

IPCHEM - Information Platform for Chemical Monitoring

Case study 1 – Benzene in ambient air

Version 2 (December 2018)



<https://ipchem.jrc.ec.europa.eu>

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1 BACKGROUND

To protect human health and the environment as a whole, it is particularly important to reduce emissions of pollutants at source and to identify and implement the most effective emission reduction measures at local, national and European level. Therefore, emissions of harmful air pollutants should be avoided, prevented or reduced and appropriate objectives set for ambient air quality taking into account relevant World Health Organisation standards, guidelines and programmes.

Benzene is one of these harmful air pollutants, as human exposure to benzene has been associated with a range of acute and long-term adverse health effects and diseases, including cancer and aplastic anaemia.

DIRECTIVE 2008/50/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 May 2008 on ambient air quality and cleaner air for Europe defines and establishes objectives for ambient air quality designed to avoid, prevent or reduce harmful effects on human health. Annex XI of this Directive sets a limit value for benzene which shall not be exceeded from 1 January 2010 (date by which the limit value is to be met):

| Averaging period | Limit value | Margin of tolerance | Date by which limit value is to be met |
|------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Benzene | | | |
| Calendar year | 5 µg/m ³ | 5 µg/m ³ (100%) on 13 December 2000, decreasing on 1 January 2006 and every 12 months thereafter by 1 µg/m ³ to reach 0 % by 1 January 2010 | 1 January 2010 |

2 CASE STUDY 1

The case study is focused on the identification of outdoor air concentration values of benzene in Northern Italy cities which did not meet the limit value of 5 µg m⁻³ in 2011 (Figure 1) using the chemical concentration data available in IPCHEM and the functionalities of the platform.



Figure 1: Case study's area and chemical compound of interest

| | |
|---------------------------|-----------------------|
| Compound (Chemical) | Benzene |
| Medium | Ambient (outdoor) Air |
| Area (region) of interest | Northern Italy |
| Limit value | 5 µg m ⁻³ |
| Time period of interest | 2011 |

3 OPERATIONAL STEPS

3.1 Selection of chemical

Starting from the IPCHEM home page, click on the search tool 'Search data by Chemical, Media and Country'

Search data by Chemical,
Media and Country

Then follow the steps described below:

→ Type the name of 'benzene' in the field called 'Type chemical name/synonymous', then select the chemical name from the list box.



Search Chemical:

Type chemical name/synonymous

Type chemical CAS number

Search Chemical:

benze

- 1-tert-butyl-2-methoxy-4-methyl-3,5-dinitrobenzene
- 2,4-dinitrochlorobenzene
- 2-nitrochlorobenzene
- 3,5-dichloronitrobenzene
- 3-nitrochlorobenzene
- 4-nitrobenzene, 1,2-dichloro-
- azobenzene
- benzenamine, n-ethyl-3-methyl-
- benzene**
- benzene, 1,2-dichloro-3-nitro-
- benzene, 1,4-dichloro-2-nitro-
- benzene, 1-chloro-2-methyl-3-nitro-
- benzene, 1-ethyl-2-methyl-
- benzene, 2,4-dichloro-1-nitro-
- benzenesulfonamide

3.2 Selection of media





→ Click on the 'Select media (optional)' and choose 'Outdoor air' from the check box list under the check box category named 'Atmosphere'.

Search Chemical:

benzene

Type chemical CAS number

Refine by module (optional)

Optional filters

1 media selected

Select project/institution (optional)

Select date (optional)

Advanced Search

You searched:

Media: Atmosphere (Outdoor Air)

Country (optional):

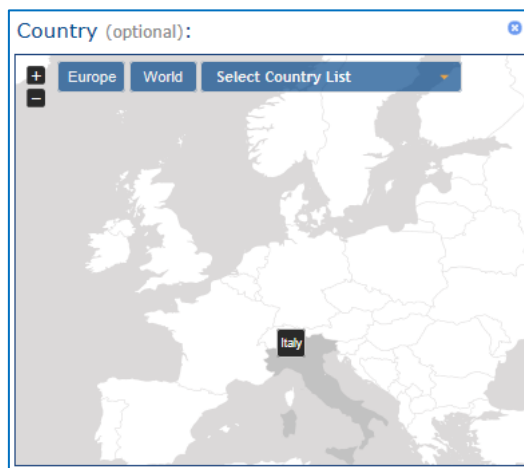
Select a Media

☐ Water
 ☐ Waste
 ☐ Soil
 ☐ Atmosphere
 ☐ Indoor Air
 ☒ Outdoor Air
 ☐ Personal Sampling
 ☐ Other
 ☐ Biota
 ☐ Food and Feed
 ☐ Human
 ☐ Consumer Product

Clear Selections

3.3 Selection of country

→ Select 'Italy' by clicking directly on the map of Italy or by selecting from the drop-down list of countries.



The results of the query are displayed into the search page: all the data collections available in IPCHEM, which include data on benzene measured outdoors in Italy, are listed in the same page.



Information Platform for Chemical Monitoring data
 Enhancing access to chemical data occurrence

You searched: ✕

Chemical name: benzene ✕

Media: Atmosphere (Outdoor Air) ✕

Country: Italy ✕

sorted by acronym ▾ A-Z ▾ displaying 1 to 5 out of 5 results Show 20 ▾ entries

< 1 >



AIRBASE

European air quality database ➔

European Environment Agency (EEA) ✉ [Metadata Info](#) Data Access: Public

Chemical Name: benzene CAS Number: 71-43-2 ⚠ Media: Atmosphere (Outdoor Air)

Environmental



AIRMEX

European Indoor Air Monitoring and Exposure Assessment Project ➔

European Commission - Joint Research Centre ✉ [Metadata Info](#) Data Access: Public

Chemical Name: benzene CAS Number: 71-43-2 ⚠ Media: Atmosphere (Outdoor Air)

Product & Indoor Air



AIRQUALITY

European air quality database ➔

European Environment Agency (EEA) ✉ [Metadata Info](#) User Rights: Owner

Chemical Name: benzene CAS Number: 71-43-2 ⚠ Media: Atmosphere (Outdoor Air)

Environmental



OFFICAIR

Indoor air pollution in modern office buildings ➔

European Commission - Joint Research Centre ✉ [Metadata Info](#) Data Access: Public

Chemical Name: benzene CAS Number: 71-43-2 ⚠ Media: Atmosphere (Outdoor Air)

Product & Indoor Air



SINPHONIE

Schools Indoor Pollution and Health Observatory Network in Europe database on chemical and biological pollutants ➔

European Commission, DG SANTE ✉ [Metadata Info](#) User Rights: Restricted Owner

Chemical Name: benzene CAS Number: 71-43-2 ⚠ Media: Atmosphere (Outdoor Air)

Product & Indoor Air

3.4 Selection of the database of interest


→ Select the 'AIRBASE –European air quality database' data collection to access the related data by clicking on the corresponding title in the databases list. By selecting the 'AIRBASE' database the specific Database Console appears.

→ Select 'Show all sample sites' to display all sampling data sources onto the map.

AIRBASE
Data Access: Public

European air quality database

+ Click HERE to start bounding



Type of Area

Sampling Matrix

Statistic Name

Statistics Average Group

You are searching:

Chemical Name : benzene

CAS Number : 71-43-2

Media : Atmosphere (Outdoor Air)

Country Name : Italy

Show sample sites by page

Show all sample sites





Show sample sites by location

Pick Row(s) or Request Full Table

Request Full Table

Page size: 50

Showing 1-50 of 2854

| | Location | Sample Source | Sampling Date | Conc. Value | Unit of Measure | LOD | LOQ | Media/Setting | Level of Aggregation | |
|--------------------------|--------------------------------------------------------------------|---------------------------------------------|---------------|-------------|-----------------|-----|-----|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> | Country: Italy Name: MONTOPOLI IN VAL D'ARNO Position: exact | Code: IT0859A Name: PI-SAN-ROMANO 905016 | 2000 | 540 | µg/m3 | | | Media: Atmosphere (Outdoor Air) Sampling Matrix: air | Statistic Name: maximum Aggregation Period: year Statistics Average Group: hour Statistics Number Valid: 64 Statistics Percentage Valid: 0.729 |   |
| <input type="checkbox"/> | Country: Italy Name: MONTOPOLI IN VAL D'ARNO Position: exact | Code: IT0859A Name: PI-SAN-ROMANO 905016 | 2000 | 428.906 | µg/m3 | | | Media: Atmosphere (Outdoor Air) Sampling Matrix: air | Statistic Name: annual mean Aggregation Period: year Statistics Average Group: hour Statistics Number Valid: 64 Statistics Percentage Valid: 0.729 |   |

Data of concentration measurements are displayed in tabular format (the so-called 'Master Table') and onto the map, where the coloured points represent the sampling source locations.

3.5 Selection of specific 'filter criteria'

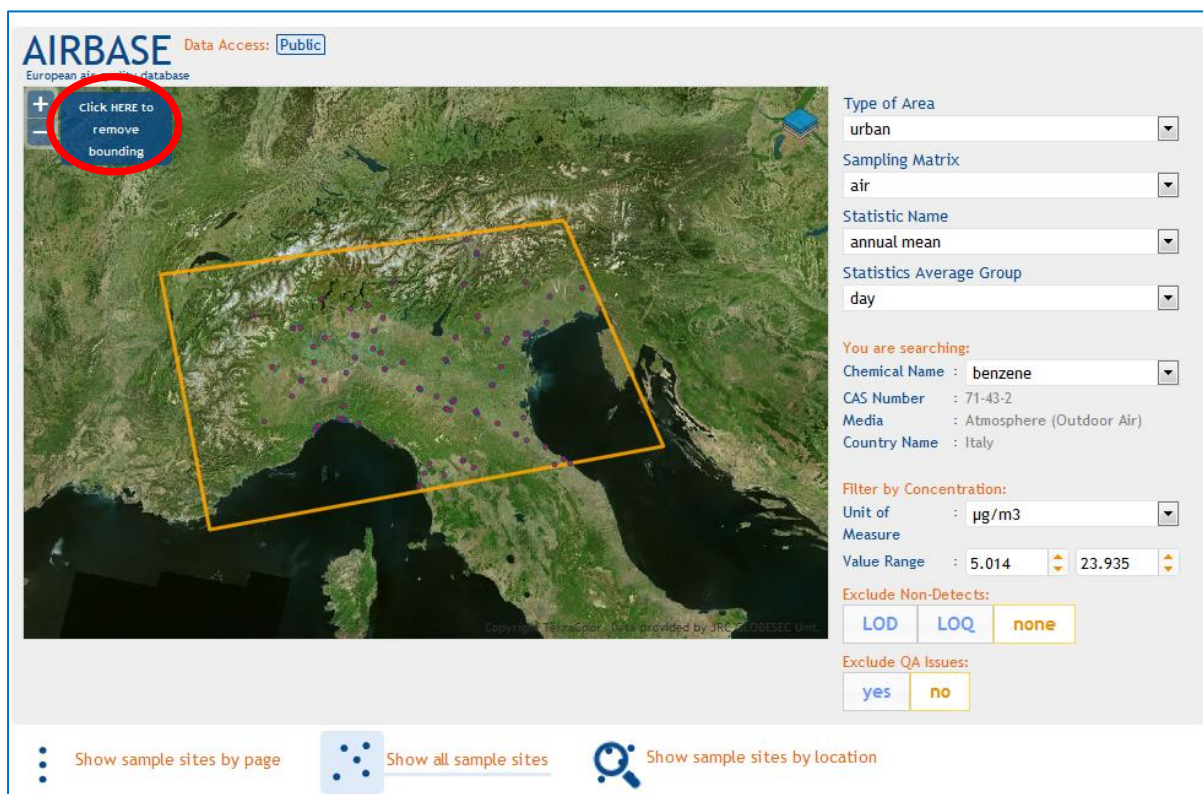
→ Choose some specific filter criteria of 'AIRBASE', available on the top-right part of the Database Console to narrow the data selection in the following order:

| Filter | Value |
|--------------------------|-------------------------------------------------------------------------------------------------------|
| Type of Area | Urban (we are looking for a city) |
| Sampling Matrix | Air |
| Statistic Name | Annual mean |
| Statistics Average Group | Day |
| Filter by Concentration | Unit of Measure: $\mu\text{g}/\text{m}^3$ Value range: 5.002 – 23.935 (where 5 is the limit value) |

Note: the filters 'Exclude Non-Detects' and 'Exclude QA Issues' are respectively automatically defined as 'none' and 'no'.

3.6 Selection of area (Northern Italy)

→ Click on the blue button 'Click HERE to start bounding' on the top left part of the map and draw a polygon for delimiting the area of Northern Italy to focus on.



The screenshot shows the AIRBASE web interface. On the left, a map of Northern Italy is displayed with a yellow bounding polygon. A blue button labeled 'Click HERE to start bounding' is circled in red. On the right, the filter settings are visible:

- Data Access:** Public
- Type of Area:** urban
- Sampling Matrix:** air
- Statistic Name:** annual mean
- Statistics Average Group:** day
- You are searching:**
 - Chemical Name:** benzene
 - CAS Number:** 71-43-2
 - Media:** Atmosphere (Outdoor Air)
 - Country Name:** Italy
- Filter by Concentration:**
 - Unit of Measure:** $\mu\text{g}/\text{m}^3$
 - Value Range:** 5.014 to 23.935
- Exclude Non-Detects:** LOD, LOQ, none
- Exclude QA Issues:** yes, no

At the bottom, there are three buttons: 'Show sample sites by page', 'Show all sample sites', and 'Show sample sites by location'.

Note: once the polygon was drawn, the 'Filter by Concentration' needs to be set up.

3.7 Selection of data records

→ According to the performed spatial selection, change the number or data records displayed into the Master Table from the 'Page size' pull down list. By default the page size is set to '10' rows.



If the previous step is omitted only the first 10 rows will be by default selected to store and process their corresponding data into the Basket.

→ Setting the page size to 100 from the drop-down list, 53 data records that were previously selected in the delimited map area of Northern Italy are displayed into the Master Table; the number of records might change according to the size and shape of the polygon you have drawn.

| Pick Row(s) or Request Full Table | | | | | | | | | |
|-----------------------------------|----------------------------------------------------|---------------------------------------------------|---------------|-------------|-----------------|-----|-----|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Page size: 100 | | | | | | | | | Showing 1-53 of 53 |
| <input type="checkbox"/> | Location | Sample Source | Sampling Date | Conc. Value | Unit of Measure | LOD | LOQ | Media/Setting | Level of Aggregation |
| <input type="checkbox"/> | Country: Italy Name: BOLOGNA Position: exact | Code: IT1159A Name: PORTA SAN FELICE 803713 | 2001 | 23.935 | µg/m3 | | | Media: Atmosphere (Outdoor Air) Sampling Matrix: air | Statistic Name: annual mean Aggregation Period: year Statistics Average Group: day Statistics Number Valid: 240 Statistics Percentage Valid: 65.753 |

→ Select all 53 records to store them into the IPCHEM Basket by picking-up the top box of the first column (indicated by the red arrow in the figure below).

| Pick Row(s) or Request Full Table | | | | | | | | | |
|-------------------------------------|---------------------------------------------------------------|---------------------------------------------------|---------------|-------------|-----------------|-----|-----|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Page size: 100 | | | | | | | | | Showing 1-53 of 53 |
| <input checked="" type="checkbox"/> | Location | Sample Source | Sampling Date | Conc. Value | Unit of Measure | LOD | LOQ | Media/Setting | Level of Aggregation |
| <input checked="" type="checkbox"/> | Country: Italy Name: BOLOGNA Position: exact | Code: IT1159A Name: PORTA SAN FELICE 803713 | 2001 | 23.935 | µg/m3 | | | Media: Atmosphere (Outdoor Air) Sampling Matrix: air | Statistic Name: annual mean Aggregation Period: year Statistics Average Group: day Statistics Number Valid: 240 Statistics Percentage Valid: 65.753 |
| <input checked="" type="checkbox"/> | Country: Italy Name: REGGIO NELL'EMILIA Position: exact | Code: IT0702A Name: TIMAVO 803513 | 2001 | 20.695 | µg/m3 | | | Media: Atmosphere (Outdoor Air) Sampling Matrix: air | Statistic Name: annual mean Aggregation Period: year Statistics Average Group: day Statistics Number Valid: 345 Statistics Percentage Valid: 94.521 |
| <input checked="" type="checkbox"/> | Country: Italy Name: BOLOGNA Position: exact | Code: IT1159A Name: PORTA SAN FELICE 803713 | 2002 | 20.344 | µg/m3 | | | Media: Atmosphere (Outdoor Air) Sampling Matrix: air | Statistic Name: annual mean Aggregation Period: year Statistics Average Group: day Statistics Number Valid: 320 Statistics Percentage Valid: 87.671 |

→ Click on 'Pick 53 Row(s)', the white text next to the small Shopping Basket icon:

Pick 53 Row(s) 

Showing 1-53 of 53


The number '1' appears at the top of the screen, next to the shopping basket icon 'Your basket', indicating that 1 sub-set of selected (picked-up) data has been added to the IPCHEM Basket.




3.8 Visualisation of selected data






→ Select the shopping basket icon of the menu bar and enter into the IPCHEM Basket tool.



→ Click on the  'Processing' icon to process the selected data and prepare a zip folder to download the datasets for offline analysis.




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 Home
  Search
  Your basket
  Your viewer
  Share


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Your Basket


Search:
Show 10 entries


| | | Chemical name | CAS | Country | Database | Criteria | Status | Viewer |
|---|-------------------------------------|---------------|---------|---------|----------|----------|------------------------|-------------------------------------------------------------------------------------|
| 1 | <input checked="" type="checkbox"/> | benzene | 71-43-2 | Italy | AIRBASE | + | to process (pick) [53] |  |

Showing 1 to 1 of 1 entries
 



1 European air quality database
European Environment Agency (EEA)

[Metadata Info](#)


Picked Measures 






Show/Hide Columns
Search:
Show 10 entries


| Chemical Name | CAS Number | Country Code | Country Name | Sample Source Code | Sample Source Name | Concentration Value | Unit of Measure | Sampling Date | LOD | LOQ | Media |
|---------------|------------|--------------|--------------|--------------------|-------------------------|---------------------|-----------------|---------------|------|------|--------------------------|
| benzene | 71-43-2 | ITA | Italy | IT1159A | PORTA SAN FELICE 803713 | 23.935 | µg/m3 | 2001 | null | null | Atmosphere (Outdoor Air) |
| benzene | 71-43-2 | ITA | Italy | IT0702A | TIMAVO 803513 | 20.695 | µg/m3 | 2001 | null | null | Atmosphere (Outdoor Air) |
| benzene | 71-43-2 | ITA | Italy | IT1159A | PORTA SAN FELICE 803713 | 20.344 | µg/m3 | 2002 | null | null | Atmosphere (Outdoor Air) |

→ Select the 'Viewer/globe' icon to enter the IPCHEM Viewer tool:

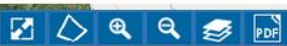


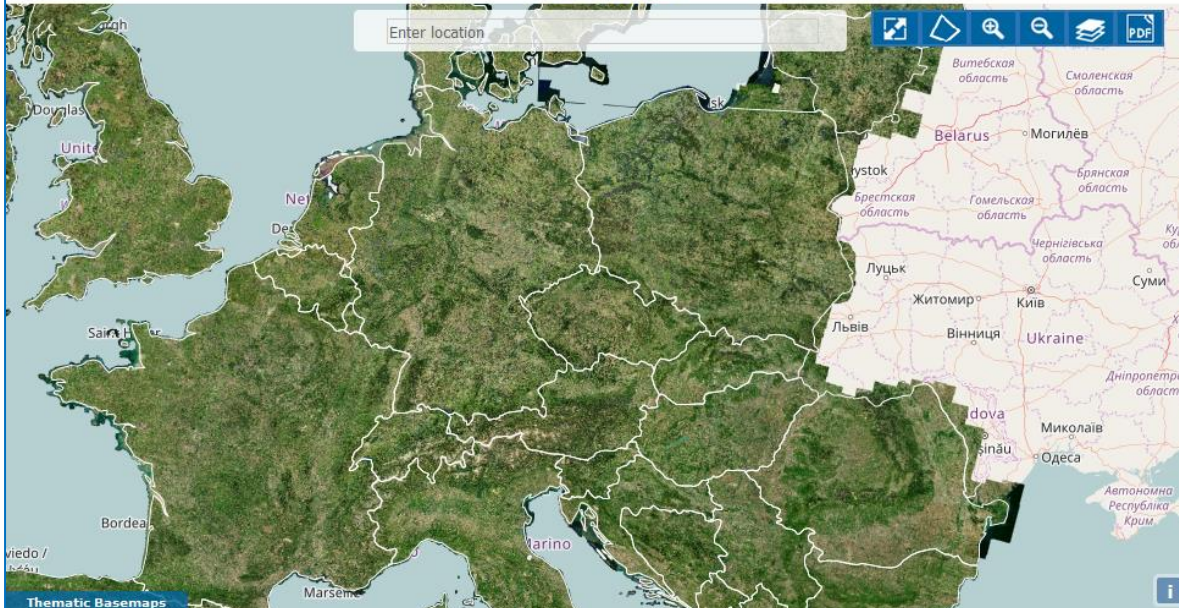
Each of the selected data that saved into the IPCHEM Basket tool is also available as spatial layer in the IPCHEM Viewer.

 Home
  Search
  Your basket
  Your viewer
  Share





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Your Viewer





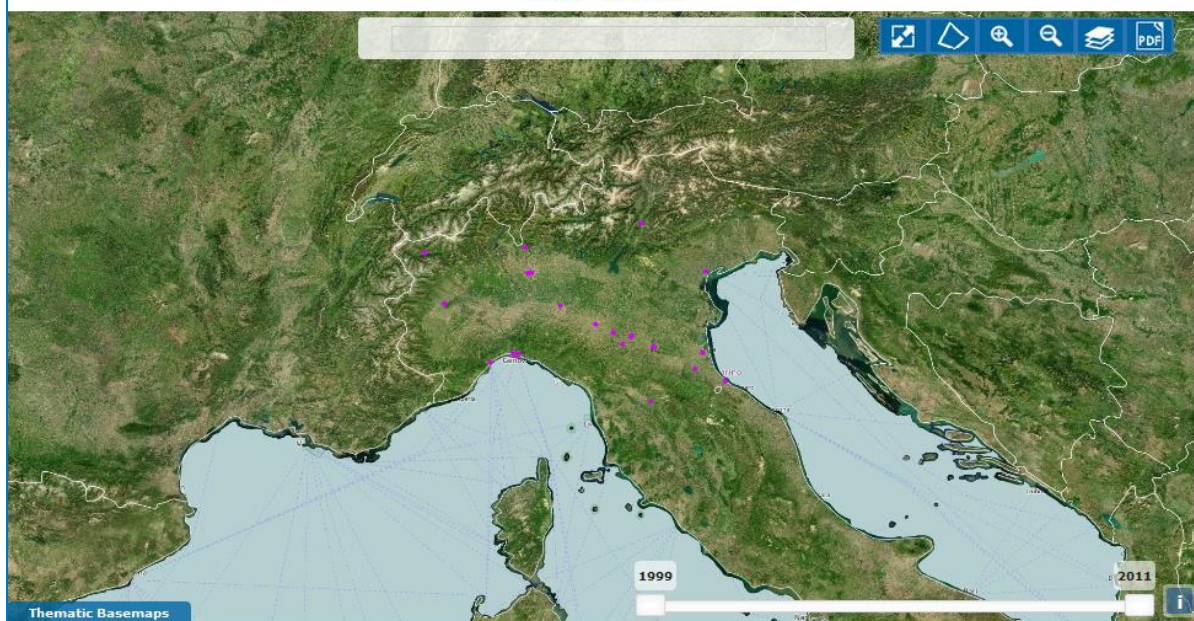
Thematic Basemaps

| Database | Chemical name | CAS | Country | Media | Actions |
|-------------------------------|---------------|---------|---------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| European air quality database | benzene | 71-43-2 | Italy | Atmosphere (Outdoor Air) | <input checked="" type="checkbox"/>    |




→ Pick-up the check-box in the 'Actions' column and then click on the '+' button to open the IPCHEM Editor Console.



Your Viewer



Query results

| Database | Chemical name | CAS | Country | Media | Actions |
|-------------------------------|---------------|---------|---------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| European air quality database | benzene | 71-43-2 | Italy | Atmosphere (Outdoor Air) | <input checked="" type="checkbox"/>    |

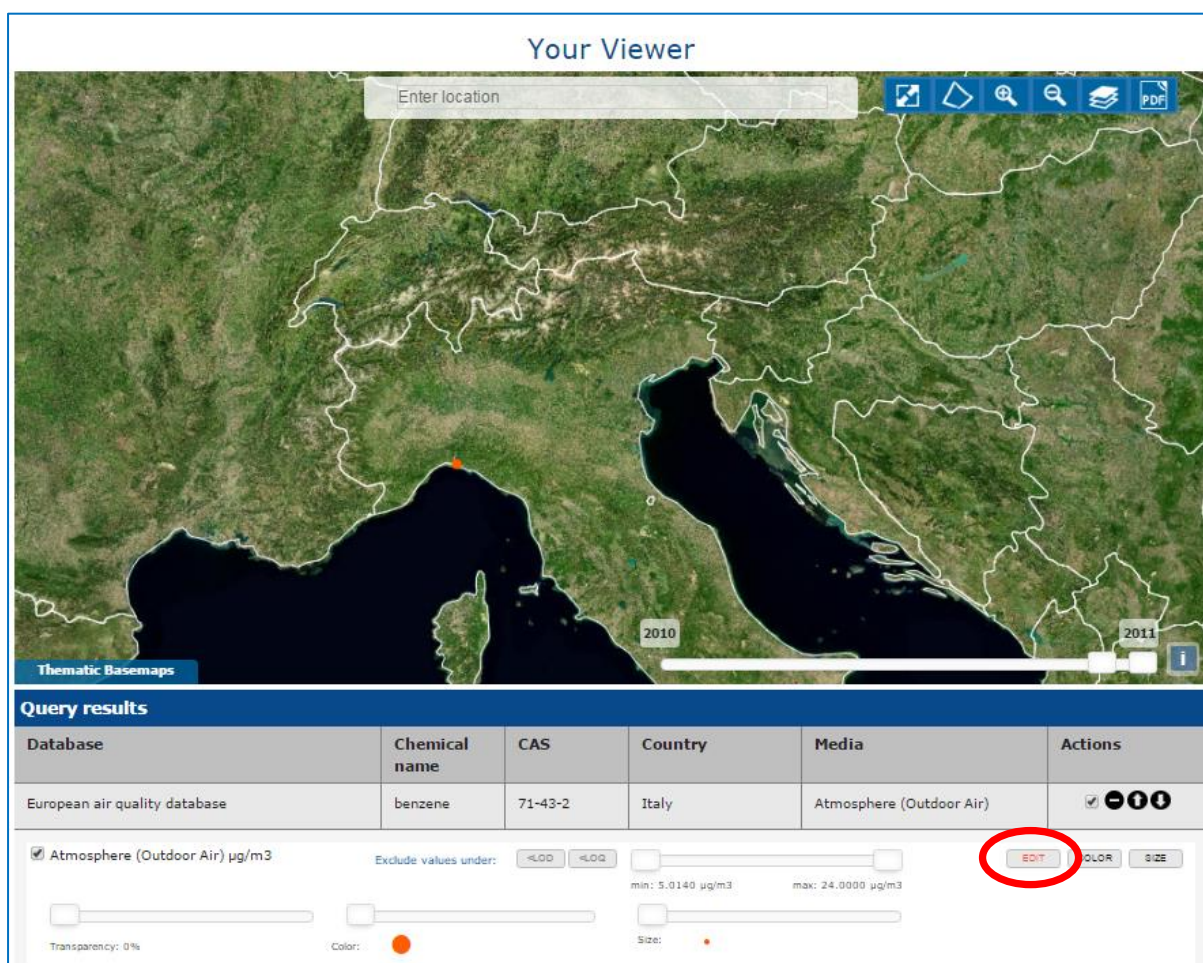
☒ Atmosphere (Outdoor Air) µg/m3

Exclude values under:

min: 5,0140 µg/m3 max: 23,9350 µg/m3

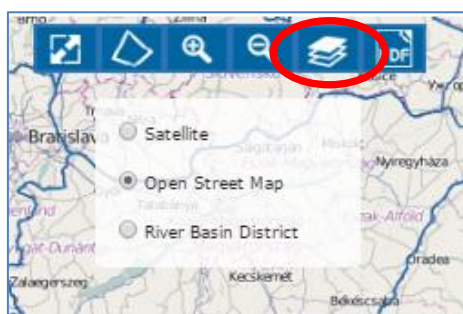
→ Select the time-period relevant for this case study and fine tune the data selection (2010-2011) by moving the time-slider accordingly.



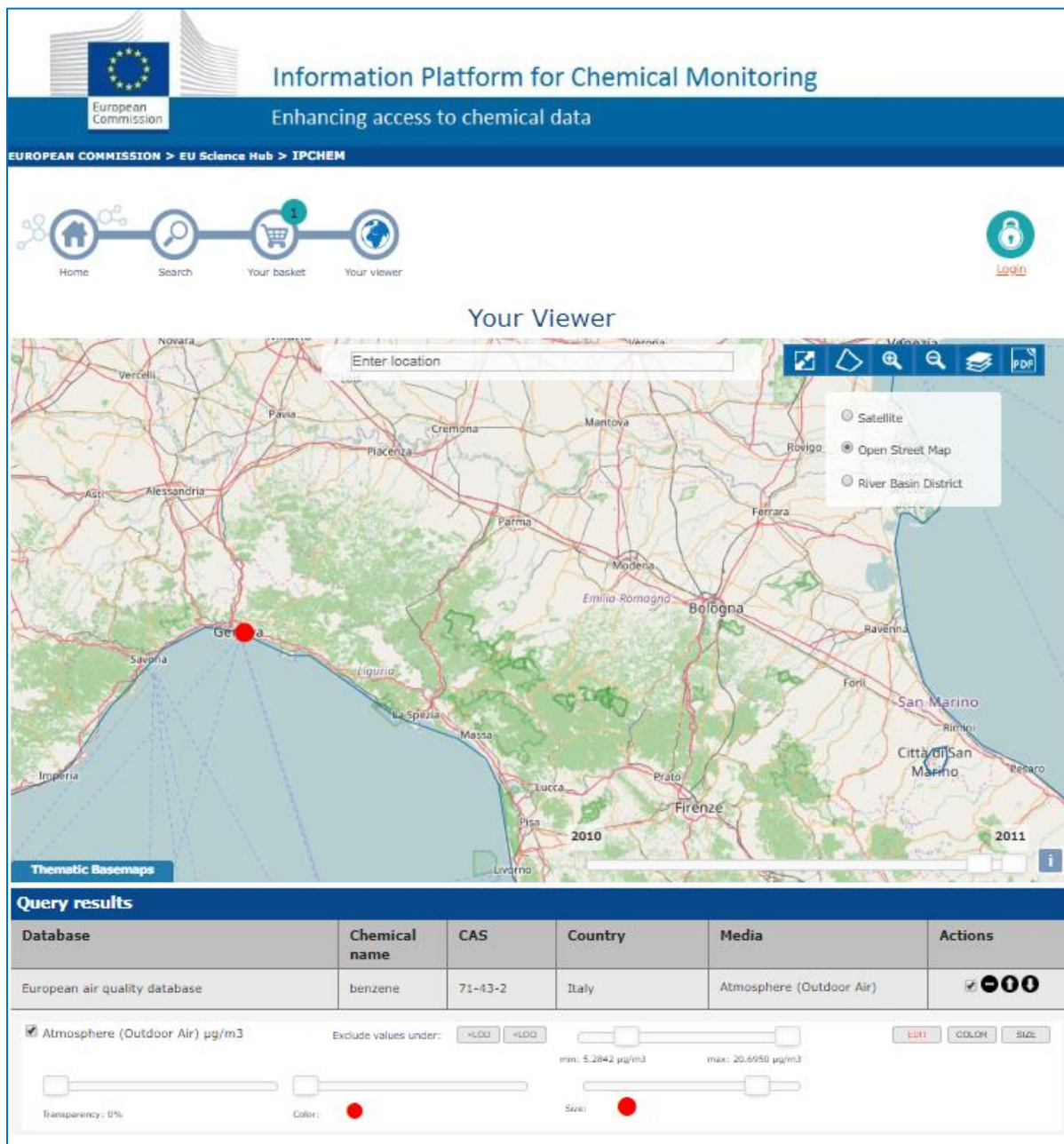


→ By selecting 'EDIT' from the IPCHEM Editor Console it is possible to change the 'colour', 'size' and transparency of the data (points) which are displayed onto the map.

For the delimited area of Northern Italy and the time period selected (2010-2011) only one point is displayed onto the map, representing the annual mean concentration value of benzene in AIRBASE exceeding the benzene concentration threshold limit of $5 \mu\text{g m}^{-3}$ in 2011.



→ Choose 'Open Street Map' as Basemap layer in the tool bar menu of the Viewer, to identify the name of the specific sampling data source location of interest.



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EUROPEAN COMMISSION > EU Science Hub > IPCHEM

Home Search Your basket Your viewer Login

Your Viewer

Enter location

Satellite Open Street Map River Basin District

Thematic Basemaps

| Database | Chemical name | CAS | Country | Media | Actions |
|-------------------------------|---------------|---------|---------|--------------------------|---------|
| European air quality database | benzene | 71-43-2 | Italy | Atmosphere (Outdoor Air) | ☑️ 📄 📊 |

☑️ Atmosphere (Outdoor Air) $\mu\text{g}/\text{m}^3$ Exclude values under: <LOQ <LOQ min: 5.2842 $\mu\text{g}/\text{m}^3$ max: 20.6958 $\mu\text{g}/\text{m}^3$ EDIT COLOR SIZE

Transparency: 0% Color: Size:

The city exceeding the limit value for benzene in 2011 is close by **GENOVA**.

This result is based only on the data retrieved from the 'AIRBASE' database. Other queries can be launched for the same compound (benzene searched in different databases). This would result in identifying additional concentration data that can be stored into the IPCHEM Basket and displayed onto the IPCHEM Viewer, thus facilitating comparison and evaluation of benzene concentration data found in different databases.