

# The case-study of Cogoleto National Priority List Site (Chromium VI contamination)

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## Overview

1. Hystorical Background
2. Contamination
3. Chromium VI Contamination: Health Effects

## Cogoleto NPL site location

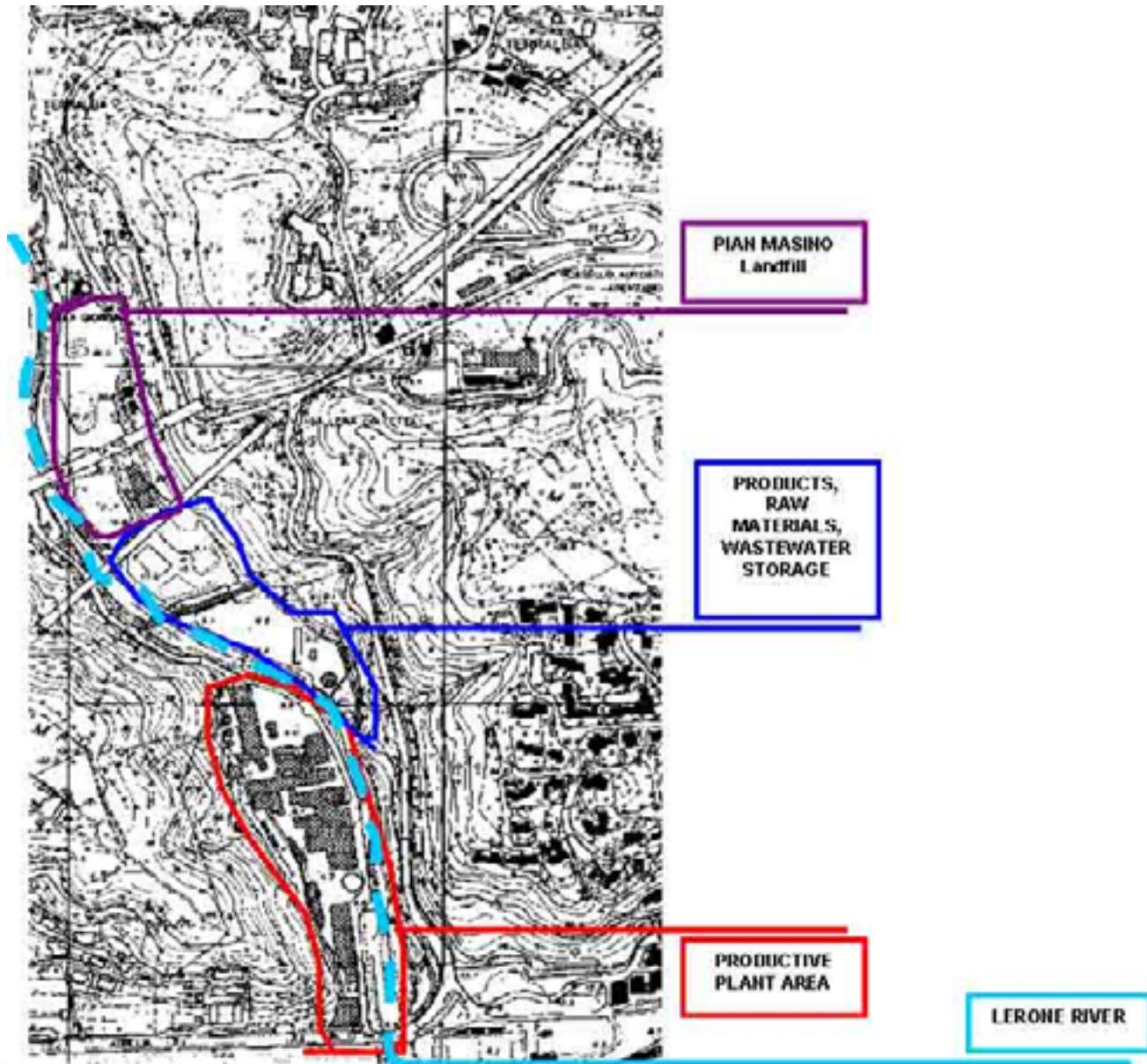


## Cogoleto Industrial Plant





# THE SITE



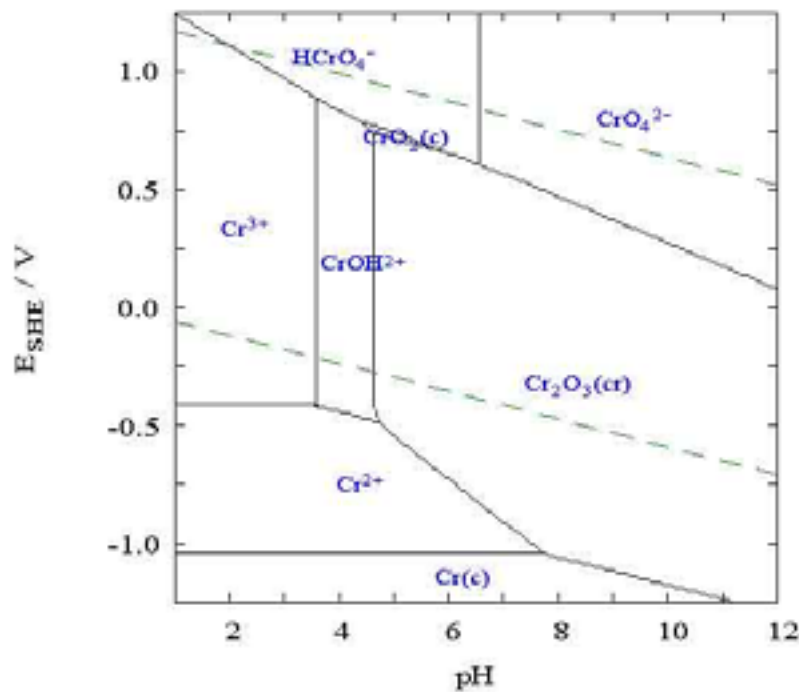
## Historical Background

- 1900: plant authorized by the Municipality of Cogoletto
- Up to 1985 the residues of the industrial production (about 40.000 – 50.000 cm/year) were discharged into the sea
- From 1986 the residues of the industrial production were landfilled (MSW landfill of Pian Masino)
- 1997: the hazardous waste landfill of Mulinetto authorized
- 2003: the plant stops its industrial activity

## Description of productive process

- Transformation of Chromium III (mineral) into Chromium VI (extremely soluble) through alkaline fusion.
- Raw materials: chromite (mineral), sodium carbonate, sulphuric acid

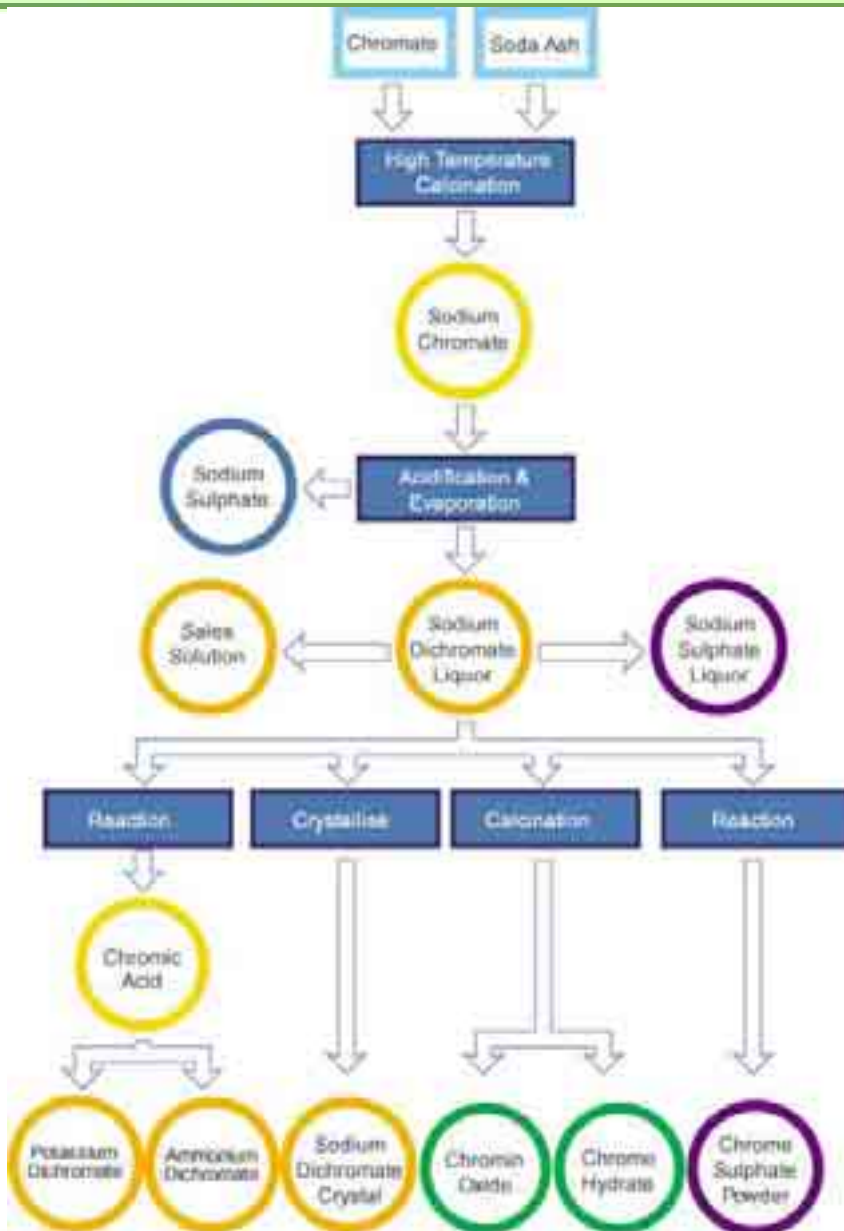
$$[\text{Cr}^{3+}]_{\text{TOT}} = 10.00 \mu\text{M}$$



$t = 25^\circ\text{C}$



Chromite from Albania



Layout of the production of:

-Sodium Dichromate

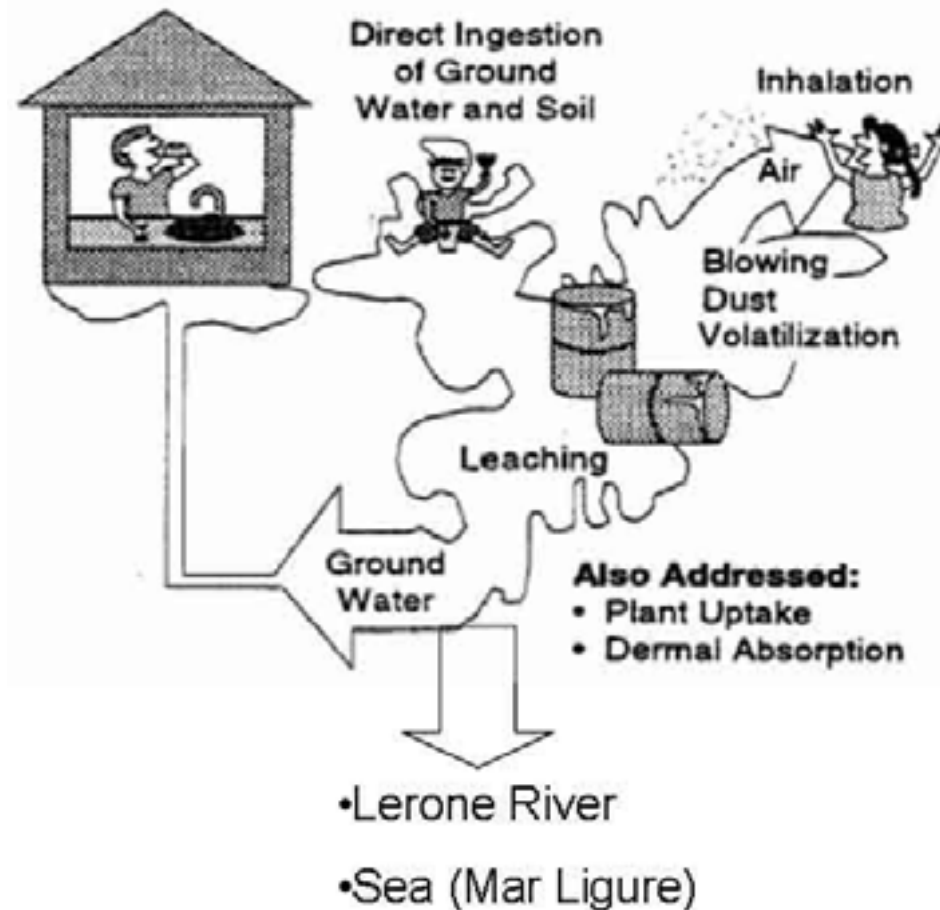
-Chrome Sulphate



## Potential Sources of Contamination



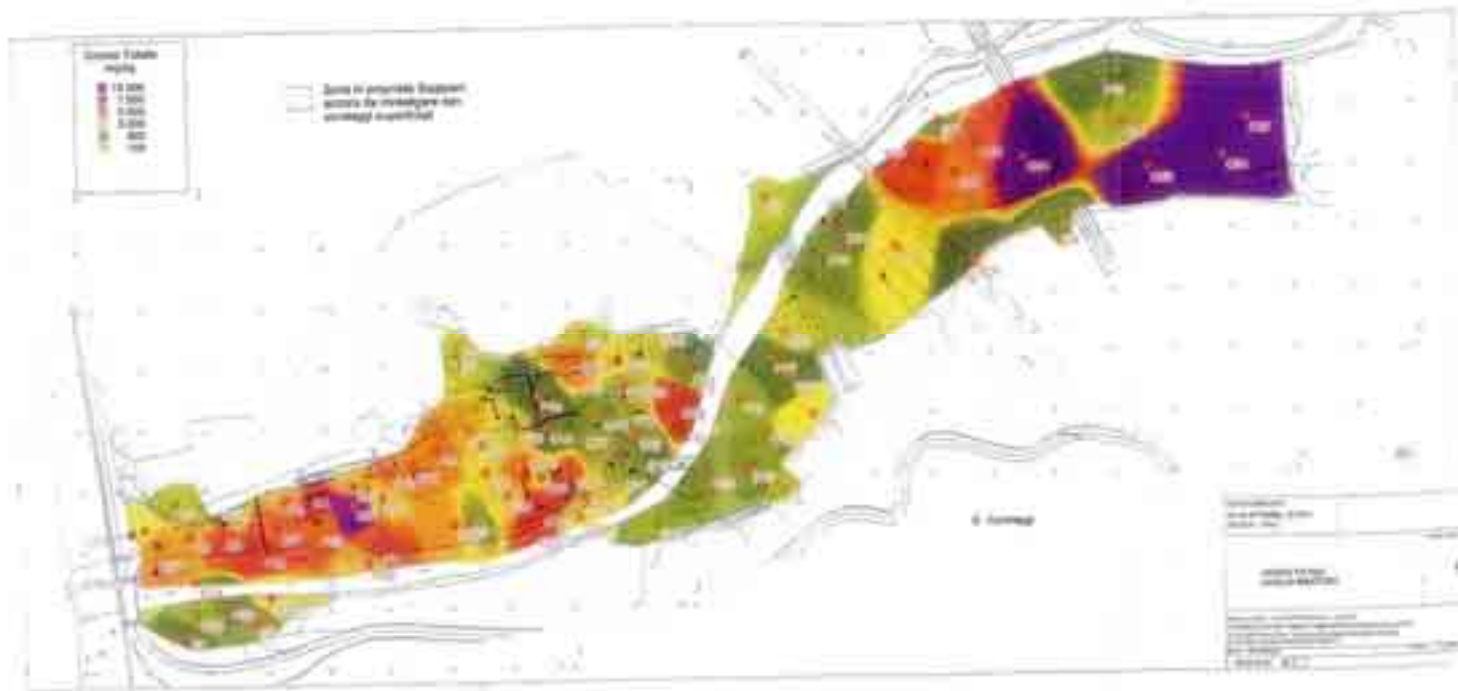
## Potential Pathways and Targets



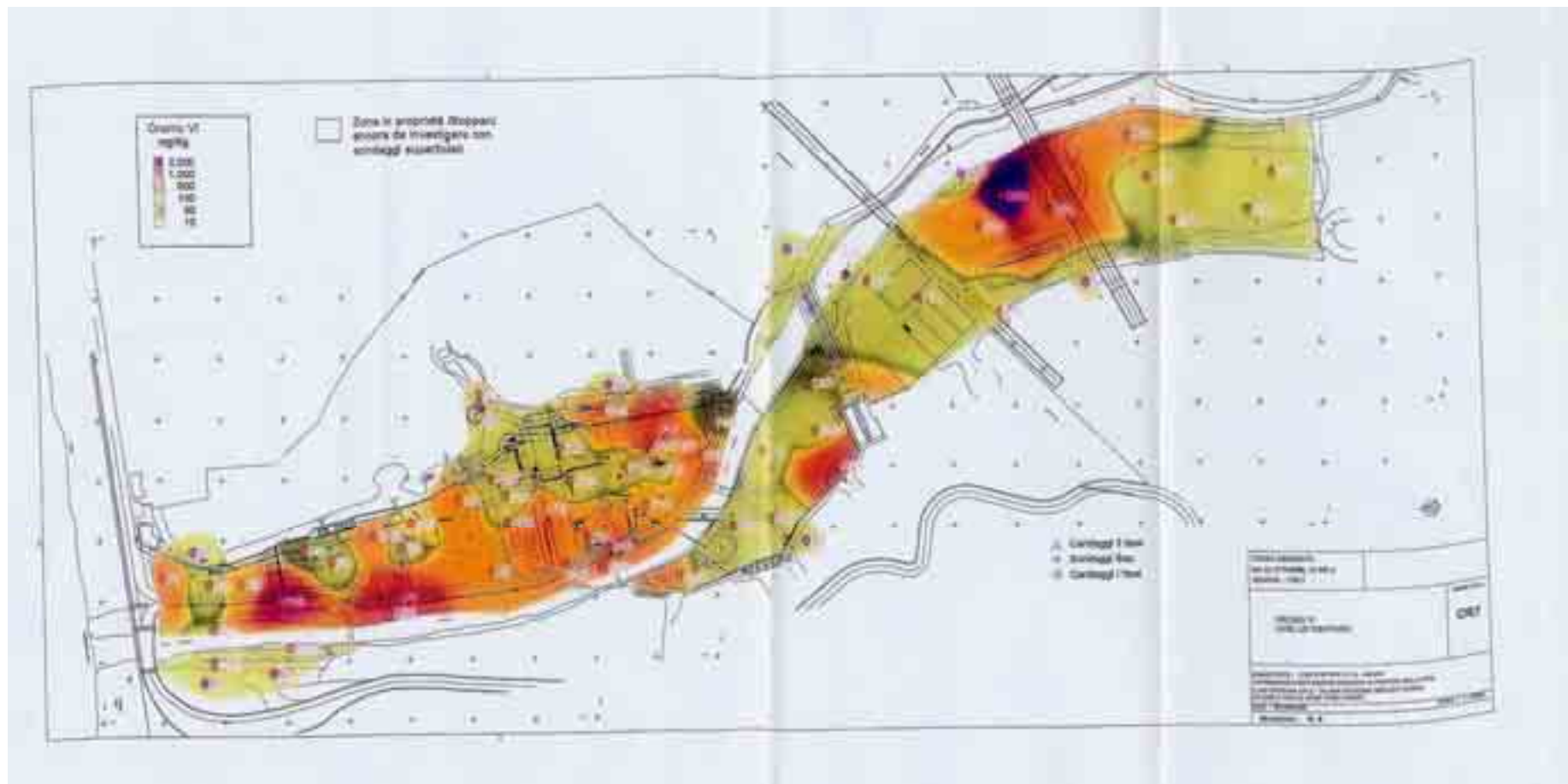
## Contamination

- Soil
- Total Chromium: up to 15.000 mg/kg (1000 times the regulatory limit = 15 mg/kg)
- Chromium VI: up to 2000 mg/kg at Pian Masino landfill area
- Nichel: concentration range from 500 to 1000 mg/kg, “hot spot” up to 1500 mg/kg
  
- Sediment
- Cr VI 1200-1900 mg/kg: Contamination Range of the sediments upstream
- Cr VI 1500-5000 mg/kg: Contamination Range of the sediments downstream
  
- Groundwater
- High levels of Cr and CrVI contamination: 100.000-250.000 µg/l in the area of the industrial plant
- High levels of contamination at the river mouth (Cr VI from 100-400 µg /l)

## Total Chromium Concentration in Unsaturated Soil

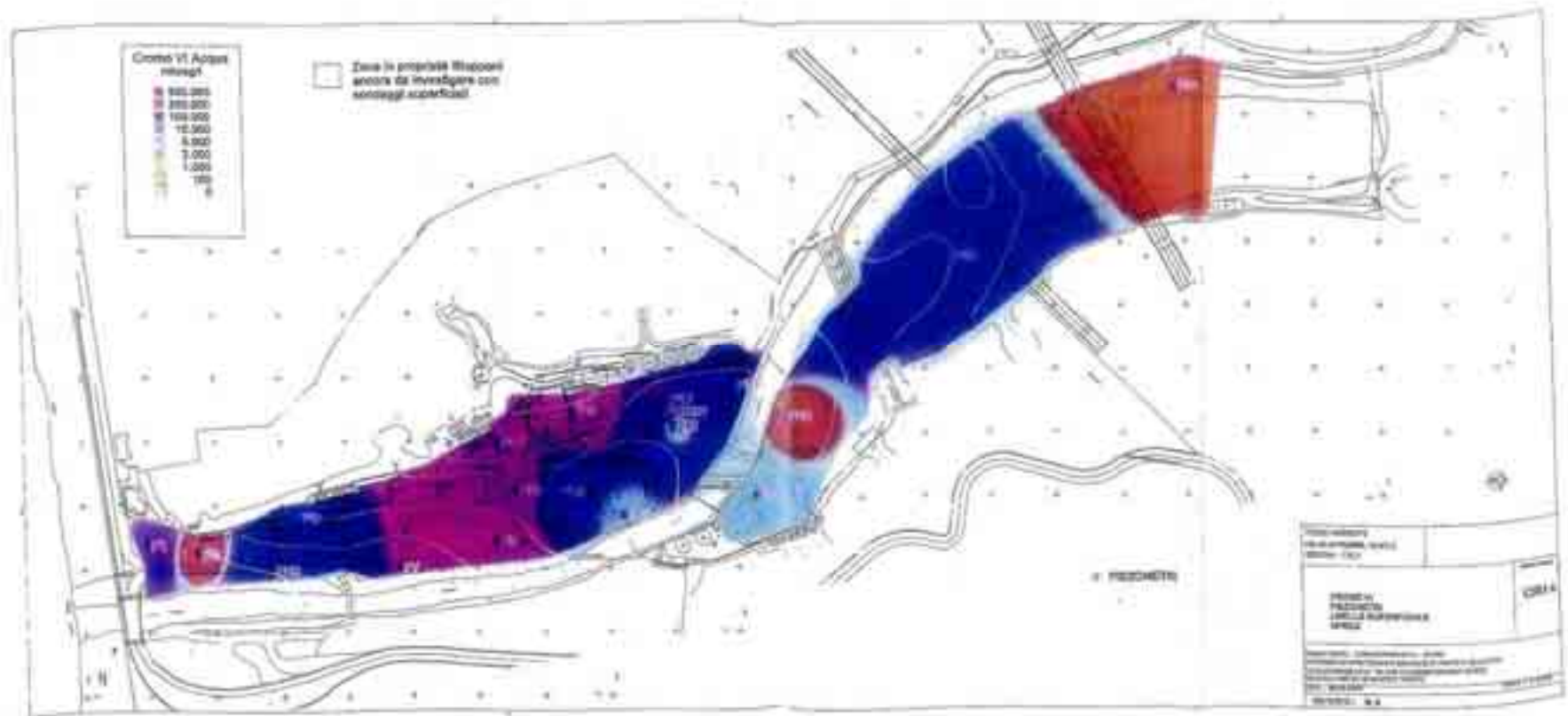


# Chromium VI Concentration in Unsaturated Soil





## Chromium VI Concentration in Groundwater



## What is Hexavalent Chromium?

- Chromium VI or Cr(VI)
- Toxic form of chromium metal, generally man-made
- Used in many industrial applications, primarily for its anti-corrosive properties
- Can be created during certain “hot” work processes where the original form of chromium was not hexavalent



## Sources of Occupational Exposure

	Types of Hexavalent Chromium Chemicals
pigments in paints, inks, and plastics	<ul style="list-style-type: none"> <li>• lead chromate (chrome yellow, chrome green, molybdenum orange) (<math>\text{PbCrO}_4</math>)</li> <li>• zinc chromate (<math>\text{ZnCrO}_4</math>)</li> <li>• barium chromate</li> <li>• calcium chromate</li> <li>• potassium dichromate</li> <li>• sodium chromate</li> </ul>
anti-corrosion coatings (chrome plating, spray coatings)	<ul style="list-style-type: none"> <li>• chromic trioxide (chromic acid)</li> <li>• zinc chromate (<math>\text{ZnCrO}_4</math>)</li> <li>• barium chromate (<math>\text{BaCrO}_4</math>)</li> <li>• calcium chromate</li> <li>• sodium chromate</li> <li>• strontium chromate (<math>\text{SrCrO}_4</math>)</li> </ul>
stainless steel	<ul style="list-style-type: none"> <li>• hexavalent chromium (when cast, welded, or torch cut)</li> </ul>
textile dyes	<ul style="list-style-type: none"> <li>• ammonium dichromate (<math>(\text{NH}_4)_2\text{Cr}_2\text{O}_7</math>)</li> <li>• potassium chromate</li> <li>• potassium dichromate</li> <li>• sodium chromate</li> </ul>
wood preservation	<ul style="list-style-type: none"> <li>• chromium trioxide</li> </ul>
leather tanning	<ul style="list-style-type: none"> <li>• ammonium dichromate (<math>(\text{NH}_4)_2\text{Cr}_2\text{O}_7</math>)</li> </ul>

## Major operations/job tasks resulting in potential Cr(VI) exposure:

- Chrome plating/Electroplating
- Welding on stainless steel or Cr(VI) painted surfaces
- Painting
  - Aerospace
  - Auto body repair
- Chromate pigment and chemical production



Chrome Plating Bath

## Major operations/job tasks resulting in potential Cr(VI) exposure: (cont.)



Bridgework

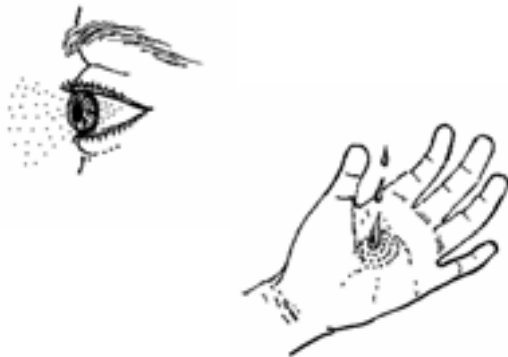
- Chromium dye and catalyst production
- Glass manufacturing
- Plastic colorant production
- Construction
  - Traffic painting
  - Refractory brick restoration
  - Paint removal from bridges



## Routes of Exposure

### How Can Hexavalent Chromium Enter the Body?

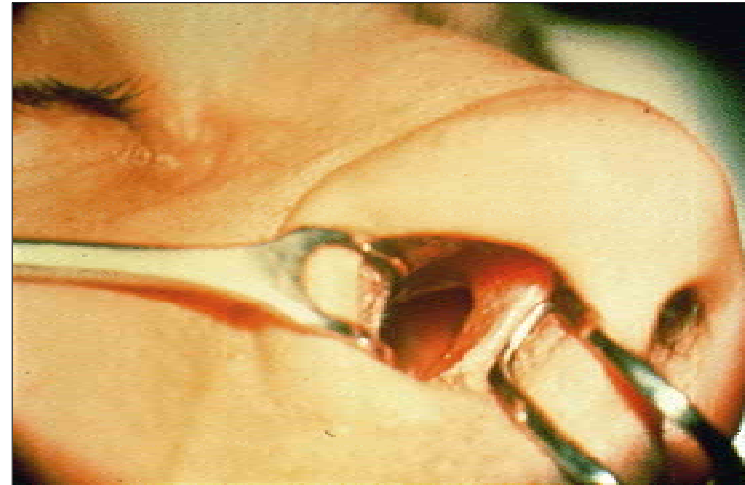
- Inhalation of dusts, mists, or fumes created during processes involving the use of Cr(VI) compounds or hot processes that cause the formation of Cr(VI)



- Eye or skin contact with powder, dusts, or liquids containing Cr(VI)

## Major Health Effects

- Lung cancer
- Nasal septum ulcerations and perforations
- Asthma



Permanent perforation of the nasal septum from continuous exposure performing chrome plating of small appliance parts

## Major Health Effects



“Chrome hole” on finger. Can also occur on hands or forearms, and on bottom surfaces of feet from chrome salts permeating through boots or shoes.

(Continued)

- Skin ulcers
- Allergic and irritant contact dermatitis