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# PROJECT DOCUMENT



# Profile of Potential Environmental Risks (PPER)

*Being better prepared*

**UNITED NATIONS**

Joint UNEP/OCHA Environment Unit

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## 1. Overview

*Introduction*

In January 2007, the Joint UNEP/OCHA Environment Unit (Joint Environment Unit) launched a pilot project to identify secondary risks posed by large infrastructure and establishments likely to hold hazardous materials after natural disasters, the **Profile of Potential Environmental Risks (PPER)**.

This document gives an overview of the PPER: experiences to date, present use and possible future applications. It also describes how it fits relative to other tools, in particular the Flash Environmental Assessment Tool. Most important, this document is an invitation for all stakeholders to support the realization of the PPER in its full potential as a vital disaster management tool.

*Context*

Environmental emergencies represent 'secondary (environmental) risks'[1]: natural and complex emergencies can impact infrastructure and industrial installations, and such impacts may pose a *threat* to the health and security of the population and the emergency responders. Too often, these risks are neglected, resulting in preventable deaths and injuries among the affected population and emergency responders. It is easier to manage secondary risks if their location and potential extent is known prior to or very early in the crisis, and if such information is made readily available to relevant authorities and emergency responders to assist in their decision-making processes.

**EXAMPLE 1:** Petrol station blast- Democratic Republic of Congo

On 17 January 2002 the Mt. Nyiragongo volcano erupted and lead to a huge humanitarian emergency in the neighbouring city of Goma. Four days later, lava flows caused an explosion at a petrol station. Fifty people, who had survived the volcano eruption, were killed.

(Source picture: http://news.bbc.co.uk/olmedia/1770000/images/ 1773233 ap300explosion.jpg)

Recognizing the importance of environmental risks following sudden onset natural disasters, the Advisory Group on Environmental Emergencies[2] in 2005 recommended the Joint Environment Unit develop a tool to be used in the field immediately

[1] In this paper, secondary risks are defined as possible acute environmental impacts on human life and health after the initial disaster. Longer-term impacts related to ecosystems and livelihoods are not the primary focus of this project. As such, they may need to be the subject of broader general environmental assessments.

[2] The Advisory Group on Environmental Emergencies (AGEE) is an international forum that brings together environmental experts from around the world to share information, expertise and lessons learned for improved response to environmental emergencies worldwide, and in particular in developing countries. The Joint UNEP/OCHA Environment Unit serves as the secretariat to this group. The AGEE meets once every two years to share experiences and new approaches in the field of response to environmental disasters, as well as to review the work of the Joint Unit, and to provide advice and guidance on areas for development and future activities.

following a natural disaster to assist in the identification of acute, life-threatening environmental impacts. This guidance resulted in the development of the Flash Environmental Assessment Tool (FEAT) by the Dutch National Institute for Public Health and the Environment (RIVM). In line with the FEAT-methodology, the Joint Environment Unit launched the project Profile of Potential Environmental Risks, which is the practical application of the first module of the FEAT.

*Activities to date*

The Joint Research Centre of the European Commission currently identifies critical infrastructure such as nuclear power plants, large dams and (air)ports that are potentially affected by disasters. This information is shared as part of the alert messages after natural disasters, issued by Global Disaster Alert and Coordination System (GDACS), a joint initiative of the United Nations and the European Commission. Since the PPER project can complement the work of the Joint Research Centre, both parties recognize the advantage of collaborating to raise awareness about secondary risks after natural disasters.

In the first half of 2007, the Joint Environment Unit has finalized the feasibility phase of the project. In the second phase of the project, the PPER has been used as a *response tool* so that secondary risks are taken into account in the emergency phase. Currently, the identification of secondary risks in an affected area has become a standard activity of the Joint Environment Unit after each major natural disaster. Building on the need for identification of secondary risks, the PPER has the capacity to become a valuable tool for the purpose of *response preparedness* and *prevention* for both natural disasters and technological accidents. This application would require an extensive mapping exercise of large infrastructure and establishments likely to hold hazardous materials in a certain number of vulnerable countries prior to the occurrence of an environmental emergency.

**EXAMPLE 2:** Gas Pipeline Explosion-Indonesia[1]

From May 2006 onwards a mud volcano in Indonesia has been spewing millions of litres of slurry caused by a cracked gas well. An UNDAC mission assessed the situation in June/July. No casualties were reported. Six months later a mudflow caused an explosion of a gas pipeline. Twelve people were killed.

(Source picture: http://graphics8.nytimes.com/images/blogs/thelede/posts/1204mud.jpg)

*Initial conclusions*

The advantage of the PPER is obvious. Too often secondary risks cause avoidable injuries and death both among the already affected population and among emergency responders. For that reason, the identification of secondary risks is not the sole concern and responsibility of affected countries, but also of responding countries.

At this status of the project development, two observations can be made. First, the project is feasible. Second, the identification of secondary risks is essential in responding to and preventing humanitarian crises.

## 3. Partners

*The PPER is possible through the cooperation of the following partners:*

### Joint UNEP/OCHA Environment Unit

The Joint Environment Unit is the United Nations core mechanism to mobilize and coordinate the international response to environmental emergencies and natural disasters with major environmental impacts. As part of its mandate, it can assist in the identification of environmental/secondary risks posed by large infrastructure or establishments likely to hold hazardous materials.

### The Joint Research Centre

The Joint Research Centre provides customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national. As a founding partner of the Global Disaster Alert and Coordination System (GDACS), JRC created the current disaster impact and alert component, multi-hazard disaster monitoring and the GDACS website which automatically combines and integrates information from various organizations.

### Global Disaster Alert and Coordination System (GDACS)

GDACS is a joint initiative of the United Nations and the European Commission, which provides near real-time alerts about natural disasters around the world and tools to facilitate response coordination. GDACS takes the form of a web-based platform that combines existing web-based disaster information management systems with the aim to alert the international community in case of major sudden-onset disasters and to facilitate the coordination of international response during the relief phase of the disaster. Based on the location and magnitude of the disasters and the local population and their vulnerability, disasters are classified in three classes, ranging from green - very low likelihood of humanitarian disaster, orange - potential humanitarian disaster to red - very high likelihood of humanitarian disaster.
The PPER was presented at the annual GDACS Stakeholders meeting in April 2007. Based on the support the PPER received from the GDACS Stakeholders, it was agreed to further integrate environmental risks into GDACS.

## 3. Link to the Flash Environmental Assessment Tool

*This section describes how the PPER fits in relation to other key environmental assessment methodologies, in particular to the Flash Environmental Assessment Tool.*

### Flash Environment Assessment Tool

The Flash Environment Assessment Tool (FEAT) is a field assessment methodology to rapidly identify urgent/acute environmental risks from disasters in the period immediately following a disaster. The primary focus of the FEAT is on the identification of acute risks related to industrial infrastructure and natural systems. As a secondary consideration, the FEAT will also help to identify medium to longer-term issues, given that many of these may be evident, and should be identified, at the earliest stages following a disaster. The intended users of the FEAT are members of humanitarian emergency response teams, such as United Nations Disaster Assessment and Coordination (UNDAC) teams. These users are familiar with field assessments, but do not have necessarily the specific background in environmental impacts.

The FEAT is hierarchically organized according to modules that move from the general to the specific levels. The first module (Aerial View) starts with an initial screening of the big and obvious potential secondary risks. The second module (Regional priority scan) identifies and prioritises the additional objects of interest within the region while the third module (Impact assessment) performs an actual impact assessment of a specific object. Each module is designed to answer a specific question and to reflect a situation the user may encounter. The modules are for independent use, but together represent the typical steps usually followed by going from the first notification until the end of the initial response.

In order to translate the first module of the FEAT-methodology (Aerial View) in practical terms, the Joint Environment Unit initiated the project of **Profile of Potential Environmental Risks (PPER)**.

## 4. Development of the project

*An overview of the development of the PPER project can be divided in three sections:*

1. *Experiences to date*
2. *Current use*
3. *Possible future application*

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# 1. EXPERIENCES TO DATE

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In January and February 2007, a pilot phase was undertaken to check the feasibility of the project. This phase consisted of finding publicly available information sources on large infrastructure and establishments likely to hold hazardous materials.[3] Then evaluating the availability and applicability of risk assessment tools, which could be used to define the threat posed by secondary risks[4]. In addition, case studies were undertaken on several natural disasters that occurred during this two-month period. The results of the case studies were shared with the UN Country Team, OCHA and UNEP Regional Offices.

- Floods Peru 19 January 2007
- Floods Bolivia 24 January 2007
- Floods Indonesia 6 February 2007
- Floods Mozambique 9 February 2007
- Floods/Cyclones Madagascar 26 February 2007
- Floods Zambia 1 March 2007

## Preliminary conclusion

The initiative was well received by its target audience. UN Country teams and OCHA national and regional offices showed interest in the project and took secondary risks into account during their response phase. The PPER was also shared with the UNDAC team to Bolivia and national authorities in Indonesia. Requests for assistance were considered in Indonesia and Mozambique, but no incidents resulting from the identified large infrastructure and establishments likely to hold hazardous materials were reported.

## Challenges

1. The existence of information gaps, especially concerning dams, mining activities and industries.
2. The need for greater accuracy on the type and the location of industries.
3. In some cases the preparation of the PPER was time-consuming due to a lack of easily accessible or incomplete data.

[3] For a list of the public available information sources, see Annex I
[4] For a list of the risk assessment tools used, see Annex II

## 2. CURRENT USE: RESPONSE TOOL

*An example of a PPER can be found in Annex III.*

**Goal** Secondary risks are taken into account in the emergency phase after a natural disaster

**Objective** Emergency responders, such as UN Country Teams and UNDAC teams, are alerted to the danger of secondary risks posed by large infrastructure and establishments likely to hold hazardous materials located in the affected area after each major natural disaster. The Joint Environment Unit hopes to provide both a specific alert to the facilities identified in the PPER as well as a general alert to secondary risks. This general alert is imperative since other secondary risks, which could not be identified from a distance, could exist.

**Outcome** Upon receiving the PPER, the emergency responders may wish to take the required actions, including mitigation and/or preparedness activities and alerting the national authorities. The Joint Environment Unit can assist in addressing these risks, if needed.

**Timing** The trigger for preparing a PPER is an OCHA Situation Report after a natural disaster. A PPER can be prepared in two-three hours.

**Methodology** Upon receiving a situation report, a number of publicly available websites and commercial databases are screened for the presence of large infrastructure and establishments likely to hold hazardous materials in the affected area (see Annex I). If these facilities are present, the Joint Environment Unit compiles a document containing the following five dimensions of information:

| Presence | Hazardous materials | Threats | Impact | Location |
|---|---|---|---|---|
| Working from an existing list, the presence of large infrastructure and installations likely to hold hazardous materials is defined. | Any hazardous materials these industrial facilities may contain. | Threats associated with the infrastructure as such or with the hazardous materials contained by these facilities. | To define the possible impact of these threats on human life and/or life support, on the direct or the long-term | If possible, the place name and/or geographical coordinates of the facilities reflected by a map |

**Distribution**

Send to
- UNDAC Team
- UN Country Team
- National authorities
- Other relevant stakeholders

Posted on
- Joint Environment Unit website: http://ochaonline.un.org/ochaunep/
- GDACS www.gdacs.org
- Virtual OSOCC[5]

[5] The Virtual OSOCC is a website platform, developed by the OCHA Field Coordination Support Section (FCSS) to facilitate decision-making for international response to major disasters though real-time information exchange by all actors of the international disaster response community

**Cooperation with GDACS**:

- The managers of GDACS provided editor-access to the Joint Environment Unit to post PPERs on the GDACS-website.
- Glide numbers for natural disasters are used by the Joint Environment Unit. GLobal IDEntifier number (GLIDE) is a globally common Unique ID code for disasters. The components of a GLIDE number consist of two letters to identify the disaster type (e.g. EQ - earthquake); the year of the disaster; a six-digit, sequential disaster number; and the three-letter ISO code for country of occurrence.
- In the future, field updates, as they can come available through field teams, such as MapAction and UNDAC teams can be shared and integrated into GDACS.

**Project Implementation**

Between January and May 2007, PPERs have been prepared by the Joint Environment Unit for the following natural disasters:

1. Floods- Peru
2. Floods-Bolivia
3. Floods-Indonesia
4. Floods-Mozambique
5. Floods-Madagascar
6. Floods-Zambia
7. Earthquake- Indonesia
8. Tsunami- Solomon Islands
9. Cyclone Indlala- Madagascar
10. Floods-Argentina
11. Floods- Uruguay

## Preliminary conclusion

The preparation of a PPER has become a standard response activity of the Joint Environment Unit.

## Challenges

- While is it clear that such a project would benefit the affected population as well as the entire humanitarian community, the project is only as good as the availability of data on the type and location of the facilities in the disaster affected countries.

## 3. FUTURE APPLICATION: PREVENTION TOOL

**Goal**

Better preparedness for secondary risks after natural disaster and prevention of technological accidents:

**Objective**

National authorities, UN agencies and other relevant stakeholders are better informed on the location and threat of secondary risks posed by large infrastructure and establishments likely to contain hazardous materials. If national authorities and/or other relevant stakeholders are better prepared for secondary risks, the risk of death and injuries among the population and emergency responders due to environmental emergencies can be decreased. In addition, if a disaster occurred information on secondary risks would be readily available in a user-friendly format ensuring that no time is lost in gathering this data. This would improve the speed as also the quality of response.

**Outcome**

Secondary risks are taken into account before an emergency occurs in order to take prevention/response preparedness/disaster risk reduction activities. If requested, the Joint Environment Unit, within the scope of the Environmental Emergencies Partnership, can assist countries in improving its preparedness and prevention for environmental emergencies. The identification of hotspots can also be followed by the Awareness and Preparedness for Emergencies at Local Level (APELL) process. The APELL process is a management tool that helps local people develop the information and decision-making structures they need to address the hazards facing their community. With the cooperation of the authorities, the APELL process can run a demo during twelve to eighteen months in one location on local level. If successful, this demo can be replicated by national authorities on country level.

**Methodology**

The development of a *database* (PPER database) mapping secondary risks in a certain number of vulnerable countries.

**Thematic Scope**

The secondary risks are defined on the basis of a pre-defined list of large infrastructure and establishments likely to hold hazardous materials (Annex I). The PPER database will consist of the same five dimensions of information as currently used in the PPER as a response tool. (see p. 7)

**Geographical scope**

The database will be prepared for twenty disaster-prone, vulnerable countries from the least developed countries in the world, as ranked in the Human Development Index. The selection will be based on extensive data and rankings of the vulnerability of countries and impact of natural disasters in the past. The standards of ECHO Intervention Priority Ranking will be explored, specifically. This ranking takes into account human development, exposure to natural disasters, resilience of the population to cope with a hazard, the GDP of a country and other relevant factures.

## Preliminary conclusion.

Mapping large infrastructure and/or establishments likely to hold hazardous materials in a certain number of vulnerable countries has benefits for a wide range of stakeholders:

- Raise awareness of the hazard associated with large infrastructure and/or establishments likely to hold hazardous materials
- Raise awareness of environmental concerns in the humanitarian community.
- Provide a bridge between several stakeholders concerned with environmental issues.
- Greatly facilitate the work of the Joint Environment Unit not only in its response activities but also in response preparedness activities.
- Increase the accessibility of valuable information, which is currently extremely scattered, in a single and user-friendly format.
- A practical cooperation between two large international bodies, the United Nations and the European Commission.
- Avoid duplication of efforts
- Provide a rationalization of resources since donors would be offered a single financial channel for one project, executed by several beneficiary organizations.
- Become an essential resource of information for the Joint Research Centre in its activities.
- Serve as a basis for an environmental component in the alerting function of GDACS after natural disasters.

## Challenges

### 1. Human Resources

The actual research and time-consuming collection of data would form an extra burden on the capacity of the Joint Environment Unit. The PPER-database would need to be developed by a research institute, while the Joint Environment Unit can contribute to the contents from its experience in environmental emergencies, and is in a good position to liaise with the relevant stakeholders who could provide important information.

### 2. Data resources

2.1. The first source of the necessary data for the PPER-database would come from the targeted countries themselves. It is assumed they have the most accurate information of installations in their country. Therefore their cooperation is essential in the development of this database.

***Action required:*** *Taking in consideration the danger posed by certain facilities and industrial installations both for its national population as for international relief workers, countries are encouraged to share national information to decrease the danger of secondary risks.*

2.2. Data can also be found in commercially available databases on specific themes, such as mining and large dams. This data is very accurate and therefore extremely useful for the PPER-database. Both partners have started to acquire access to some of these databases,

however, it is limited due to the high costs of these databases. Another benefit of such data is that duplication of work, efforts and time in mapping facilities at risk can be avoided.

***Action required:*** *Two options:*

*1. Application of the 'space charter' for certain very expensive databases.*

*One way of overcoming the financial obstacle in accessing the information in the database is the use of the 'International Charter on Space & Major Disasters'. Through this charter, civil defense organizations can request satellite data from several space agencies in the case of natural or technological disasters under certain conditions. If used for the purpose of the PPER, data would remain with the company maintaining the database on secondary risks, but upon the occurrence of an disaster, the relevant information can be released to the Joint Research Centre and the Joint Environment Unit for the use in the PPER.*

*2. Provision of financial means to acquire full access to the databases*

2.3. Data on the presence and location of facilities at risk can be found in post-emergency assessments in the field, as prepared by the Joint Environment Unit, UNEP, UNDP, environmental NGOs and other agencies.

***Action required:*** *Research needs to be undertaken to gather all this information from the different sources so that it can be inserted in the database.*

2.4. Other sources of information are public available websites, which are used now in compiling the PPER.

***Action required:***

*- Integrate all information of these various websites into the database*

*-Screen the Internet for additional public available information sources*

2.5. Finally, the data in previous products, can be used in the database. In order to easily translate electronic information into the PPER- database, the current PPER uses XML.

## 3. Financial Resources

The development of the PPER-database requires extensive funding for hiring consultants, travel, information and equipment. The Joint Environment Unit will explore options on how to fund the development of the database.

**Sustainability**
The PPER-database is not a static product, but requires continuous investment and commitment from all stakeholders. The database would need to be maintained and up-dated regularly in order to provide accurate information on the presence and location of the large infrastructure and/or establishments likely to hold hazardous materials.

## 5. Conclusion

The PPER started of as a response tool in order to guarantee full consideration of secondary risks by relevant stakeholders in the emergency phase after a natural disaster. While the use of the PPER for this goal has proven beneficial and will continue to do so in the future, the potential of the tool is not limited to this use only. Ideally, secondary risks require identification before and after the occurrence of an emergency. Therefore, the PPER can reach its full potential if it is also developed into a database covering vulnerable countries.

To reach this aim, long-term support and commitment of several stakeholders is required. The danger posed by secondary risks concerns affected countries, donor countries and the international community at large. Overall, the threat of large infrastructure and/or establishments likely to hold hazardous materials does not only affect the population, but also citizens from donor countries who volunteer to provide assistance.

The Joint Environment Unit hopes that the readers of this document, acknowledging the benefit of the PPER-project, will provide the necessary support for its full development in particular in the form of access to data.

## ANNEX I: List of public available information sources

| Type of facility | Public available information source |
|---|---|
| 1. Large hydrodams | • http://www.worldenergy.org/wec-geis/publications/reports/ser/hydro/hydro.asp |
| 2. Nuclear installations | • http://www-pub.iaea.org/MTCD/publications/PDF/cnpp2003/CNPP_Webpage/pages/countryprofiles.htm<br>• http://www.worldenergy.org/wec-geis/publications/reports/ser/nuclear/nuclear.asp<br>• http://www.iaea.org/programmes/a2/index.html<br>• http://www.iaea.org/worldatom/rrdb/<br>• http://www.grid.unep.ch/data/download/gnv181.gif |
| 3. Mining activities | • http://pubs.usgs.gov/of/2006/1135/<br>• http://minerals.usgs.gov/minerals/pubs/country/sa.html#bl<br>• http://www.infomine.com/countries/<br>• http://www.mbendi.co.za/a_sndmsg/Country_List.asp?C=1&PT=0<br>• http://www.worldenergy.org/wec-geis/publications/reports/ser/uranium/uranium.asp<br>• http://www.worldenergy.org/wec-geis/publications/reports/ser/coal/coal.asp |
| 4. Oil & Gas infrastructure | • http://www.eia.doe.gov/emeu/cabs/index.html<br>• http://www.worldenergy.org/wec-geis/publications/reports/ser/gas/gas.asp<br>• http://www.mbendi.co.za/<br>• http://www.lib.utexas.edu/maps/map_sites/oil_and_gas_sites.html |
| 5. Energy power stations | • http://www.eia.doe.gov/emeu/cabs/index.html<br>• http://www.worldenergy.org/wec-geis/publications/reports/ser/gas/gas.asp<br>• http://www.mbendi.co.za/<br>• http://www.lib.utexas.edu/maps/map_sites/oil_and_gas_sites.html |
| 6. Food/Agro industry | |
| 7. Chemical industry | • http://www.pops.int/documents/implementation/nips/submissions/default.htm<br>• http://www.chem.unep.ch/pops/pcdd_activities/inventories/default.htm |
| 8. Hazardous waste sites | • http://maps.grida.no/go/graphic/radioactive_chemical_and_biological_hazards_in_central_asia<br>• http://www.basel.int/natreporting/compilations.html |
| 9. Public areas and services | |
| 10. Explosives | |
| 11. Metallurgic and electronic industry | • http://www.mbendi.co.za/a_sndmsg/Country_List.asp?C=1&PT=0<br>• http://pubs.usgs.gov/of/2006/1135/<br>• http://minerals.usgs.gov/minerals/pubs/country/sa.html#bl |
| 12. Specific basic industry | |

## ANNEX II: List of risk assessment tools used

- Conseil pour la réduction des accidents industriels majeurs (CRAIM). *Risk Management Guide for Major Industrial Accidents intended for municipalities and industry*. 2002 Edition.

- International Atomic Energy Agency (IAEA). *Manual for the classification and prioritisation of risks due to major accidents in process and related industries. Inter-agency Programme on the Assessment and Management for Health and Environmental Risks from Energy and other Complex Industrial Systems.* 1996.

- UNEP Industry and Environment (IE). Hazard Identification and evaluation in a local community. Technical report n°12. 1998.

- UNDAC Field Handbook

**ANNEX III- Example of a PPER**

## Joint UNEP/OCHA Environment Unit
# Profile of Potential Environmental Risks
## Floods Uruguay- May 11, 2007
## FL-2007-000057-URY

*Disclaimer*

*This profile is not a conclusive list. Other risks may be possible from sources that are not readily identifiable. The information sources used are public websites. All efforts are made to screen the websites for accuracy.*

**Objective:**

The objective of the Profile of Potential Environmental Risks (PPER) is to alert the UN Country Team after the natural disaster to potential secondary risks posed by large infrastructure and industrial facilities containing hazardous materials located in the affected area. This information can be shared with local and national authorities. Any actual secondary risk should be addressed at the earliest possible stage.

**Event:** Uruguay is suffering one of its worst floods since1959. The damage caused by this year's unusually prolonged floods is very extensive. Over 110,000 people have been affected. The floods caused severe damage to public infrastructure including roads, water supply, sewerage, drainage, power and telephone lines, housing, agriculture and municipal buildings, particularly schools and healthcare facilities.

**Summary of findings:**

The following large infrastructure and industrial facilities may pose a risk:

| Facility/Industry | HAZMAT, if applicable | Hazard |
|---|---|---|
| 1. Large infrastructure | | |
| Large hydrodams | | |
| 3 hydroelectric dams at the Rio Negro | - | Dam stability might be affected, dammed water, high voltage electricity |
| 2. Establishments likely to hold hazardous materials (HAZMAT)[1] | | |
| Large storage or combustible-processing facilities | | |
| Petroleum production | Gasoline, naphta, hydrofluoric acid, propane, butane, ethylene, propylene, mercaptan, liquefied natural gas and other combustibles | Corrosive<br>Flammable<br>Toxic |
| Transport of petroleum or gasoline | | |
| Gas distribution centre | Natural gas, propane | Inflammable |
| Pipelines | Natural gas, propane, butane, ethylene, ethane, methane, kerosene, crude petroleum, chlorine, hydrogen, etc | Inflammable<br>Pressurized pipelines |
| Large cooling facilities | | |
| Food industry (slaughterhouses, dairy products, fat, fish and meat, breweries, refrigerated warehouses, etc.) | Ammonia, freons, sulphure, dioxide | Toxic<br>Corrosive |
| Specific basic products | | |

| | | |
|---|---|---|
| Tanneries | Trivalent chromium sulphate, sodium slats, arsenic, cyanide, ammonium sulphate, sulphuric acid, lime and aniline. | Toxic<br>Corrosive |
| Specific chemical products | | |
| Textile industry | Benzene, naphthalene, acids, alkalis, chlorine, bromine, sodium nitrate, ammonia, sodium sulphate and metals | Flammable<br>Toxic<br>Corrosive<br>Oxidizing |
| Metallurgic and electronic industry | | |
| Electronic industry | Arsine, trimethylchlorosilane | Toxic<br>Flammable<br>Corrosive |
| Public areas and services | | |
| Drinking water filtration plant | Chlorine | Toxic<br>Corrosive<br>Oxidizing |
| Sewage treatment plant | Chlorine, hydrogen peroxide | Toxic<br>Corrosive<br>Oxidizing |
| Hospitals | Mercury, radioactive sources, solvents, compressed gases, infectious substances | Toxic<br>Radioactive<br>Flammable<br>Infectious substances |