

The Air Emissions Inventory (AEI) Project: An Update on a Universal Schema

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ABSTRACT

The Air Force's electronic emissions management system (APIMS) has streamlined the inventory process in all areas except one, distribution of air emissions to state and local agencies. These agencies require similar information but in formats which vary from State to State. The Air Force, Nebraska, North Carolina, Texas, Utah, Washington, and EPA joined together to investigate the development and use of a single file format which could save the Air Force millions of dollars.

This paper will give an update on a project originally started as the "Air Force Project" and presented in the Poser Session last year. The universal schema has now been developed with the help of our project partners. Discussion about the development of this schema and early testing will be covered, as well as the future impact of a universal schema on industry.

INTRODUCTION

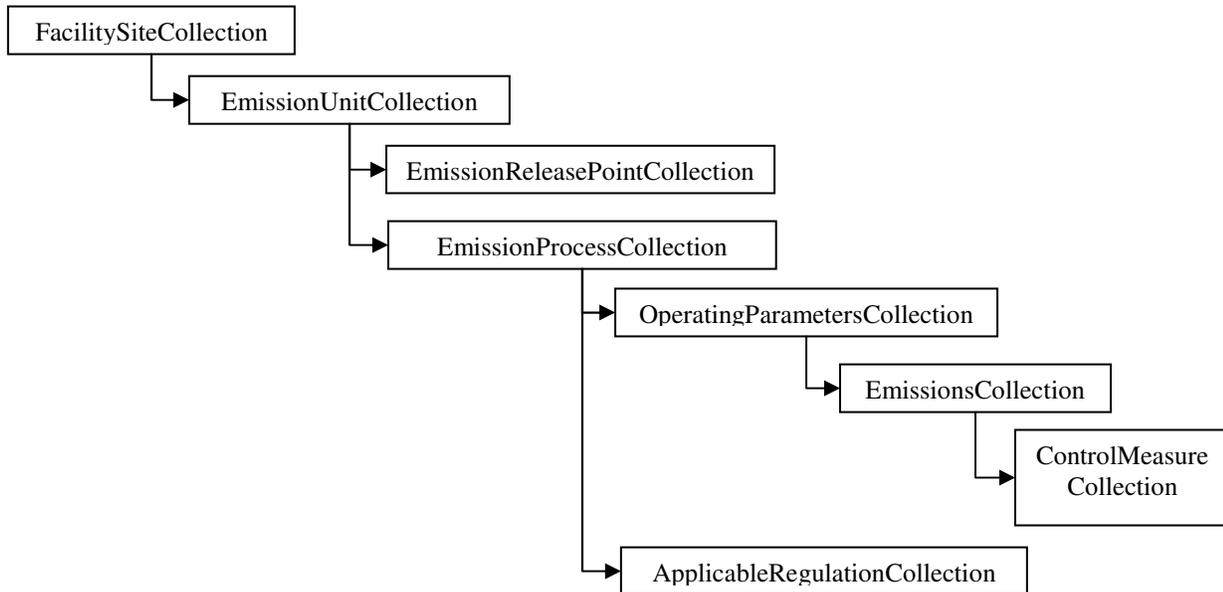
Currently the Air Force has operational facilities in 31 States. The overwhelming majority of Air Force Bases have a requirement to submit an annual air emission inventory (AEI) to the agency that directly regulates their operations. To help manage the maintenance of the data required as part of an AEI, a management system called the Air Program Information Management System (APIMS) has been developed. Currently, 50 of the 62 CONUS facilities are using APIMS, as well as an additional 10 Army Posts, 2 Naval Stations and 1 Marine Corps Camp. Having operations under the jurisdiction of such a broad array of regulating agencies has led to a substantial cost to the Air Force, as well as the other APIMS users, in submitting emission inventories.

In order to address this requirement in a more efficient, and cost-effective manner, the Air Force, in cooperation with the States of Nebraska, North Carolina, Texas, Utah and Washington, as well as EPA have begun a pilot study investigating the development of a Universal Schema and using the Exchange Network to transmit the AEI file. The overall goal of the pilot study is to ensure the most accurate and timely submission of air emissions data to the State regulatory agencies from Air Force facilities under their jurisdiction.

BODY

The first step towards a successful pilot study was the development of a universal emission inventory schema. Requirements for the universal schema were gathered through several teleconferences with the individual study participants, as well as a joint teleconference with all participants to review the overall requirements. After all requirement collection was complete a consolidated list of requirements was taken for development and captured through the design of a single, hierarchical schema. The schema design follows the data model of the Facility and Point Inventory Schema (EIS). In the universal schema, there are 6 levels of the hierarchy that will encompass all data needed for an emission inventory for all participating agencies. The basic structure of the universal schema is shown in Figure 1.

Figure 1. Hierarchical structure of the Universal Emission Inventory Schema.



An additional element of the schema not shown in the conceptual outline is the Configuration Structure Collection. This collection is utilized in the event that a process that is vented through two emission release points is represented as two pieces of information in the submission.

Each level of the schema has numerous attributes, outlined in Tables 1 through 9 presented at the end of this document, which will provide the same level of detail seen in current emission inventory submissions. One possible alteration in the structure that will be investigated during extended testing of the schema will be the collapse of the Emission Release Point Collection and Emission Process Collection into a single collection record. A number of similar attributes are associated to each record and for purposes of simplifying the overall structure this possibility may have merit.

As this project is still in the pilot study phase it is appropriate to present a summary of milestones remaining for completion of the study. Each milestone presented has the projected date of completion, as well as a brief description of what each entails.

- Create an MOU with all partners in the study: Initial draft created in May 2006, will be revised as progress is made toward flowing data, and will be finalized before universal emissions inventory data is exchanged between APIMS and the respective State.
- Create a schematron process against the universal schema: This will include development of all code lists and acceptable values for improved data quality. Anticipated completion during the Summer of 2007

- Develop the Flow Configuration Document: This will be a high-level road map of the pathway to data exchange between APIMS and the appropriate States. Anticipated completion during the summer of 2007.
- Test the proposed universal schema: This will include testing the export of data from APIMS in the universal schema format, transfer of the submission file from APIMS to CDX and on to the States and investigating options for electronic signature. As this step is somewhat opaque and will require correction of errors and re-testing no clear anticipated completion date exists.
- State review of submission package: This will be completed in parallel with the testing effort to ensure that all data necessary for each State is included in the submission file.
- Develop converters for review or universal schema data: A converter will be developed for each state to provide ease of review of the data included in the submission file.
- Move the data transfer into full production: Once all testing and State review is complete the data transfer will be moved from the pilot study phase into full production.
- Eliminate previous reporting procedures: After the concept of electronic submission via the universal schema is proven the final step will be to eliminate the methods that each facility previously used to submit their AEI.

CONCLUSIONS

With the project still in the pilot study phase very few conclusions can be drawn at this point. With current progress it is apparent that the development of a universal schema for emission inventories will provide a substantial cost savings to the Air Force. A great deal of effort has been spent in getting APIMS implemented across the Air Force and providing the ability to export directly from the management system to a format that is universally accepted will help to standardize the business processes and business practices across the agency which will help to lessen the impacts of diminishing budget and reduction in manpower. A second conclusion that can be drawn from the development of the universal schema is that with the participation of the State and local regulators the schema is not unique to the Air Force, but instead could be utilized by all Facilities falling under their jurisdiction. Again this provides the opportunity for standardization of submission to that agency which will result in a cost savings to the regulator.

Table 1. Facility Site Collection attributes with definitions.

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
CountyStateFIPS	The Federal Information Processing Standard (FIPS) code for the county where the site is located	X		
Tribal Code	The code of an American Indian or Alaskan native area	X		
Facility Site Identifier	Identification number provided by the State, Local or Tribal agencies, that consistently identifies a Facility Site over time	X		X
EIS Identifier	Unique identifier of an EIS facility site record.	X	This identifier is assigned by the EIS and is unique within the inventory	
TRI ID	Toxic Release Inventory (TRI) ID for the facility			
Facility Reg ID	Facility Registry ID			
Facility Site Status Code	Identifies the operating Status of the Site	X	Codes for Operating, Temporarily Shutdown, Permanently Shutdown	
ORIS ID	Unique identifier for electric generating units		No longer required to report in EIS	
Facility SIC	Standard Industrial Classification Code System		Suggest keeping for this iteration, since not all have adopted NAICS. No longer required in EIS	
Facility NAICS	North American Industry Classification	X		
Facility Site Name	Name of the facility	X		
Location Address	Address of the physical location of the facility	X		
State Identity	Full text description of USPS State in which the Facility is located	X	Illinois	
Country Identity	Textual name of the country Facility is located in			
County Identity	Full text description of county in which the Facility is located		Cook	
Tribal Land Name	Full text tribal name		Navajo Nation	
Location Description Text	A brief explanation of where the Facility Site is located. This may include navigational directions and/or more descriptive information about the location of the site			
Contact Name	The complete name of the contact person, including first name, middle name or initial and surname. Lead contact for facility transmitting data			
Contact Address	Mailing address for contact			

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Contact City	Mailing city for contact			
Contact Zip	Mailing zip code for contact			
Contact Email	E-mail address for contact			
Contact Fax	Fax number for contact			
Facility Comments	Free form field to add additional comments about this facility			
OP Hours per Day	Hours per day that a facility is active			
Op Days per Week	Days per week that a facility is active			
Location City	The closest city to the facility physical location			
Title V Flag	Flag to indicate whether the source is a Title V source.			
Site Latitude	The measure of the angular distance on a meridian north or south of the equator	X		
Site Longitude	The measure of the angular distance on the meridian east and west of the equator	X		
UTM Easting	The easting Universal Transverse Mercator (UTM) coordinate expressed in meters for this site			
UTM Northing	The northing Universal Transverse Mercator (UTM) coordinate expressed in meters for this site			
UTM Zone	The zone of the Universal Transverse Mercator (UTM) system in which a site is located			
Horizontal Collection Method	The code that represents the method used to determine the latitude and longitude coordinates for a point on earth	X	i.e. 001-The geographic coordinate determination method based on address matching-house number	
Horizontal Accuracy Measure	The measure of the accuracy (in meters) of the latitude and longitude coordinates	X		
Horizontal Coordinate Reference Datum Code	The code that represents the place for which geographic coordinates were established.	X	27 or 83	
Geographic Reference Point Code	The code that represents the place for which geographic coordinates were established.	X	i.e. 106-Point where a substance is released.	
Source Map Scale Numeric	The number that represents the proportional distance on the ground of one unit of measure on the map or photo.	X		

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
	This is mandatory for all horizontal data collection methods except for using Global Positional System (GPS)			
Local Regulatory Authority	Flag to indicate which local jurisdiction the source belongs to.		One-letter code	

Table 2. Emission Unit Collection attributes with definitions.

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Unit Identifier	Identification number provided by State, Local, and Tribal agencies that consistently identifies a unit over time.	X		
EIS Emission Unit ID	Unique identifier of an EIS Emission Unit. This identifier is assigned by the EIS and is unique within the inventory	X		
Unit Description	Description of the emissions unit	X		
Design Capacity	The measure of the size of the unit based on the maximum continuous throughput capacity of the unit. This information is only required for combustion sources.			
Design Capacity Unit of Measure	Unit of measure for the design capacity of the emissions unit			
Rated Capacity	Manufacturer-provided operational capacity of the unit			
Source Location	Physical location of the emission unit			
Comments	Comments about the emission unit			
Unit Status Code	Identifies the operating status of the emissions unit.	X	Code for the following values ie., Operating, Temporarily Shutdown, Permanently Shutdown	
Unit Status Start Date	The date on which the operating status became effective.			
Unit Status End Date	The date on which the operating status ended			

Table 3. Emission Release Point Collection attributes with definitions.

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Release Point Identifier	Identification number provided by State, Local, and Tribal agencies that consistently identifies a stack, pipe, or vent over time.	X		
EIS Emission Release Point Identifier	Unique identifier of an EIS emissions release point. This identifier is assigned by the EIS and is unique within the inventory	X		
Release Type				
Emission Release Point Point Height Measure	The height (in feet) of the stack or the fugitive from the ground.	X		
Emission Release Point Stack Diameter	The diameter (in feet) of the stack. This is the stack's inner physical diameter. Diameter will be used to calculate velocity from flow rate, or to calculate cross-sectional area from velocity.			
Emission Release Point Stack Fence Line Distance Measure	The measure (in feet) of the horizontal distance from the stack to the nearest fence line of property within which the stack is located.			
Emission Release Point Exit Gas Temperature Measure	The temperature of the exit gas stream (in degrees Fahrenheit)			
Emission Release Point Exit Gas Velocity Measure	The velocity of the exit gas stream (in feet per second)			
Emission Release Point Gas Flow Rate Measure	The stack gas flow rate (in actual cubic feet per second (ACFS)).			
Emission Release Point Fugitive Width	The width (measured in feet) of the fugitive release in the east-west direction as if the angle is zero degrees.			
Emission Release Point Type	Code for the physical configuration of an emissions release point.	X	i.e. Fugitive, Vertical, Horizontal, Gooseneck, Vertical with rain cap, Downward facing vent	

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Emission Release Fugitive Length	The length (measured in feet) of the fugitive release in the north-south direction as if the angle is zero degrees.			
Emission Release Fugitive Release Angle	The orientation angle for the area in degrees from North, measured positive in the clockwise direction.			
Geographic Reference Point Code	The code that represents the place for which geographic coordinates were established.	X	i.e. 106-Point where a substance is released.	
Moisture Content	The percentage of moisture contained in the stack gases			
Oxygen Percent	The percentage of Oxygen contained in the stack gases			
Plume Height	The height (in feet) of the plume above the stack, estimated value			
Emission Release Point Description	A text description of the emissions release point			
Latitude Measure	The measure of the angular distance on a meridian north or south of the equator.	X		
Longitude Measure	The measure of the angular distance on the meridian east and west of the equator.	X		
UTM Easting	The easting Universal Transverse Mercator (UTM) coordinate, expressed in meters (i.e., the horizontal distance from the reference edge of the UTM zone) for the site.		Conditional - If Lat/Lon is not indicated, UTM must be complete.	
UTM Northing	The northing Universal Transverse Mercator (UTM) coordinate, expressed in meters (i.e. for the North hemisphere, the vertical distance from the equator; for the Southern hemisphere, 10,000,000 minus the vertical distance from the equator) for the site.		Conditional - If Lat/Lon is not indicated, UTM must be complete.	
UTM Zone	The zone of the Universal Transverse Mercator (UTM) system in which a site is located.		Conditional - If Lat/Lon is not indicated, UTM must be complete.	
Fugitive Area	The numeric value of the area of the fugitive source		25	
Fugitive Height	The height of the fugitive source above ground level		Example would be storage piles , 120	
Fugitive UOM	the unit of measure of the fugitive source			
Horizontal Collection Method	The code that represents the method used to determine the latitude and longitude coordinates for a point on earth.	X	i.e. 001-The geographic coordinate determination method based on address matching-house number.	

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Horizontal Accuracy Measure	The measure of the accuracy (in meters) of the latitude and longitude coordinates	X		
Horizontal Coordinate Reference Datum Code	The code that represents the reference datum used in determining latitude and longitude or UTM coordinates	X	ie. 101-Entrance point of a facility or station.	
Geographic Reference Point Code	The code that represents the place for which geographic coordinates were established.	X	i.e. 106-Point where a substance is released.	
Source Map Scale Numeric	The number that represents the proportional distance on the ground of one unit of measure on the map or photo. This is mandatory for all horizontal data collection methods except for using Global Positional System (GPS)	X		
Last Test Date	The date of the last stack test conducted			
Comment	Comment about the emissions release point			

Table 4. Operating Parameters Selection attributes and definitions.

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Process Identifier	Identification number, provided by State, Local, and Tribal agencies, that consistently identifies a process over time.	X		
EIS Process Identifier	Unique identifier of an EIS process. This identifier is assigned by the EIS and is unique within the inventory.	X		
Operating Status Code	Code that identifies the Operating Status of the Facility Site during the reporting period.	X	i.e. Routine, Upset, Transition	
Reporting Period Code	Time fram for the reported emissions data	X	i.e. Annual, 5 Month, Ozone Season, Daily	
Start Date	Start date of the period in which reported emissions occurred.	X		
End Date	End date of the period in which reported emissions occurred.	X		
Throughput Winter	The percentage of a process that operating during the Winter months (reported in whole numers between 0 and 100)			
Throughput Spring	The percentage of a process that operating during the Spring months (reported in whole numers between 0 and 100)			
Throughput Summer	The percentage of a process that operating during the Summer months (reported in whole numers between 0 and 100)			
Throughput Fall	The percentage of a process that operating during the Fall months (reported in whole numers between 0 and 100)			
Average Days Per Week	The average number of days per week that the emission process is active within the reported period.			
Average Hours Per Day	The average number of hours per day that the emission process is active within the reported period.			
Average Weeks Per Period	The average number of weeks per period that the emission process is active within the reported period.			
Actual Hours per Period	Actual number of hours the process is active for the reported period.			

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Material Identifier	Material code for material or fuel processed.		Material Code in EIS. i.e. 659 (Beer); 663 (Bituminous Coal); 684 (Cans)	
Material Throughput Unit of Measure	Appropriate unit of measure for material throughput quantity.		E6BTU	
Material Code			Same as Material Identifier?, yes	
Material Description	description of the material or fuel processed			
Material IO Code	Code that identifies whether the material is consumed (used) or produced		E - Process Material Existing; I - Process Material Input; O - Process Material Output	
Heat Content	The heat content of a fuel (measured in million BTU per ton of coal, 1000 gallons of oi or million SCF of gas)			
Sulfur Content	The sulfur content of a fuel (mass percent)			
Ash Content	The ash content of a fuel (mass percent)			
VOC Content	The VOC content of the material			
MACT Compliance			This data element has moved to the Regulatory table	
Confidential	Is data confidential or public?		Y or N	
Insignificant Source	Flag to indicate whether the unit is an "Insignificant Emissions Unit (IEU) or Insignificant Activity (IA)" for Title V reporting			
TSP Content				
Operated				
Emission Start Time			No longer needed in EIS	
Emission End Time			No longer needed in EIS	
Comment	Text form for additional information			

Table 5. Emissions Process Collection attributes and definitions.

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Process Identifier	Identification number, proved by State, Local, and Tribal agencies, that consistently identifies a process over time.	X		
EIS Process Identifier	Unique identifier of an EIS process. This identifier is assigned by EIS and is unique within the inventory.	X		
Release Point ID	Identification number provided by State, Local, and Tribal agencies that consistently identifies a stack, pipe, or vent over time.			
Reporting Period Code	Time frame for the reported emissions data	X	ie. Annual; 5 Month; Ozone Season, Daily	
Source Classification Code	EPA Source Classification Code.	X	10200202 (Industrial Bituminous Coal Wall-Fired Boiler)	
MACT			MACTs are now in the Regulatory Table of the EIS	
Emission Process Description	A text description of the emissions process			
Comments	Comment about the emissions process			

Table 6. Emissions Collection attributes with definitions.

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Process Identifier	Identification number, proved by State, Local, and Tribal agencies, that consistently identifies a process over time.	X		
EIS Process Identifier	Unique identifier of an EIS process. This identifier is assigned by EIS and is unique within the inventory.	X		
Pollutant Code	The pollutant code as defined in the NIF tables	X	PM10	
Pollutant Name	The pollutant name associated with the pollutant code			
Total Emissions	Totaled calculated or estimated amount of emissions	X		
Emission Unit of Measure	Unit of measure for reported emissions		LB/TON	
Emission Type			Reported in Operating Parameters	
EF Value	Emission Factor in EIS. The emission factor used for the emissions value if a calculated value was provided.		2.46	
Emissions Calculation Code	Code that defines the method for how the emissions value was calculated.		i.e., 01-CEMS - Continuous Emissions Monitoring System	
Emission Factor Reliability Code	Code indicating the reliability of the emission factor.		i.e., A - AP-42 Rating A	
Control Status			See Control Measure Collection table	
Source of Emission Factor Code	Identify the source of the emission factor		AP-42	
Alg Formula	Algebraic formula used to calculate the emissions		Free form text field	
Alg Comments	Comments about the formula used		Free form text field	
HAP As VOC	Indicator if the pollutant is classified as both a HAP and a VOC			
HAP As PM10	Indicator if the pollutant is classified as both a HAP and as PM10			
Level Identifier				
Comments	Comments about the emissions			

Table 7. Control Measure Collection attributes with definitions.

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Process Identifier	Identification number, provided by State, Local and Tribal agencies, that consistently identifies a process over time.	X		
EIS Process Identifier	Unique identifier of an EIS process. This identifier is assigned by EIS and is unique within the inventory.	X		
Percent Capture Efficiency	The percent capture efficiency of the control measure			
Overall Capture and Control Efficiency	Collective percent reduction of the overall capture and for the pollutant and process.	X		
Control Measure Code	Control measure code.	X	code of ie., Primary Control Device Type, Secondary Control Device Type	
Control Installation Date	Date control measure was installed or implemented			
No. of Units	number of similar control devices		such as 3 cyclones in series	
Device Type	(remove, same as device description below)			
Device Efficiency	(remove, efficiency is in element above)			
Device ID	Identification number, provided by the State, Local, and Tribal agencies			
Device Description				
Comment	Comment about the control measures			

Table 8. Applicable Regulation Collection attributes with definitions.

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Facility Site Identifier	Identification number provided by the State, Local or Tribal agencies, that consistently identifies a Facility Site over time.	X		
EIS Identifier	Unique identifier of an EIS facility site record. This identifier is assigned by the EIS and is unique within the inventory	X		
Emission Unit Identifier	Identification number, provided by State, Local and Tribal agencies, that consistently identifies a process over time.	X		
EIS Emission Unit Identifier	Unique identifier of an EIS process. This identifier is assigned by EIS and is unique within the inventory.	X		
Process Identifier	Identification number, provided by State, Local and Tribal agencies, that consistently identifies a process over time.	X		
EIS Process Identifier	Unique identifier of an EIS process. This identifier is assigned by EIS and is unique within the inventory.	X		
Regulatory Start Date	The date on which the Facility Site or Emissions Unit or Emissions Process became subject to a regulatory program			
Regulatory Code	Code that describes the Federal regulatory program or rule	X	i.e. NSPS, ARP, CAIR, MACT Code (1643 (Dry Cleaning-Perchloroethylene)); 0308 (Iron Foundries)	
Comment	Comment about the applicable regulation			

Table 9. Configuration Structure Collection attributes with definitions.

Data Element	Description	Required by EIS	Examples or Comments	Required for a State Submit
Process Identifier	Identification number, provided by State, Local and Tribal agencies, that consistently identifies a process over time.	X	This table is used in the event that a process that is vented through two emission release points would be represented as two pieces of information in this collection. i.e. Process 1 with Emissions Release Point A, and Process 1 with Emission Release Point B.	
EIS Process Identifier	Unique identifier of an EIS process. This identifier is assigned by EIS and is unique within the inventory.	X		
Release Point Identifier	Identification number, provided by State, Local and Tribal agencies, that consistently identifies a process over time.	X		
EIS Emisissions Release Point Identifier	Unique identifier of an EIS process. This identifier is assigned by EIS and is unique within the inventory.	X		
Emission Unit Identifier	Identification number, provided by State, Local and Tribal agencies, that consistently identifies a process over time.	X		
EIS Emission Unit Identifier	Unique identifier of an EIS process. This identifier is assigned by EIS and is unique within the inventory.	X		
Average Percent Emissions	Typical percent of a process's emissions vented through an emission's release point on an annual basis	X		
Configuration Start Date	Data on which the configuration structure became effective			
Configuration End Date	Date on which the configuration structure was no longer effective			
Comment	Comment about configuration structure			