Ricardo Energy & Environment

Open Data Services for Air Quality Scotland

Tony Bush
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Agenda for this session

- Introduction to Open Data Services?

- Why have they been introduced?

- What are the benefits & objectives?

- Demonstration of the new Air Quality Scotland open data services

- Some helpful URLs to wider open data sharing initiatives

What are Open Data Services for air quality?

- A new data sharing mechanism for Air Quality Scotland & Europe

- A mechanism based on recognised internet & open data standards

- Data download can be automated

- Machine readable – based on XML encoding

- Support machine to machine data exchange

- Easily configurable to be human readable

- An API type interface to Air Quality Scotland

- Harmonised data model & vocabulary for Europe

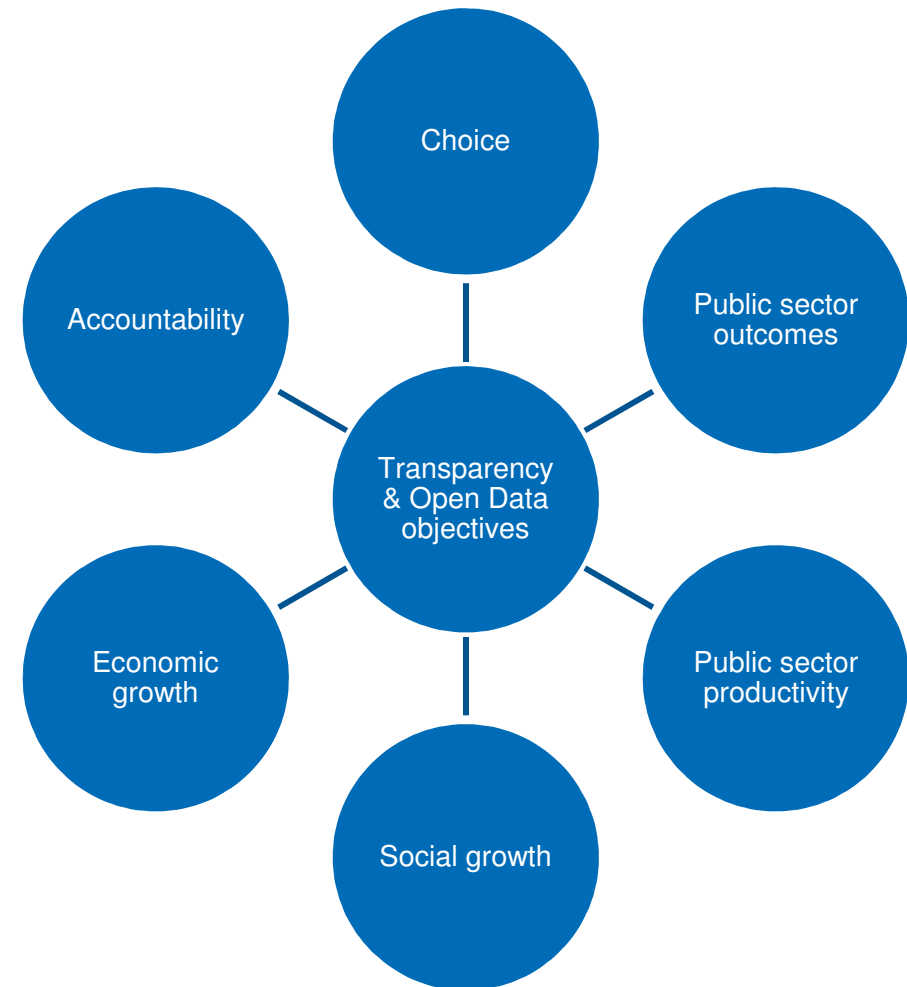- 28+ countries across Europe using the same air quality language

Why are they needed?

Multiple drivers

- Changing data landscape, many common themes and drivers
- The Ambient Air Quality Directive e-Reporting
- INSPIRE Directive
- Cabinet Office Transparency and Open Data agenda committed Government at all levels to
  - A 'right to data'
  - Releasing the potential of Public Sector Information wherever possible
- Changing appetite in the developer community

Objectives

- Better evidence base
- Better data sharing
- Better data governance

Choice

Public sector outcomes

Accountability

Transparency & Open Data objectives

Economic growth

Public sector productivity

Social growth

Core supporting work

European Air Quality e-Reporting initiative

- Air Quality Scotland's Open Data Services are based on the European e-Reporting data model

- AQ e-Reporting is outcome of the modernisation programme for reporting under the Air Quality Directive

- AQ e-Reporting provides a new framework for reporting AQ information at a European level under the Air Quality Directive

- Upgrades standards for data encoding and sharing

- Streamlines duplication in reporting

- Reinforces internal consistency

- Uses machine readable formats to facilitate automated sharing QA/QC & processing

- Uses INSPIRE principles, concepts and standards
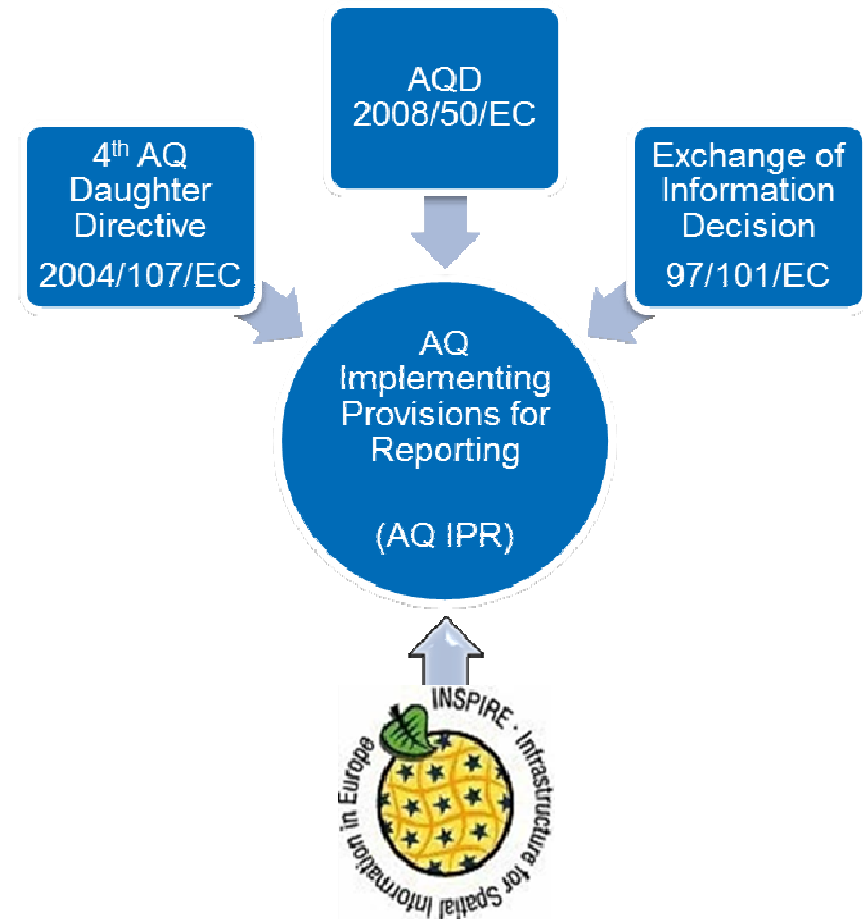
What does it mean in practice ?

- Human readable reports & report content

- Decision 2004/461/EC, spreadsheet template Form 2 (+ shapefiles)

Form 2 Delimitation of zones and agglomerations (96/62/EC Articles 5 and 11(1b) and 2008/50/EC Articles 4 and 22)					
	Zones				
Full zone name	Greater London Urban Area	West Midlands Urban Area	Greater Manchester Urban Area	West Yorkshire Urban Area	Tyneside
Zone code	UK0001	UK0002	UK0003	UK0004	UK0005
Pollutant(s), possibly separate protection targets, to which the zone applies	A;M	A;M	A;M	A;M	A;M
Type (ag/nonag)	ag	ag	ag	ag	ag
Area (km^2)	1618	605	554	352	221
Population	7807696	2120435	1863849	1176821	731847
Art.22 application	P				
Zone boundary source (geospatial file/ LAU2 list)	+513325.59-000544.48	+523725.58-015507.47	+533841.75-021836.50	+535315.87-014401.38	+545738.94-013634.29
Zone geospatial file name	+512434.95+000558.27	+523623.09-015627.34	+533823.50-021903.59	+535257.63-014334.11	+545704.83-012712.46
LAU2 code(s)	+512434.02+000650.00	+523623.06-015534.17	+533855.86-021903.83	+535257.75-014428.88	+545705.07-012808.67
	+512434.02+000650.00	+523655.43-015534.12	+533856.00-021809.37	+535330.11-014428.68	+545705.32-012904.89

What does it mean in practice ?

- Become machine readable

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<!-- Created by GO Publisher Desktop 2.1.2 Build 28125 from 2012-03-22 11:26 -->
<!-- Snowflake Software Ltd. (http://www.snowflakesoftware.com)  -->
<gml:FeatureCollection xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:wfs="http://www.opengis.net/wfs/2.0" xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:fes="http://www.opengis.net/fes/2.0" xmlns:aqd="http://aqd.ec.europa.eu/aqd/0.2" xmlns:base="urn:x-inspire:specification:gmlas:BaseTypes:3.2"
  xmlns:gmd="http://www.isotc211.org/2005/gmd" xmlns:gco="http://www.isotc211.org/2005/gco" xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:gss="http://www.isotc211.org/2005/gss"
  xmlns:gts="http://www.isotc211.org/2005/gts" xmlns:gsr="http://www.isotc211.org/2005/gsr" xmlns:base2="http://inspire.ec.europa.eu/schemas/base2/0.1rc2" xmlns:sc="http://www.interactive-
instruments.de/ShapeChange/AppInfo" xmlns:ad="urn:x-inspire:specification:gmlas:Addresses:3.0" xmlns:bu="http://inspire.jrc.ec.europa.eu/schemas/bu/2.0" xmlns:tn-a="urn:x-
inspire:specification:gmlas:AirTransportNetwork:3.0" xmlns:tn="urn:x-inspire:specification:gmlas:CommonTransportElements:3.0" xmlns:gn="urn:x-inspire:specification:gmlas:GeographicalNames:3.0" xmlns:net="urn:x-
inspire:specification:gmlas:Network:3.2" xmlns:au="urn:x-inspire:specification:gmlas:AdministrativeUnits:3.0" xmlns:su-nuts="http://inspire.jrc.ec.europa.eu/schemas/su-nuts/2.0" xmlns:su-
vector="http://inspire.jrc.ec.europa.eu/schemas/su-vector/2.0" xmlns:su-core="http://inspire.jrc.ec.europa.eu/schemas/su-core/2.0" xmlns:hh="http://inspire.jrc.ec.europa.eu/schemas/hh/2.0"
  xmlns:ef="http://inspire.jrc.ec.europa.eu/schemas/ef/2.0" xmlns:om="http://www.opengis.net/om/2.0" xmlns:sd="http://inspire.jrc.ec.europa.eu/schemas/sd/2.0" xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"
  xmlns:swe="http://www.opengis.net/swe/2.0" xmlns:cp="urn:x-inspire:specification:gmlas:CadastralParcels:3.0" xmlns:am="http://inspire.ec.europa.eu/schemas/am/3.0rc2"
  xmlns:ompr="http://inspire.ec.europa.eu/schemas/ompr/2.9" xmlns:sams="http://www.opengis.net/samplingSpatial/2.0" xmlns:sam="http://www.opengis.net/sampling/2.0"
  xsi:schemaLocation="http://www.opengis.net/wfs/2.0 http://schemas.opengis.net/wfs/2.0/wfs.xsd http://aqd.ec.europa.eu/aqd/0.2 http://dd.eionet.europa.eu/schemas/id2011850eu_v05/AirQualityReporting.xsd"
  gml:id="zones">
- <gml:featureMember>
  - <aqd:AQD_ReportingHeader gml:id="ReportingHeader_1">
      <aqd:change>false</aqd:change>
      <aqd:changeDescription>Information has not been change since 2000</aqd:changeDescription>
    + <aqd:inspireId>
    + <aqd:reportingAuthority>
    - <aqd:reportingPeriod>
      - <gml:TimePeriod gml:id="ReportingTimePeriod_1">
          <gml:beginPosition>2010-01-01T00:00:00.000</gml:beginPosition>
          <gml:endPosition>2011-01-01T00:00:00.000</gml:endPosition>
        </gml:TimePeriod>
      </aqd:reportingPeriod>
    - <aqd:content>
      - <aqd:AQD_Zone gml:id="Zone_UK0001">
        - <am:inspireId>
          - <base:Identifier>
              <base:localId>LOCAL_ID_0</base:localId>
              <base:namespace>AQD_UK</base:namespace>
            </base:Identifier>
          </am:inspireId>
        + <am:name>
        - <am:geometry>
          - <gml:Polygon gml:id="FID_1" srsName="urn:ogc:def:crs:EPSG::27700">
            - <gml:exterior>
              - <gml:LinearRing>
                  <gml:posList srsDimension="2">527336.6875 159888.671875 527355.75 159897.265625 527355.125 159899.109375 527438.875 159946.5 527581.5 159951.96875 527600.75
                  159968.625 527637 159999.953125 527587.5 160204.546875 527609.875 160398.25 527685.4375 160401.359375 527692.125 160456.15625 527721.6875 160336.75 527648.25
                  160305.3125 527664.5625 160265.734375 527724.5625 160274.484375 527769.9375 160152.140625 527771.875 160035.15625 527852.75 160076.890625 527859.6875
                  160054.03125 527810.3125 159969.578125 527728.3125 159945.5 527701.5 159888.09375 527709.5625 159917.0625 527671.9375 159904.78125 527648.3125 159897.0625
                  527665.8125 159729.609375 527638 159394.640625 527791.0625 159389.203125 527882.875 159385.953125 527844.1875 159281.0625 527819.3125 159213.703125 527826.5
                  159159.703125 527941.125 159035.609375 528060.125 159046.015625 528091 159048.71875 528245.8125 159207.25 528187.3125 159432.1875 528561.125 159648.953125
                  528414.625 159899.5 528358.25 159916.65625 528287.3125 160000 528194 160160.765625 528468 160306.828125 528456.875 160375.40625 528572 160416.578125
```

What's included in Air Quality Scotland's beta services?

Better attribute data
- Large gap filling task carried out
- Ensured consistency data holdings
- Needed to support the e-Reporting data model

A register of air quality objects
- AQ objects (stations, sampling points, inlets) identified by persistent http IDs
- Http IDs make attribute data accessible via the internet
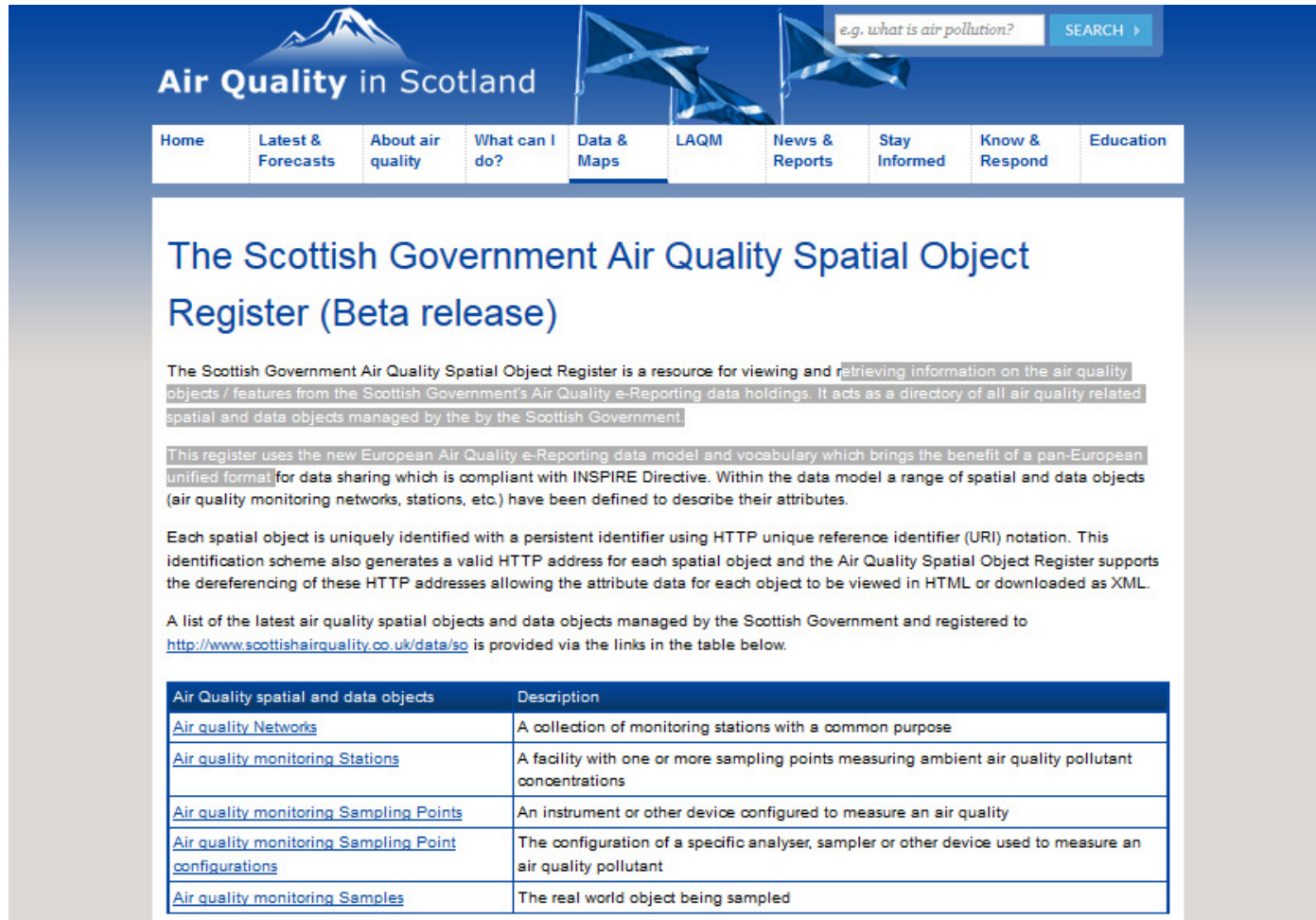
Atom feeds for bulk downloads
- Support for users wanting to download lots of data
- INSPIRE compliant download service

Sensor Observation Service (SOS)
- User driven API type interface
- Fast & flexible (XML, JSON, REST, SOAP etc.)
- INSPIRE compliant download service

Air Quality Scotland Spatial Objects Register

- Supports governance of Air Quality Scotland & UK air quality data holdings
- http://preview.scotarc.aeat.com/data/so/about/

Air Quality Scotland Spatial Objects Register

- Supports governance using persistent http identifiers for all Air Quality Scotland objects
- http://preview.scotarc.aeat.com/data/so/stations/

Air Quality Scotland Spatial Objects Register

- Supports human readable content
- http://preview.scotarc.aeat.com/data/so/SCT_Station_ABD

Air Quality e-Reporting Attribute Data for Scottish Stations
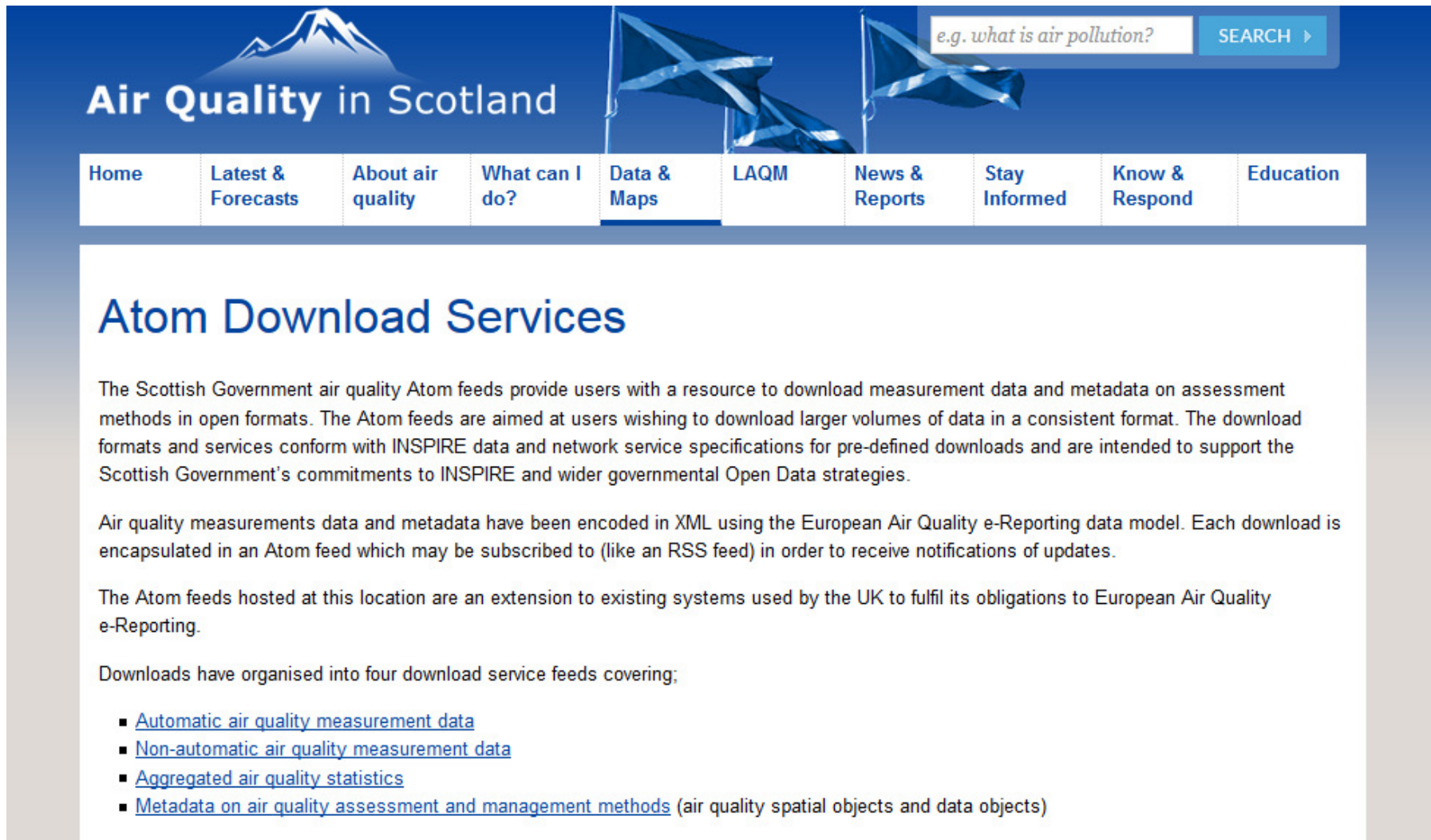
gml:id	SCT_Station_ABD	
base:Identifier	base:localId	SCT_Station_ABD
	base:namespace	http://www.scottishairquality.co.uk/data/so
	base:versionId	17-03-2016
ef:name	Aberdeen Errol Place	
gml:Point/srsName	urn:ogc:def:crs:EPSG::4258	
gml:Point/gml:pos	57.157360 -2.094278	
aqd:municipality		
ef:measurementRegime	http://dd.eionet.europa.eu/vocabulary/inspire/MeasurementRegimeValue/continuousDataCollection	
ef:mobile	false	
gml:TimePeriod	gml:beginPosition	1999-09-18T12:00:00Z
	gml:endPosition	
ef:belongsTo	http://www.scottishairquality.co.uk/data/so/SCT_Network_1	
aqd:natlStationCode	Aberdeen Errol Place	
aqd:EUStationCode	not-applicable	
aqd:stationInfo	http://www.scottishairquality.co.uk/latest/site-info?site_id=ABD	
aqd:areaClassification	http://dd.eionet.europa.eu/vocabulary/aq/areaclassification/urban	
aqd:altitude	5	
aqd:areaClassification	http://dd.eionet.europa.eu/vocabulary/aq/areaclassification/urban	

Air Quality Scotland Spatial Objects Register

- Supports machine readable content

- http://preview.scotarc.aeat.com/data/so/SCT_Station_ABD?format=application/xml

```xml
-<gml:FeatureCollection xsi:schemaLocation="http://dd.eionet.europa.eu/schemaset/id2011850eu-1.0 http://dd.eionet.europa.eu/schemas/id2011850eu-1.0/AirQualityReporting.xsd" gml:id="SCT_Station">
  -<gml:featureMember>
    -<aqd:AQD_Station gml:id="SCT_Station_ABD">
      -<ef:inspireId>
        -<base:Identifier>
            <base:localId>SCT_Station_ABD</base:localId>
            <base:namespace>http://www.scottishairquality.co.uk/data/so</base:namespace>
            <base:versionId>17-03-2016</base:versionId>
        </base:Identifier>
      </ef:inspireId>
      <ef:name>Aberdeen Errol Place</ef:name>
      <ef:mediaMonitored xlink:href="http://inspire.ec.europa.eu/codeList/MediaValue/air"/>
      -<ef:geometry>
        -<gml:Point srsName="urn:ogc:def:crs:EPSG::4258" gml:id="Point_1">
            <gml:pos srsDimension="2">57.157360 -2.094278</gml:pos>
        </gml:Point>
      </ef:geometry>
      <ef:measurementRegime xlink:href="http://dd.eionet.europa.eu/vocabulary/inspire/MeasurementRegimeValue/continuousDataCollection" xsi:nil="true"/>
      <ef:mobile>false</ef:mobile>
      -<ef:operationalActivityPeriod>
        -<ef:OperationalActivityPeriod gml:id="StationActivity_1">
          -<ef:activityTime>
            -<gml:TimePeriod gml:id="TimePeriod_content_1">
                <gml:beginPosition>1999-09-18T12:00:00Z</gml:beginPosition>
                <gml:endPosition indeterminatePosition="unknown"/>
            </gml:TimePeriod>
          </ef:activityTime>
        </ef:OperationalActivityPeriod>
```

Air Quality Scotland Atom feeds

- Support bulk download of historical data

- http://preview.scotarc.aeat.com/data/atom-dls/

Air Quality Scotland Sensor Observation Service

- Supports automated user configured data of discrete data sets
- http://preview.scotarc.aeat.com/data/sos/about/

Air Quality Scotland Sensor Observation Service

- Send a request to the SOS via URL form or POST request

http://sos.staging.ricardo-aea.com/sos-scotland/service?service=AQD&version=1.0.0&request=GetObservation&observedProperty=http://dd.eionet.europa.eu/vocabulary/aq/pollutant/5&temporalFilter=om:phenomenonTime,After,2016-01-01T00:00:00.000Z

http://sos.staging.ricardo-aea.com/sos-scotland/service?service=AQD&version=1.0.0&request=GetObservation&observedProperty=http://dd.eionet.europa.eu/vocabulary/aq/pollutant/5&temporalFilter=om:phenomenonTime,After,2016-03-21T00:00:00.000Z

```
-<gml:FeatureCollection xsi:schemaLocation="http://www.opengis.net/om/2.0 http://schemas.opengis.net/om/2.0/observation.xsd http://dd.eionet.europa.eu/schemaset/id2011850eu-1.0
  http://dd.eionet.europa.eu/schemas/id2011850eu-1.0/AirQualityReporting.xsd http://www.opengis.net/swe/2.0 http://schemas.opengis.net/sweCommon/2.0/swe.xsd http://www.opengis.net/gml/3.2
  http://schemas.opengis.net/gml/3.2.1/gml.xsd" gml:id="fc_5087CF5512B06B7F4E6DF951D9BBDD5F07159DEA">
 -<gml:featureMember>
  -<aqd:AQD_ReportingHeader gml:id="CCACEAED1DCDE9EB64FF557579082E682FF13CCE">
     <aqd:change>false</aqd:change>
     <aqd:changeDescription/>
   -<aqd:inspireId>
    -<base:Identifier>
       <base:localId>SCT_E2a#</base:localId>
       <base:namespace>http://www.scottishairquality.co.uk/data/so</base:namespace>
       <base:versionId xsi:nil="true" nilReason="missing"/>
     </base:Identifier>
   </aqd:inspireId>
   -<aqd:reportingAuthority>
    -<base2:RelatedParty>
     -<base2:individualName>
        <gco:CharacterString>Andrew Taylor</gco:CharacterString>
      </base2:individualName>
     -<base2:organisationName>
      -<gco:CharacterString>
         Scottish Government, Directorate For Environment &amp; Forestry, Environmental Quality
       </gco:CharacterString>
      </base2:organisationName>
```

Benefits of the new Open Data Services for Air Quality Scotland

Standardisation
- Modern IT & open standards
- Harmonised data model for Europe

INSPIRE compliance
- INSPIRE compliant data specifications
- INSPIRE compliant download services

Alignment with Open Data Strategies
- Air quality e-Reporting & INSPIRE align well with Governmental & Departmental strategies

Better Governance
- Rigorous data model
- Data model optimised for air quality

Better sharing
- More choice
- Modern IT & open standards
- Machine readable

Some useful URLs to similar initiatives

- **European Air Quality e-Reporting Portal**

  http://www.eionet.europa.eu/aqportal

- **European up-to-date data viewer**

  http://maps.eea.europa.eu/hub/AirQuality/

- **European Air Data Explorer (AIDE)**

  http://aide.apps.eea.europa.eu/?source={%22query%22:{%22match_all%22:{}},%22sort%22:[{%22Namespace%22:{%22order%22:%22asc%22}},{%22ReportingYear%22:{%22order%22:%22asc%22}}]}

- **European up-to-date data download service**

  http://discomap.eea.europa.eu/map/fme/AirQualityUTDExport.htm

Tony Bush
Apertum Consulting
tony.bush@apertum.co.uk

Questions?