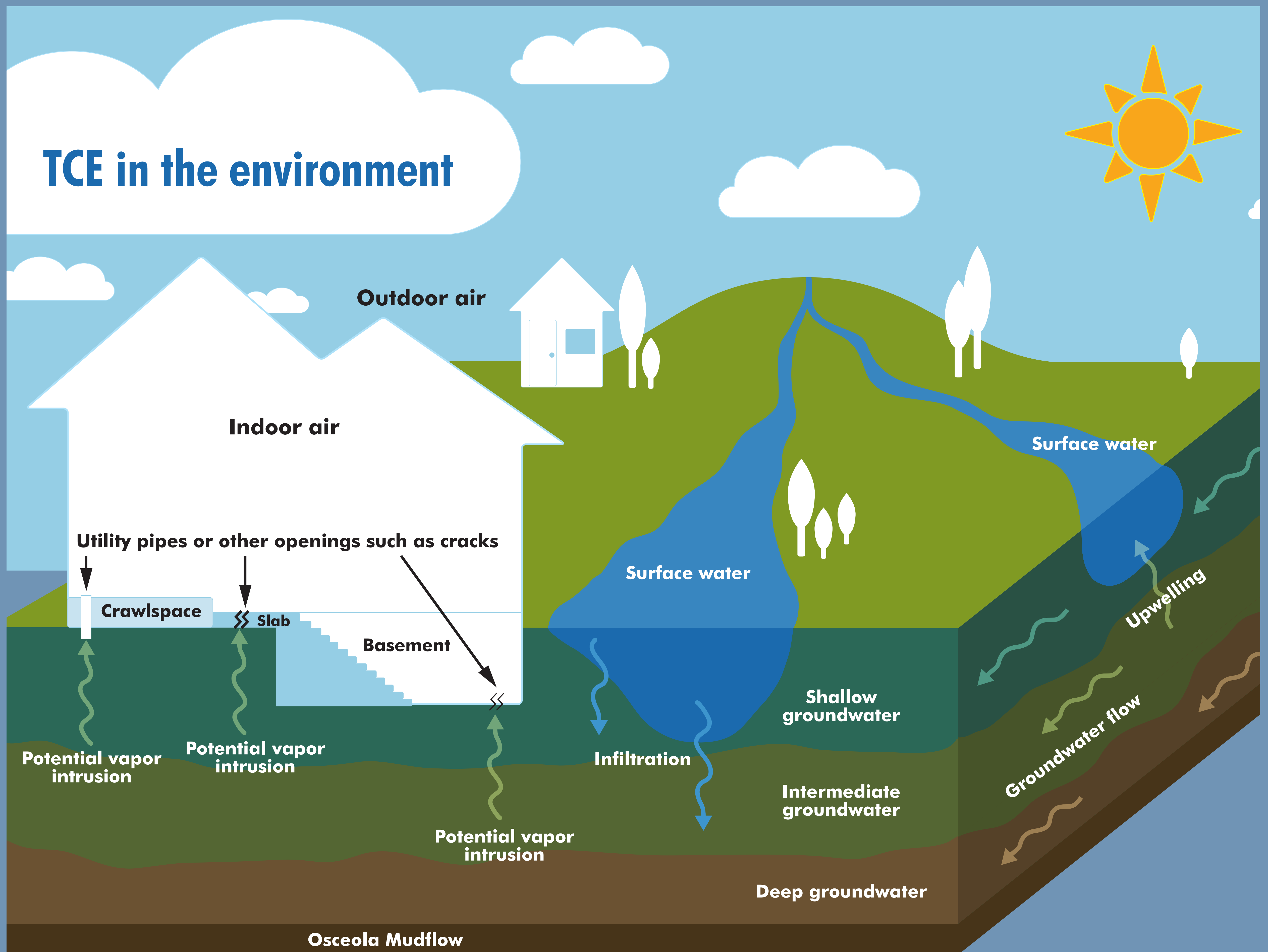
Provide valuable input on cleanup planning, including public comment at key decision points





# How Is This Being Investigated?

- Groundwater monitoring wells
- Surface water samples
- Air quality testing



How TCE can move through groundwater, surface water and air.

## The Remedial Investigation

To date, the chemicals found are at low levels that are not expected to pose a risk to human health and the environment. If chemicals are found to be an immediate risk, Ecology will direct Boeing to implement interim actions to reduce risk.

**Chemicals can enter the body three ways:**

Breathing

Touching

Swallowing

This is referred to as exposure. To date, the environmental samples collected have demonstrated that human exposure to the chemicals released is very low.





## Why is there a cleanup level?

- One of the goals of site cleanup is returning the land or water to beneficial use and preventing the migration of contaminants.
- A cleanup level is a concentration in soil, ground water, surface water, or air that the State of Washington has determined is protective of human health and the environment.
- Washington's Model Toxics Control Act (MTCA) defines how an environmental cleanup proceeds and what the cleanup levels will be.

## How are Cleanup Levels set?

Cleanup levels are calculated differently depending on whether:

- a chemical is cancer-causing or not.
- the level is applied to groundwater, surface water, air, or soil.
- the site will be used primarily for industrial, commercial, or residential purposes.



# How will the contamination be cleaned up?

Potential cleanup technologies will be evaluated as part of the Feasibility Study, and the Cleanup Action Plan will implement one or a combination of several cleanup technologies.

There are a number of different technologies used for cleaning up contaminated groundwater. Some potential treatment technology options are listed in the table below. These are general options that may or may not be feasible or beneficial at the Boeing Auburn site.

Technology	What it does
<b>Pump and treat</b>	Pump out the contaminated ground water, clean it, and return the clean water to the ground
<b>Vapor extraction</b>	Extract contaminated soil vapors from the ground, remove the contaminants, and release the clean air
<b>Air sparging</b>	Push clean air into the ground to replace contaminated soil vapors <ul style="list-style-type: none"> <li>• Can be used with vapor extraction</li> </ul>
<b>Soil flushing</b>	Inject a combination of water, solvents, or surfactants to the soil to dissolve and wash away the contamination
<b>Soil heating</b>	Heat the ground to either vaporize the chemicals off the soil or degrade them in place <ul style="list-style-type: none"> <li>• Can be used with vapor extraction</li> </ul>
<b>Bioremediation</b>	Use bacteria (microorganisms) to degrade the chemicals <ul style="list-style-type: none"> <li>• <b>Aerobic:</b> use bacteria that need oxygen to work</li> <li>• <b>Anaerobic:</b> use bacteria that don't need oxygen</li> <li>• <b>Enhanced:</b> add food for the bacteria to help them work harder</li> <li>• <b>Constructed wetland:</b> Create an ecosystem where the bacteria can live and degrade chemicals in the water that passes through</li> </ul>
<b>Monitored natural attenuation</b>	Monitor soil or groundwater concentrations to ensure they are degrading at an appropriate rate under natural conditions
<b>Chemical treatment in place (in situ)</b>	Inject reactive chemicals into the soil or ground water to degrade the contamination by processes similar to burning or forming rust <ul style="list-style-type: none"> <li>• <b>Oxidative:</b> add a chemical that releases electrons</li> <li>• <b>Reductive:</b> add a chemical that uses electrons</li> </ul>
<b>Treatment wall or permeable reactive barrier</b>	Construct a porous wall in the ground that allows the ground water to pass through but catches the contaminants



# Bioremediation Pilot Study

In summer 2015, Boeing and its contractor performed a bioremediation pilot study under the direction of Ecology to determine if this previously successful method might be effective for cleaning up the contaminated groundwater in Algona and Auburn.

## Study Process

- During the study, technicians injected a non-toxic, food-grade solution into the groundwater wells located in northeastern Algona (see map).
- This technology, called bioremediation, has worked in situations where concentrations of TCE and its breakdown products were at higher levels than what is in the groundwater under Algona and Auburn.
- Boeing used this technology to clean up a contaminated source area on its property during the 2004-2005 Interim Action.
- The results of the pilot study will help Ecology evaluate whether the technique is effective when the chemicals present in the groundwater plume are at lower concentrations.



## What is Bioremediation?

- Bioremediation is the use of microbes to clean up contaminated soil or groundwater. Microbes are very small organisms, such as bacteria, that live naturally in the environment.
- Some types of microbes are able to digest contaminants, changing them into breakdown chemicals. Some of the breakdown chemicals are also toxic, but eventually all of the chemicals are reduced to water and carbon dioxide.
- Bioremediation stimulates the growth of certain microbes that use contaminants as a source of food and energy.
- For bioremediation to be effective, the right temperature, nutrients, and food must be present.





## Remedial Investigation

The Remedial Investigation (RI) identifies the boundaries of the plume and the potential impacts of the contamination by evaluating data from groundwater, surface water, and air samples. The RI must provide sufficient data in order to propose effective cleanup actions as part of the feasibility study.

### What type of information is included in the RI?

- The boundaries of the contaminated groundwater plume
- The locations, concentrations, and depths of chemicals and breakdown products in soil, groundwater, and air
- An evaluation of the potential pathways for human exposure to the chemicals
- Results of investigations at the Boeing property
- A detailed description of the locations requiring cleanup

### What public feedback is useful for the Draft RI Report?

- Additional information about where contaminants could have migrated
- Other ways people could come into contact with the contamination
- Other possible contaminant releases on the Boeing property that have not been investigated yet





## Feasibility Study

The Feasibility Study (FS) identifies solutions for cleanup or remediation of impacted areas.

### What type of information is included in the FS?

- A detailed comparison of the potential cleanup or remediation solutions, including:
  - Evaluating the technology's feasibility
  - Cost
  - Likelihood of success
  - Timeline for implementation
- Cleanup levels for air, surface water, groundwater, and soil

### What public feedback is useful for FS planning?

- Your ideas about how cleanup or remediation activities could affect you and your neighborhood
- Feedback on cleanup solutions that you support or don't support
- Factors that could prevent a cleanup solution from working





## Cleanup Action Plan

The Cleanup Action Plan (CAP) identifies the chosen cleanup solution and develops the plan to implement that solution. It is based on information and technical analyses generated during the RI/FS with regard to public comments and community concerns. A draft of the CAP is made available for public review and comment before finalizing.

### What type of information is included in the CAP?

- A detailed description of the chosen cleanup solution
- How the solution will be implemented
- A cleanup schedule
- Previous case studies

### What public feedback is useful at the CAP phase?

- Level of support for the chosen cleanup solution
- Impacts of the chosen cleanup or remediation on your neighborhood
- Factors that could prevent the chosen solution from working