The Erase Project
Remediation of an industrial site

Porto, April 17, 2018
Diogo Almeida Santos
Air view of the Chemical Complex of Estarreja
The past (from 60 years ago)

<table>
<thead>
<tr>
<th>Industry</th>
<th>Industrial wastes</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fertilizers industry</strong></td>
<td>ammonia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sulphuric acid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ammonium sulphate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fertilizers compounds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ashes &amp; pyrites sludges + contaminated soils</td>
<td>115</td>
</tr>
<tr>
<td><strong>Chlor-alkali industry</strong></td>
<td>chlorine &amp; caustic soda</td>
<td></td>
</tr>
<tr>
<td></td>
<td>hydrochloric acid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sodium hypochlorite</td>
<td></td>
</tr>
<tr>
<td></td>
<td>brine sludges + contaminated soils</td>
<td>166</td>
</tr>
<tr>
<td><strong>PVC industry</strong></td>
<td>vinyl chloride</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PVC polymer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PVC wastes + lime sludges</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>313</td>
</tr>
</tbody>
</table>

Phase I

Environmental remediation of accumulated historical industrial wastes
Objectives of the Erase project

Minimization of environmental impacts associated with the historical industrial wastes accumulated on site, in order:

- to stop the contamination of soil and water table, resulting from the leaching process;
- to recover the areas used for the landfill of the wastes.

Main points in the design concept

- Guarantee of effective impermeabilization of the confinement structure to eliminate the leaching process;  
  \( \textit{redundancy} \)
- Quick execution \( \Rightarrow \) stop leaching process \textit{asap};  
  \( \textit{Simple, effective solution} \)
- Stability of the underground base;
  \( \textit{Sandy, homogeneous soil, 10 to 15 m height, over a natural shale formation} \)
- Not to affect sensible places with population or agriculture land;  
  \( \textit{Inside the industrial area and previously used for disposal of wastes} \)
construction scheme

pyrites wastes and contaminated soils
impermeabilization of the base (hdpe #2 mm)

deposition of layers of pyrites wastes and contaminated soils
deposition of mercury contaminated wastes over a lime+sand layer

landfill of mercury contaminated wastes (before remediation)
landfill of mercury contaminated wastes
(after remediation)

Impermeabilization of the cover
(bentonite membrane)
final works

Air view of the Chemical Complex of Estarreja
Monitoring wells network

Figura 1: Localização dos pontos de monitorização pertencentes ao programa ERASE.

monitoring well
Phase II
Environmental remediation of hydraulic ditch (*vala de S. Filipe*)
Lay-out of vala de S. Filipe

PERFIL 2C  Esc: 1:50

PERFIL 2C

PERFIL 3  Esc: 1:50

PERFIL 3