API SPECIFICATION

WEB SERVICES FOR EXTERNAL ORGANISATIONS

DOCUMENT MANAGEMENT

1.1 Document Revision History

Version	Revision Date	Revised by	Section and change/s
0.1	26 Apr 2017	Michael Stringer	Draft for review by core stakeholders including EMV.
1.2	9 Jun 2017	Michael Stringer	Draft for circulation to external organisations for comment.
1.3	4 July 2017	Michael Stringer	Version for public release.

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2 INTRODUCTION

2.1 Document Purpose

The primary purpose of this document is technical documentation of the web service necessary to provide Emergency Management Victoria (EMV), and other interested external organisations, access to **all** air quality data that the EPA collects from both long-term (fixed) and incident air monitoring sites.

Use of these web service occurs within the Terms of Use stated in the Appendix.

2.2 Document Structure and Content

These web services are the means by which other IT professionals, primary those working for external organisations, but also those working on other EPA systems, will gain access to air quality data. This document provides the technical specification for the web services from an external perspective. The web services provide access to air quality data for the following users:

- IT professionals
- External users
- EPA users

As such this document contains the following content:

- Structure and return results of the web services, with the conceptual model presenting the business meaning of the return results.
- Business rules that the web services must apply.
- The technical constraints and context in which the web services must operate.

This document uses Unified Modelling Language (UML) to structure this content.

2.3 Web Service URLs

The URLs for the summary web services comprise the following:

http://sciwebsvc.epa.vic.gov.au/aqapi/Sites2DayAirQuality

Returns the last 2 days of air quality measurements for all operating sites.

http://sciwebsvc.epa.vic.gov.au/aqapi/GetAirQualityAirDataList

Returns the last 2 days of air quality measurements for all operating sites (provided to support existing web sites).

http://sciwebsvc.epa.vic.gov.au/aqapi/ StationData?pointid=99999

Returns the last 2 days of air quality measurements for a specific site.

http://sciwebsvc.epa.vic.gov.au/aqapi/SitesHourlyAirQuality

Returns in a structure suitable for tabular presentation all air quality measurements for a single specified hour for all operating sites.

The URLs for the foundation web services comprise the following. These web services have parameters.

http://sciwebsvc.epa.vic.gov.au/aqapi/sites

List of air quality monitoring sites operating during a specific time period.

http://sciwebsvc.epa.vic.gov.au/aqapi/monitors

List of physical characteristics (monitors or parameters) of air measured at a specific site over a specific time period – examples include CO, NO_2, or $PM_{2.5}$.

http://sciwebsvc.epa.vic.gov.au/aqapi/timebasis

List of time intervals for air quality measurements made for a specific monitor at a specific site over a time period – examples include 5-minute average 1-hour average measurements of CO. The EPA stores measurements for multiple time basis for each monitor.

http://sciwebsvc.epa.vic.gov.au/aqapi/measurements

List of air quality measurements made, and associated analysis such as Air Quality Index, for a specific time basis and monitor, and at a specific site, over a specific time period – for example, 5-minute average measurement values for CO taken at Alphington from 1 July to 31 December 2016.

All web services return data in an XML or JSON structure with no associated style information. The calling application can set the content type returned in the call header.

3 WEB SERVICES

Because this document applies directly to functionality of the web services, including how they analyse and present data, it is organised around the web services (as use cases) and the underlying conceptual model.

3.1 Overall Functionality

This set of constraints applies to the data in whichever web service it appears.

Function ID	Description
F006	All date and time values define the start of the time period that the date and time value identifies. For example 14:00 identifies the 14:00 to 15:00 time period.
F007	Unless otherwise specified by parameters sent to the web services, they return Measurements for 1-hour average, and 8-hour and 24-hour rolling averages calculated hourly.
F009	All web services are accessible to the public. There is no security on access to the services.

3.2 Web service = Sites

Purpose: Provide a list of locations (Sites) at which the EPA operated air quality monitoring equipment for a time period.

Context: First of the four 'foundation' web services that provide access to all air quality data that the EPA has collected. The first three foundation web services provide reference data necessary for the fourth Measurements service, which provides the air quality measurement data.

Call Parameters

If any parameters are required, all the parameters in the table below need to be used.

Parameter	Description	Data Type
monitoringPurpose	Code number identifying the purpose of the air quality monitoring. Use 1010.	Integer
fromDate	The start date of the date range during which air monitoring was operational, provided as text in the format 'YYYYMMDD', with leading zeros for month and day as necessary.	Text
toDate	The end date of the date range during which air monitoring was operational, provided as text in the format 'YYYYMMDD'.	Text

The link below is an example service call with parameters:

http://sciwebsvc.epa.vic.gov.au/aqapi/Sites?monitoringPurpose=1010&fromDate=20100101&toDate=20171231

Returned Data

The JSON/XML return data comprises the following members.

Member	Description	Data Type
NumberOfSites	Number of Sites operating in the time period.	Integer
Parameters	Values of the parameters passed to the service.	Text
ServiceName	Name of the called service.	Text
Sites	Array of Site elements containing details of a monitoring Site.	JSON/XML object
Version	Version of the web service.	Text
…Sites members		
SiteID	Unique identifier for the Site used in other web service calls.	Integer

Name	Site: name value.	Text
Latitude	Site:latitude value.	Decimal 10,6
Longitude	Site:longitude value.	Decimal 10,6
FireHazardCategory	The Health Category for the current 1-hour period when applicable to the Monitor (Parameter) and Time Basis. The integer translates to the level as 1 = 'Low'	Integer
IsStationOffline	Indicates whether the Site is offline.	Boolean
HasIncident	Indicates whether the Site has an incident type = Incident Tier 2	Boolean
IncidentType	Sites: site type, which is the text description associated with the_incident_type_flag.	Text
SiteList	JSON/XML member	
IncidentSite	JSON/XML member	
…SiteList		
Name	The Site List:name value associated with the Site.	Text
…IncidentSite		
EMVUrl	URL to EMV site for the incident.	Text
IncidentIcon	URL reference to the icon to indicate an 'incident' site.	Text

3.3 Web service = Monitors

Purpose: Provide a list of Monitors measured at a specific Site within a time period. A Monitor represents a chemical or physical property of the air at the Site, such as CO or NO_2 concentration, or the density of suspended particulate matter. (Dust and smoke are common forms of particulate matter suspended in air.) A common synonym for Monitor is Parameter.

Context: Second of the four 'foundation' web services that provide access to all the air quality data that the EPA measures. The first three foundation web services provide reference data necessary for the fourth Measurements service, which provides the air quality measurement data.

Call Parameters

Parameter	Description	Data Type
siteId	Code number identifying the Site at which the EPA monitors air quality, which the Sites service list – mandatory.	Integer
fromDate	The start date of the date range during which air monitoring was operational, provided as text in the format 'YYYYMMDD' – mandatory.	Text
toDate	The end date of the date range, provided as text in the format 'YYYYMMDD' - mandatory. The maximum date range is 183 days.	Text

The link below is an example service call with parameters:

http://sciwebsvc.epa.vic.gov.au/aqapi/Monitors?siteId=10107&fromDate=20160101&toDate=20160630

Returned Data

The JSON/XML return data comprises the following members.

Member	Description	Data Type
ServiceName	Name of the called service.	Text
Version	Version of the web service.	Text
Parameters	Values of the parameters passed to the service.	Text
NumberOfMonitors	Number of Monitors (parameters) measured for the Site in the date range.	Integer
Monitors	Array of Monitor elements containing details of what is measured at the Site.	JSON/XML object

…Monitors members		
MonitorId	Unique identifier for the Monitor used in other web service calls.	Text
ShortName	Short name of the Monitor for use in presentation on graphs and tables.	Text
CommonName	Full name of the Monitor for use when space permits.	Text
EPADescriptionURL	Location of detailed information describing the Monitor and how the EPA measures it.	Text (URL)
UnitOfMeasure	Units for Measurements of the Monitor.	Text
PresentationPrecision	Number of decimal points that should be presented in the Measurement values.	Integer
EquipmentType	JSON/XML object with information on the equipment used to measure the Monitor. This helps differentiate between different Monitors that cover the same physical attribute measured, such as $PM_{2.5}$, which the EPA measures using two different equipment types.	JSON/XML object
SiteID	The Site:point id value.	Text
…EquipmentType members		
IdNumber	IdNumber of the Equipment Type.	Integer
Code	Short descriptive code for the Equipment Type.	Text
Description	Description of the Equipment Type.	Text

3.4 Web service = Timebasis

Purpose: Provide a list of the Time Basis over which the EPA measures each Monitor at each Site. The most commonly calculated and presented Time Basis is a 1-hour average Measurement (1HR_AV). The most detailed available Time Basis is 5MIN_AV. Other Time Basis that the EPA currently use comprise 8-hour rolling average, calculated hourly, for CO, and 24-hour rolling average, calculated hourly, for $PM_{2.5}$.

Context: Third of the four 'foundation' web services that provide access to all the air quality data that the EPA measures. The first three foundation web services provide reference data necessary for the fourth Measurements service, which provides the air quality measurement data.

Call Parameters

Parameter	Description	Data Type
siteId	Code number identifying the Site at which the EPA monitors air quality, which the Sites service list – mandatory.	Integer
monitorID	ID string for a Monitor measured at the Site.	Text
fromDate	The start date of the date range during which air monitoring was operational, provided as text in the format 'YYYYMMDD' – mandatory.	Text
toDate	The end date of the date range, provided as text in the format 'YYYYMMDD' - mandatory. The maximum date range is 183 days, but without the MonitorID value it is recommended that only use a short date range - mandatory.	Text

The link below is an example service call with parameters:

http://sciwebsvc.epa.vic.gov.au/aqapi/Timebasis?siteId=10107&monitorId=BPM2.5&fromDate=20160101&toDate=20160630

Returned Data

The JSON/XML return data comprises the following members.

Member	Description	Data Type
ServiceName	Name of the called service.	Text
Version	Version of the web service.	Text
Parameters	Values of the parameters passed to the service.	Text

NumberOfTimeBasis	Number of Time Basis calculated for the Monitor(s) at the Site in the date range.	Integer
TimeBasis	Array of Time Basis elements containing details of what Time Basis are applied to Measurements at the Site.	JSON/XML object
…TimeBasis members		
TimeBaseId	Unique identifier for the Time Basis used in other web service calls.	Text
Description	Explanation of the Time Basis.	Text
IsRollingAverage		
RollingAveragePeriod		
MinDataPercent		
TimeBasisDescURL	Location of detailed information describing the Time Basis and how the EPA calculates it.	Text (URL)
MonitorId	Unique identifier for the Monitor to which the Time Basis is applied.	Text
MonitorName	Full name of the Monitor.	Text
ShortName	Short name of the Monitor.	Text
SiteID	The Site:point id value.	Text
MonitorTimeBasis	JSON/XML object with information that the EPA uses to apply business rules for the presentation of air quality data.	JSON/XML object
…MonitorTimeBasis members		
AQIPollutantStandard	The Air Quality Index (AQI) value for a pollutant Measurement equals the measured value divided by the AQI Pollutant Standard.	Number
IncidentType		
PresentationOrder	Order in which the Time Basis Measurement should be presented relative to other Time Basis Measurements.	Integer
CalcAQI	Whether the web services calculate an AQI value for a specific Measurement of a specific Monitor and Time Basis.	Boolean
CalcHealthCategory	Whether the web services calculate a health category for a specific Measurement of a specific Monitor and Time Basis.	Boolean
MonitorId		Text
TimeBasisId		Text

3.5 Web service = Measurements

Purpose: Provide a set of air quality Measurements that the EPA has made for a specific Monitor at a specific Site over a specific date range. For example CO measurements made in Geelong South from 1 Jan 2000 to 30 Jun 2000, or PM_{10} measurements made at Alphington on 7 Feb 2009.

Context: Fourth of the four 'foundation' web services that provide access to all the air quality data that the EPA measures. This foundation services provides the air quality measurement data.

Call Parameters

Parameter	Description	Data Type
siteId	Code number identifying the Site at which the EPA monitors air quality, which the Sites service list – mandatory.	Integer
monitorID	ID string for a Monitor measured at the Site – mandatory	Text
timeBasisId	ID string for the Time Basis of the Measurements, for example 1HR_AV or 24HR_RAV – mandatory.	Text
fromDate	The start date of the date range for the Measurements, provided as text in the format 'YYYYMMDDHH' – mandatory. 'HH' is the hour in 24-hour time format.	Text
toDate	The end date of the date range, provided as text in the format 'YYYYMMDDHH' - mandatory. The maximum date range is 183 days.	Text

The link below is an example service call with parameters:

http://sciwebsvc.epa.vic.gov.au/aqapi/Measurements?siteId=10001&monitorId=PM10&timebasisid=1HR_AV&fromDate=2009020706&toDate=2009020723

Returned Data

The JSON/XML return data comprises the following members.

Member	Description	Data Type
ServiceName	Name of the called service.	Text
Version	Version of the web service.	Text
Parameters	Values of the parameters passed to the service.	Text
NumberOfMeasurements	Number of Measurements for the Monitor(s) at the Site in the date range.	Integer
Measurements	Array of Monitor elements containing details ofwhat is measureSite.	JSON/XML object
…Measurement members		
DateTimeStart	Start of the time period over which the Measurement applies. The Time Basis defines the duration of the time period. Format is YYYY-MM-DDTHH:NN:SS, where HH is in 24-hour format and NN is minutes.	Text
Value	Measurement:value for the Time Basis at the specified Measurement:date time start.	Text
Latitude	Latitude at which the Measurement was taken, which at present is the Site latitude.	Number
Longitude	Longitude at which the Measurement was taken, which at present is the Site longitude.	
QualityStatus	Displays ‘9’ if sufficient Measurement values were available. ‘1’ indicates that less than 75% of the required measurement values existed and ‘0’ indicates that no data existed.	Integer
AQIIndex	AQI index value that applies to the Measurement:value, which is calculated by dividing the value by the AQI Pollutant Standard.	Integer
AQICategoryDescription	Description of the AQI category into which the AQI index falls.	Text
AQICategoryAbbreviation	Abbreviated for the AQI category.	Text
AQIBackgroundColour	Hexidecimal ID of the background colour that should be used whenever presenting the Measurement:value or AQI index. This is the colour that should be used when presenting graphs or charts of these values.	Text
AQIForegroundColour	Hexidecimal ID of the foreground colour that should be used whenever presenting the Measurement:value or AQI index.	Text
DateTimeRecorded	Date and time on which the EPA recorded the Measurement value. Format is YYYY-MM-DDTHH:NN:SS.	Text
SiteID	The Site:point id value.	Text
TimeBaseId	Unique identifier for the Time Basis used in other web service calls.	Text
MonitorId	Unique identifier for the Monitor to which the Time Basis is applied.	Text
MonitorName	Full name of the Monitor.	Text
ShortName	Short name of the Monitor.	Text
IsStationOffline	Indicates whether the Site is offline.	Boolean
HealthCategoryLevel	Health category currently only applies to MnitorId=BPM2.5 and TimeBasisId=24_RAV. When it does, this element presents thelevel where 1 = Low and	Integer

	7 = Hazardous – Extreme.	
HealthCategory Description	Short descriptive text associated with the health category.	Text
HealthCategory ValueRange	Range of Measurement: values that fall into the health category.	Text
HealthCategory VisibilityText	Visibility ranges that typically occur with the health category.	Text
HealthCategory Message	Full text of health guidance information that applies to the health category. This includes HTML formatting tags.	Text
HealthCategory BackgroundColour	Hexidecimal ID of the background colour that should be used whenever presenting the Measurement:value for which there is a health category.	Text
HealthCategory ForegroundColour	Hexidecimal ID of the foreground colour that should be used whenever presenting the Measurement:value.	Text
EquipmentType	JSON/XML object with information on the equipment used to take the Measurement.	JSON/XML object
MonitorTimeBasis	JSON/XML object with information that the EPA uses to apply business rules for the presentation of air quality data.	JSON/XML object
…EquipmentType members		
IdNumber	IdNumber of the Equipment Type.	Integer
Code	Short descriptive code for the Equipment Type.	Text
Description	Description of the Equipment Type.	Text
…MonitorTimeBasis members		
AQIPollutantStandard	The Air Quality Index (AQI) value for a pollutant Measurement equals the measured value divided by the AQI Pollutant Standard.	Number
IncidentType		
PresentationOrder	Order in which the Time Basis Measurement should be presented relative to other Time Basis Measurements.	Integer
CalcAQI	Whether the web services calculate an AQI value for a specific Measurement of a specific Monitor and Time Basis.	Boolean
CalcHealthCategory	Whether the web services calculate a health category for a specific Measurement of a specific Monitor and Time Basis.	Boolean
MonitorId		Text
TimeBasisId		Text

3.6 Web service = Sites2DayAirQuality

Purpose: Provide the last two-days of all air quality data available for all sites currently operating, including Incident Air Monitoring (IAM) sites. The two days of data ends at the completed 1-hour period closest to the current time.

Context: This web service provides a limited amount of data for all currently operating monitoring Sites.

Overall Functionality:

Function ID	Description
F003	This web service returns all available air quality data for all stations operating over the 2-day period ending at the 'current' 1-hour period.
F004	The 'current' 1-hour period is the hour that finished before the time now, less a 'buffer' period. For example at the time 15:25 the current 1-hour period is 13:00 to 14:00.
F005	Currently the buffer period is 35 minutes.

F045	When no Measurement:value exists for a specific Monitor on a specific 1-hour period the web service returns 'no data' as the value text.
F080	Return the Site AQI summary for the 48-hour period, which is done by returning members in the SampleData1Hr array for the AQI member that exists in each Station member.

Call Parameters

None.

The link below is an example service call:

http://sciwebsvc.epa.vic.gov.au/aqapi/Sites2DayAirQuality

Returned Data

The return data comprises the following members.

Member	Description	Data Type
ServiceName	Name of the web service called.	Text
DateTime	Current 1-hour period for the last Measurement values, as specified above. Presented as a long date for start and end times of the hour.	Text
Stations	Array of Sites for which there exists Measurement values over the past 48-hour period.	JSON/XML object
Stations members		
PointId	The Site:point id value.	Text
Region	The Site List:name value.	Text
Station	The Site:name value.	Text
ParameterValueList	Array of Monitors for which there exists Measurement values taken at the Site over the past 48-hour period	JSON/XML object
AQI	JSON/XML object with the Site AQI summary information	JSON/XML object
Visibility	JSON/XML object with nulls and 0 values. Included for backward compatibility.	JSON/XML object
Latitude	Site:latitude value.	Decimal 10,6
Longitude	Site:longitude value.	Decimal 10,6
AqiCategory	AQI category for the Site's AQI index summary value.	Text
HasPm25	Indicates whether the Site has Measurement values for the $PM_{2.5}$ Monitor.	Boolean
FireHazardCategory	The Health Category for the current 1-hour period when applicable to the Monitor (Parameter) and Time Basis. The integer translates to the level as 1 = 'Low'	Integer
IsADRStation	Indicates whether the Site has Measurement values for the $PM_{2.5}$ Monitor taken by an ADR machine. Used to control display of the health category information.	Boolean
IsStationOffline	Indicates whether the Site is offline.	Boolean
HasIncident	Indicates whether the Site has an incident type = Incident Tier 2	Boolean
IncidentType	Site:site type value.	Text
EmergencyUrl	URL to EMV site for the incident.	Text
ParameterValueList members	The AQI and Visibility JSON/XML objects within the Station JSON/XML object also have this JSON/XML structure.	

Id	Monitor:id value.	Text
UOM	Monitor:unit of measure.	Text
PValue		
PindexValue		
Value		
IdString	The Monitor:short name value, which is the label used for the Monitor.	Text
SampleData1Hr	Array of Measurement records for the 1-hour average Time Basis. If this Time Basis doesn't apply to the Monitor (Parameter), such as for CO at non-incident Sites, then this is an empty array.	JSON/XML object
SampleData24Hr	Array of Measurement records for a rolling average Time Basis. If this Time Basis doesn't apply to the Monitor (Parameter) such as NO2 or O3 then this is an empty array.	JSON/XML object
AqiIndex	Measurement:AQI index value for the Monitor for the 'current' 1-hour period.	Integer
HealthCategoryLevel	The Health Category for the current 1-hour period when applicable to the Monitor and Time Basis. The integer translates to the level as 1 = 'Low'.	Integer
ServiceProvider	ID number of the old EPA web service used to get the data for the ParameterValueList members.	Text
SampleData1Hr & 24Hr members		
Value	Measurement:value for the Time Basis at the specified Measurement:date time start.	Text
DateTime	Measurement:date time start value presented as text in the format 'YYYYMMDDHH' where 'HH' is in the 24-hour clock.	Text
ResultFlag	Displays '9' if sufficient measurement values were available when calculating the 1-hour averages and 24-hour rolling average for 'iPM2.5'. '1' indicates that less than 75% of the required measurement values existed and '0' indicates that no data existed.	Integer
AQI	Measurement:AQI index value that applies to the Measurement:value.	Integer
PointId	The Site:point id value.	Text
Colour	Colour code that corresponds to the Air Quality Threshold category applicable to the Measurement:AQI index value; or the Health Category Threshold applicable to the Measurement:value.	Text
HealthCategoryLevel	The Health Category for the specified Measurement:date time start when applicable to the Monitor (Parameter) and Time Basis. The integer translates to the level as 1 = 'Low'.	Integer
DoNotDisplayHealthCategoryBar	Controls display of bar around the 24-hour rolling average data for PM2.5.	Boolean

3.7 Web service = GetAirQualityAirDataList

Purpose: Provide the last two-days of air quality data for the AirWatch web page and available for all sites currently operating, including Incident Air Monitoring (IAM) sites. The two-day period ends at the 'current' 1-hour period.

Context: This web service can provide data for the existing AirWatch web page under the existing service name.

Related Visual Objects: epa.vic.gov.au/AirWatch web page.

Overall Functionality:

Function ID	Description
F0014	This web service provides exactly the same behaviour and return results as Sites2DayAirQuality.
F0015	Returns a JSON/XML data structure that as a minimum matches the JSON structure that the existing web service 'getairqualityairdatalist' returns. This results in zero impact on the AirWatch web site.

The link below is an example service call:

http://sciwebsvc.epa.vic.gov.au/aqapi/GetAirQualityAirDataList

3.8 Web service = StationData

Purpose: Provide the last two-days of air quality data for a specific Site that is currently operational. The two-day period ends at the 'current' 1-hour period.

Context: This web service can provide data for the existing AirWatch web page using the existing service name. The data is a subset of that provided by GetAirQualityAirDataList.

Overall Functionality:

Function ID	Description
F0026	This web service provides exactly the same behaviour and return results as it currently does from the old service of the same name supporting the existing AirWatch web page.
F0027	Returns a JSON/XML data structure that as a minimum matches the JSON structure that the existing web service 'getstationdata' returns. This results in zero impact on the AirWatch web site.

Call Parameters

Parameter	Description	Data Type
site	Code number identifying the Site at which the EPA monitors air quality, which the Sites service list – mandatory.	Integer

The link below is an example service call with parameters:

http://sciwebsvc.epa.vic.gov.au/aqapi/StationData?pointId=10001

Returned Data

The JSON/XML return data comprises the Station JSON/XML object for the specified PointId structured as specificed for Site2DayAirQuality.

3.9 Web service = SitesHourlyAirQuality

Purpose: Provide the air quality data available for a selected set of Monitors (Parameters) for a specified hour period, with it presenting data for **all** Sites operating in that period.

Context: External organisations use this web service to obtain all air quality data at a specific time.

Related Visual Objects: Supports the tabular presentation of epa.vic.gov.au/AirWatch web page.

Overall Functionality:

Function ID	Description
F016	Control parameter for this web service is the start time of the 1-hour period for which it is to return data.
F031	The web service returns **all** Measurement data available for the passed 1-hour

	period, organised into a collection of Measurements for each operating Site.
F022	This web service shall return a JSON/XML data structure that facilitates the rapid display of a data table with a row per Site operational for the passed 1-hour period and a column for each Monitor.
F081	Different time basis appear in different columns under the same monitor:common name. For example the 1-hour average CO Measurement for incident Sites shall appear in a different column from the 8-hour rolling average CO Measurement from fixed Sites.
F032	The web service returns the Site's AQI summary calculated from the Monitors. It returns both the value and the text summary in two different columns.
F084	When relevant, the Health Category rating for the Site is returned as the last element in the Measurements array. This only applies to Sites with 24-hour rolling average Measurement for the Monitor(Parameter) ID = $BPM_{2.5}$.
F082	'Incident Sites' are listed first as a group before 'Non-incident' Sites. Sites then list in order of Region:Name and then Site:Name.

Call Parameters

Parameter	Description	Data Type
datetimestart	The 1-hour period for which the web service is to return data, provided as text in the format 'YYYYMMDDHH' where 'HH' is in the 24-hour clock.	Text

Service call example with parameters:

http://sciwebsvc.epa.vic.gov.au/aqapi/SitesHourlyAirQuality?datetimestart=2017032111

Returned Data

The JSON/XML return data comprises the following members.

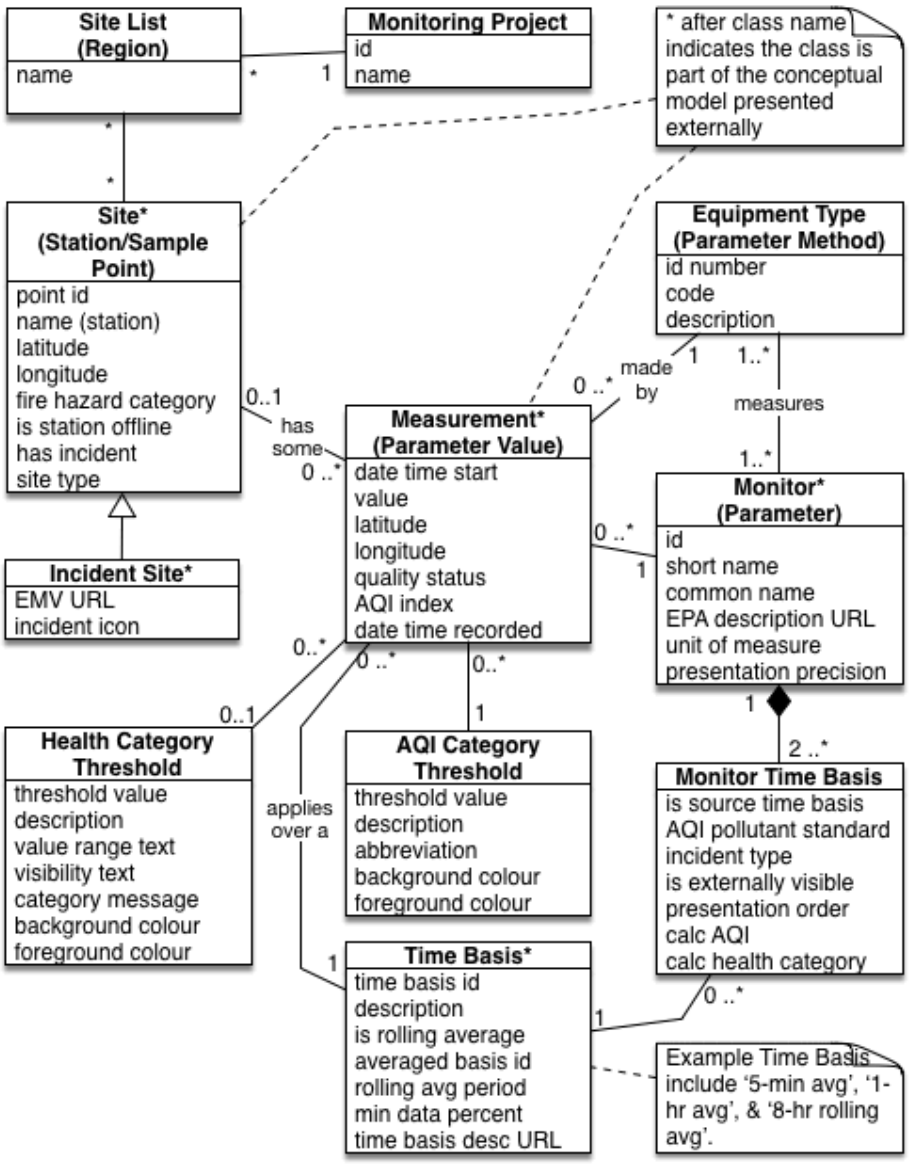
Member	Description	Data Type
ServiceName	Name of the web service called.	Text
DateTime	1-hour period for the Measurement values, as specified in the parameter sent to the web service. Presented as a long date for start and end times of the hour.	Text
IncidentMonitors	Array of metadata about the Monitors (Parameters) for which the web service is returning data for Sites deployed for Incident Air Monitoring. This would then be used for column, or possibly row, headings for a table to present the Measurement:values returned in this web service. This array only appears if there exists Measurement:value for incident Sites on the DateTime. This array has a member for every Monitor in the set of Monitors within the scope of the service, even though incident Sites normally collect Measurements for a subset of the Monitors that fixed (non-incident) Sites cover.	JSON/XML object
IncidentSites	Array of incident Sites for which there exists Measurement values for the Monitors in the scope of this web service at the passed 1-hour period. This array doesn't appear if there are no incident Sites for the DateTime.	JSON/XML object
Non-IncidentMonitors	Array of metadata about the Monitors (Parameters) for which the web service is returning data for non-incident (fixed) Sites. This is used for column headings for a table to present the Measurement:values returned in this web service. This array only appears if there exists Measurement:value for non-incident Sites on the DateTime. This array has a member for every Monitor.	JSON/XML object
Non-IncidentSites	Array of non-incident Sites for which there exists Measurement values for the Monitors in the scope of this web service at the passed 1-hour period. This array doesn't appear if there are no non-incident Sites for the DateTime.	JSON/XML object

…Monitors members		
ShortName	Monitor:short name, primarily for use as an ID, but also for alternative columns heading.	Text
CommonName	Monitor:common name for presentation as column heading.	Text
DescriptionURL	Monitor:EPA description URL for use in hyperlink from Monitor:common name.	Text
TimeBasisID	Time Basis:id for use in differentiating between Time Basis when there are multiple Time Basis for the one Monitor(Parameter) as occurs for PM2.5 and CO, and for using other web services to retrieve data.	Text
TimeBasis	Time Basis:description for use in differentiating between Measurements for a different Time Basis for the same Monitor.	Text
UnitOfMeasure	Monitor: unit of measure	Text
…Sites members		
SiteID	The Site:point id value.	Text
SiteType	Sites: site type, which is the text description associated with the_incident_type_flag.	Text
IncidentIcon	URL reference to the icon to indicate an 'incident' site.	Text
Region	The Site List:name value associated with the Site.	Text
Name	Site: name value.	Text
Latitude	Site:latitude value.	Decimal 10,6
Longitude	Site:longitude value.	Decimal 10,6
EmergencyUrl	URL to EMV site for the incident.	Text
Measurements	Array of Measurement data for presentation in the table cells.	JSON/XML object
Measurements members		
ShortName	Monitor:short name, primarily for use as an ID, but also for alternative columns heading.	Text
TimeBasisID	Time Basis:id for use in differentiating between Time Basis and using other web services to retrieve data.	Text
Value	Measurement:value for the specified DateTime, Monitor and Site.	Numeric
Precision	Monitor:presentation precision to guide the presentation of the Measurement value.	Numeric
AQIvalue	Measurement:AQI value calculated from the Measurement:value using the Monitor Time Basis:AQI pollutant standard. This provides possibility for a pop-up over the cell to display this value, or for an alternate view controlled by a toggle button.	Integer
BackgroundColour	AQI Category Threshold:background colour code associated with the Measurement:AQI value. When the object contains the Health Category rating, this element presents the Health Category background colour code.	Text
Description	AQI Category Threshold:description associated with the Measurement:AQI value. For potential display in a pop-up. When the object contains the Health Category rating, this element presents the Health Category description.	Text
Abbreviation	AQI Category Threshold:abbreviation associated with the Measurement:AQI value. For potential display in a pop-up or display with the value. When the object contains the Health Category rating, this element is null.	Text
HealthMessage	When the object contains the Health Category rating, this element presents the Health Category message.	Text (HTML)

4 CONCEPTUAL MODEL

This section details the primary business domain concepts that underpin both the return results of the web services and also provide a structure around which to organise the business rules. The conceptual model shows all concepts that determine behaviour of the web services.

4.1 Conceptual Model Overview



The following sections define the conceptual classes and applicable requirements. They are presented in alphabetical order. The attributes listed for the classes are those available to the web services, or used in the business rules controlling data presentation.

4.2 Concept: AQI Category Threshold

Definition: Set of threshold values that define the five levels of the Air Quality Index, which start at Very Good and range through to Very Poor.

Synonyms: AQI summary.

Context and Background: Each Monitor has a AQI pollutant standard used to calculate an AQI index value for a Measurement. Comparing the AQI index value to the set of threshold values defines the AQI category for the Measurement.

Business Rules:

<table>
<tr><th>Function ID</th><th>Description</th></tr>
<tr><td>F043</td><td>The AQI Category Thresholds are as follows:
<table>
<tr><th>AQI category name</th><th>AQI lower limit</th><th>AQI upper limit</th></tr>
<tr><td>VERY GOOD</td><td>-5</td><td>33.99</td></tr>
<tr><td>GOOD</td><td>34</td><td>66.99</td></tr>
<tr><td>FAIR</td><td>67</td><td>99.99</td></tr>
<tr><td>POOR</td><td>100</td><td>149.99</td></tr>
<tr><td>VERY POOR</td><td>150</td><td>99999</td></tr>
</table></td></tr>
<tr><td>F044</td><td>The colours used to represent the AQI categories comprise the following:
<table>
<tr><th>AQI and Pollutants category name</th><th>bg_colour_ hex</th><th>fg_colour_ hex</th><th>background colour</th></tr>
<tr><td>VERY GOOD</td><td>#339966</td><td>#000000</td><td></td></tr>
<tr><td>GOOD</td><td>#3399FF</td><td>#000000</td><td></td></tr>
<tr><td>FAIR</td><td>#FFFF00</td><td>#000000</td><td></td></tr>
<tr><td>POOR</td><td>#FF0000</td><td>#000000</td><td></td></tr>
<tr><td>VERY POOR</td><td>#000000</td><td>#FFFFFF</td><td></td></tr>
<tr><td>N/A</td><td>#999999</td><td>#999999</td><td></td></tr>
<tr><td>Empty cell</td><td>#CCCCCC</td><td>#CCCCCC</td><td></td></tr>
</table></td></tr>
</table>

When combined with the AQI pollutant standard, which applies to the Monitor Time Basis, this results in the following Measurement:values that reach each AQI category threshold for each Monitor.

4.3 Concept: Equipment Type

Definition: The technology that the equipment applies to measure the specific physical attribute of the air. For example the EPA has two different types of equipment to measure Particulate Matter <2.5 micron size ($PM_{2.5}$) – BAM and ADR – with each having different business rules applied.

Synonyms: Parameter Method – not used because in the context of web services the term 'Parameter' has a distinct meaning and is used frequently.

Business Rules:

Function ID	Description
F054	The CO measurements from AreaRAE machines are presented as 1-hour averages only. There are no 8-hour rolling averages calculated or presented for CO measurements from this Equipment Type – monitor(parameter) id= iCO.
F048	Only the 24-hour PM2.5 rolling average from BAM instruments triggers the health messaging. Data collected using ADRs is NOT be used to trigger health messages. Note that this is the reason that a Monitor can associate to an Equipment Type, and that Monitor Time Basis has the attribute 'calc health category'.

4.4 Concept: Health Category Threshold

Definition: Set of threshold values that define the seven levels of the Health Category, which start at Low and range through to Hazardous - Extreme.

Synonyms: None.

Context and Background: The Health Category is only calculated for 24-hour rolling average $PM_{2.5}$ Measurements taken with the 'BAM' Equipment Type.

Business Rules:

<table>
<tr><th>Function ID</th><th>Description</th></tr>
<tr><td>F054</td><td>There are 7 health categories determined by the 24-hour rolling average of $PM_{2.5}$ Measurements from BAM Equipment Type. The 'threshold value' for each health category comprise the following.
<table>
<tr><th>Health category description</th><th>24-hr $PM_{2.5}$ lower limit</th><th>24-hr $PM_{2.5}$ upper limit</th></tr>
<tr><td>Low</td><td>0</td><td>8.99</td></tr>
<tr><td>Moderate</td><td>9</td><td>25.99</td></tr>
<tr><td>Unhealthy for sensitive groups</td><td>26</td><td>39.99</td></tr>
<tr><td>Unhealthy all</td><td>40</td><td>106.99</td></tr>
<tr><td>Very unhealthy all</td><td>107</td><td>177.99</td></tr>
<tr><td>Hazardous high</td><td>178</td><td>250.99</td></tr>
<tr><td>Hazardous extreme</td><td>251</td><td></td></tr>
</table></td></tr>
<tr><td>F052</td><td>The web services only present health category messaging for the health category of the current 1-hour period. Thus if there is no $PM_{2.5}$ 24-hour rolling average value for the current hour, then no health category messaging is returned.</td></tr>
<tr><td>F055</td><td>Health category colour codes are presented for all 24-hour rolling average of $PM_{2.5}$ Measurements from BAM Equipment Type.</td></tr>
<tr><td>F056</td><td>The colours used to represent the health categories are as follows.
<table>
<tr><th>Health category description</th><th>bg_colour_hex</th><th>fg_colour_hex</th><th>background colour</th></tr>
<tr><td>Low</td><td>#709302</td><td>#FFFFFF</td><td></td></tr>
</table></td></tr>
</table>

		Moderate	#3A75C4	#FFFFFF	
		Unhealthy for sensitive groups	#EAAF0F	#FFFFFF	
		Unhealthy all	#DD5900	#FFFFFF	
		Very unhealthy all	#D81E05	#FFFFFF	
		Hazardous high	#9B301C	#FFFFFF	
		Hazardous extreme	#6B3021	#FFFFFF	
F065	Web services presenting the 'category message' must also present the 'value range text' and the 'visibility range text'.				
F066	The 'value range text' and the 'visibility range text' for each health category is as follows.				

Health category description	value range text	visibility range text
Low	0.0 – 8.9	More than 20 km
Moderate	9.0 – 25.9	10 – 20 km
Unhealthy for sensitive groups	26.0 – 39.9	5 – 10 km
Unhealthy all	40 – 106.9	2 – 5 km
Very unhealthy all	107.0 – 177.9	1.5 – 2 km
Hazardous high	Greater than 177	1 – 1.5 km
Hazardous extreme	Greater than 250	0.5 – 1 km

F067	Presentation of the link to the Emergency Management Victoria (EMV) web site - http://emergency.vic.gov.au/respond/ - occurs when the current 1-hour period health category reaches or exceeds very unhealthy for all.

4.5 Concept: Measurement

Definition: A measurement of a specific physical attribute of the air, such as CO or Particulate Matter (PM) concentration, at a specific location or Site at a specific time. The Monitor (Parameter) defines the physical attribute that the Equipment Type is measuring. The Time Basis defines the period over which the Measurement applies – for example a 1-hour average value, or an 8-hour rolling average calculated hourly.

Synonyms: Parameter Value – not used because in the context of web services the term 'Parameter' has a distinct meaning and is used frequently.

Context and Background: The smoke tracker mounted on a vehicle monitors air quality while the vehicle is moving, which means that each Measurement will have a location measured by latitude and longitude.

Data Source: The measurement equipment that the EPA deploys provides measurements to the Envista system. Envista in turn feeds both 5-minute and 1-hour average data streams to the database that supports the web services.

Business Rules:

Function ID	Description
F028	Measurement:AQI value = (Measurement:value)/(Monitor Time Basis:AQI pollutant standard) * 100
F034	Negative 5-min average values are used to calculate all 1-hour average values, including rolling averages.
F085	Negative 1-hour average values are used to calculate the rolling average values. If this results in a negative rolling average value, this value is then stored and presented as 0.
F035	Negative values for all Time Basis are presented as 0.
F036	Negative AQI index values calculated from a negative Measurement:value are presented as 0. This may result in a 0 Site AQI value, which is valid.

F039	Bad or missing Measurement:values are returned as an empty value.
F068	Measurements returned by the web services must include the 'AQI index' value, and the associated AQI Cateogry:description, abbreviation, background colour and foreground colour.
F069	Measurement records are always presented in order of oldest to newest.

4.6 Concept: Monitor

Definition: A physical attribute of air, such as CO or Particulate Matter (PM) concentration, that the EPA measures using a specific Equipment Type.

Synonyms: Parameter – not used because in the context of web services the term 'Parameter' has a distinct meaning and is used frequently.

Context and Background: Monitor is the term used in the Envista software that collects data from the measurement equipment.

Data Source: Defined when the EPA purchases a specific type of measurement equipment.

Business Rules:

Function ID	Description
F041	Presentation precision rules are as follows: AQI, O_3, NO_2 and SO_2 have 0 decimal place, $PM_{2.5}$, PM_{10} and CO have 1 decimal place API (visiblity) has 2 decimal places.
F042	When Measurement:value is stored to a higher precision than the presentation precision, values are to be rounded as per standard scientific and engineering rounding rules. For example a value ≥ 8.5 is rounded to 9, a value < 8.5 is rounded down to 8.

4.7 Concept: Monitor Time Basis

Definition: Defines the Time Basis set for which the EPA stores Measurements of each physical attribute of air (Monitor). For all Monitors the EPA stores Measurements for the 5-minute average and 1-hour average Time Basis. However for some Monitors the EPA stores additional Time Basis, such as for CO it stores an 8-hour rolling average, which is the average of the last 8 hourly average values, and is calculated every hour.

Synonyms: Parameter Time Basis – not used because in the context of web services the term 'Parameter' has a distinct meaning and is used frequently.

Context and Background: Monitor Time Basis also defines the AQI pollutant standard that applies to a Measurement of a specific Monitor. For example the 1-hour average Measurements of CO have a pollutant standard of 14.4 ppm; whereas 8-hour rolling average Measurements have a pollutant standard of 9 ppm.

Data Source: Defined when the EPA purchases a specific type of measurement equipment.

Business Rules:

Function ID	Description
F033	The AQI pollutant standards values are as follows for the relevant Monitors and Time Basis for non-incident sites. Time Basis = 1-hour average O_3 = 100 NO_2 = 120 SO_2 = 200 API = 2.35 (visibility) $PM_{2.5}$= 40 PM_{10} = 80

	Time Basis = 8-hour rolling average CO = 9 Time Basis = 24-hour rolling average $PM_{2.5}$= 25 The AQI pollutant standards values are as follows for the relevant Monitors and Time Basis for incident air monitoring sites. Time Basis = 1-hour average O_3 = 100 CO = 14.1 $PM_{2.5}$= 40

4.8 Concept: Monitoring Project

Definition: Records a purpose for performing air quality monitoring.

Synonyms: None.

Data Source: Defined when the EPA funds a purpose for monitoring air quality, such as the ongoing air quality monitoring at the 'fixed' sites, the Incident Air Monitoring program, or the Latrobe Valley microsite.

Context and Background: This concept provides a mechanism to control which data the web services present, as there are test Sites and Sites for special projects.

4.9 Concept: Site

Definition: A location at which the EPA has deployed equipment to monitor the air quality. The EPA has established some Sites for long-term operation as part of monitoring the baseline air quality across Victoria. The EPA deploys other Sites for a short duration to monitor air quality resulting from an incident such as a major bush fire or a significant industrial accident.

A sub-type of Site is Incident Site, which is represented with a different icon and has a link to the Emergency Management Victoria (EMV) web site for the incident.

Synonyms: Station and Sample Point

Context and Background: Note that not all air quality monitoring occurs at a specific Site. The smoke tracker mounted on a vehicle monitors air quality while the vehicle is moving.

Data Source: A Site is chosen by the ASG staff responsible for air quality monitoring operations.

Business Rules:

Function ID	Description
F029	AQI site = highest Measurement:AQI index value for all the Measurements recorded at the Site in the specified hour.
F038	A Site AQI **will not** be calculated or presented unless there is a valid reading for $PM_{2.5}$, PM_{10} or API (visibility), or the readings for the gaseous Monitors, which are CO, O_3, NO_2 and SO_2, reach the AQI Category Thresholds of FAIR, POOR or VERY POOR. If AQI is not available it is returned as an empty value.

4.10 Concept: Site List

Definition: A grouping of Sites to aid in understanding of the Sites on web pages, such as organising the Sites by region or type.

Synonyms: Region

Context and Background: A single Site may belong to multiple Site Lists, which in turn each associate to a Monitoring Project.

Data Source: Sites is grouped into the Site Lists by the ASG staff responsible for air quality monitoring operations.

4.11 Concept: Time Basis

Definition: A type of measurement made over a period of time, which results from some form of statistical analysis of the direct measurements made by equipment. Examples include a '1-hour average', which is the average of the 5-minute average values recorded within an hour, or an 8-hour rolling average, which is the average of the last 8 hourly average values, and is calculated every hour.

Synonyms: None

Data Source: ASG staff define which Time Basis measurements the EPA calculates and stores, and are presented to the public.

Context and Background: All Measurements apply over a Time Basis. The EPA stores 5-minute average and 1-hour average Measurements for all Monitors, and 8- or 24-hour rolling averages for CO and PM2.5 Monitors respectively at some Sites.

Business Rules:

Function ID	Description
F049	1-hour averages and rolling averages are only calculated when at least 75% of the eligible input data exists. For example a 24-hour rolling average for $PM_{2.5}$ is only calculated when there exists at least 18 1-hour average $PM_{2.5}$ Measurement records for that 24-hour period.
F051	Measurement records must associate to one of the following Time Basis: 5-minute average value 1-hour average value 8-hour rolling average calculated hourly 24-hour rolling average calculated hourly

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GLOSSARY

Term	Definition
ADR	Area Dust Monitor - Thermo Scientific Model ADR1500 Dust Monitor utilizes the highly sensitive light-scattering photometer (nephelometer) technology.
AQI	Air Quality Index is a number used by government agencies to communicate to the public how polluted the air currently is.
BAM	Beta attenuation monitoring is a widely used air monitoring technique employing the absorption of beta radiation by solid particles extracted from air flow. This technique allows for the detection of PM_{10} and $PM_{2.5}$.
Cl_2	Chlorine
CO	Carbon Monoxide
EM-COP	Emergency Management – Common Operating Platform
Fixed Sites	EPA's air monitoring Sites that are intended to measure ambient air quality. This includes ADRs at Altona North, Box Hill, Brighton, Churchill, Dandenong, Macleod, Melton, Moe, Mooroolbark, Point Cook and Wangaratta – to support Affirmation 21.
Gaseous compounds	Airborne substances CO, VOCs, SO_2, NO_2, NH_3, Cl_2, H_2S, HCN
H_2S	Hydrogen Sulphide
HCN	Hydrogen Cyanide
Incident Air Monitoring	EPA's response to an event requiring temporary air monitoring. Installs a combination of air measuring equipment at a temporary site, which is intended to provide air monitoring at incidents 2-14 days after an incident is declared.
JSON	JavaScript Object Notation is an open-standard file format that uses human-readable text to transmit data objects
NH_3	Ammonia
NO_2	Nitrogen Dioxide
O_3	Ozone
$PM_{2.5}$	Particles smaller than $_{2.5}$ micron
VOC	Volatile Organic Compounds such as Formaldehyde
SO_2	Sulphur Dioxide
XML	Extensible Markup Language (XML) defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.