The Emissions Inventory Maintenance Application

by

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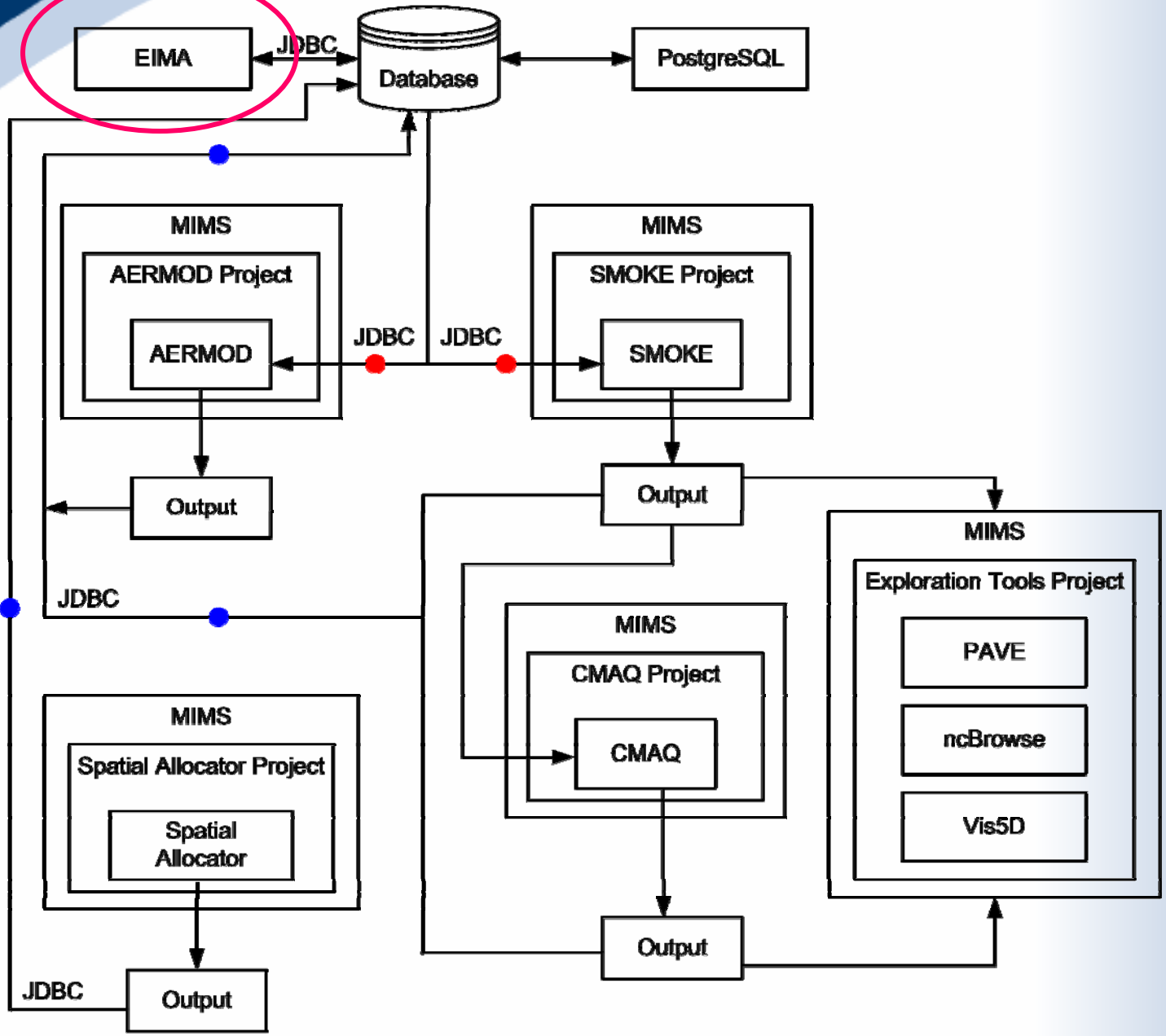
Overview

- Project Background – AQMDSS and EIMA
- Key Requirements for EIMA
- Implementation
- Installation Experiences in Beijing, PRC

Project Background

- The Air Quality Management Decision Support System (AQMDSS)
  - Integrated system to support air quality modeling on multiple spatial and temporal scales.
    - AERMOD modeling system for industrial-scale simulations
    - CMAQ for regional-scale simulations
    - SMOKE for emissions inventory processing
    - PAVE and other utilities for visualization
  - Built around database implemented in PostgreSQL
    - Enhanced version of NIF v3.0
    - Transaction support for all-or-nothing data changes
  - User interface and model executions through MIMS
  - All open source and most public domain


EIMA
JDBC
Database
PostgreSQL
MIMS
AERMOD Project
AERMOD
JDBC
JDBC
MIMS
SMOKE Project
SMOKE
Output
Output
JDBC
MIMS
Exploration Tools Project
PAVE
ncBrowse
Vis5D
MIMS
CMAQ Project
CMAQ
MIMS
Spatial Allocator Project
Spatial Allocator
Output
JDBC
Output

Key Requirements for EIMA

- Flexibility
  - Quickly accommodate updates to AQMDSS components
- User Interface
  - Simplified Chinese for client
  - English for contractors
- Limited Data Access
  - Users update only those data tables pertinent to their work
  - Users may look up supporting data
- Data Validation
  - Maximize data validation during data entry
  - Maintain connection among data tables

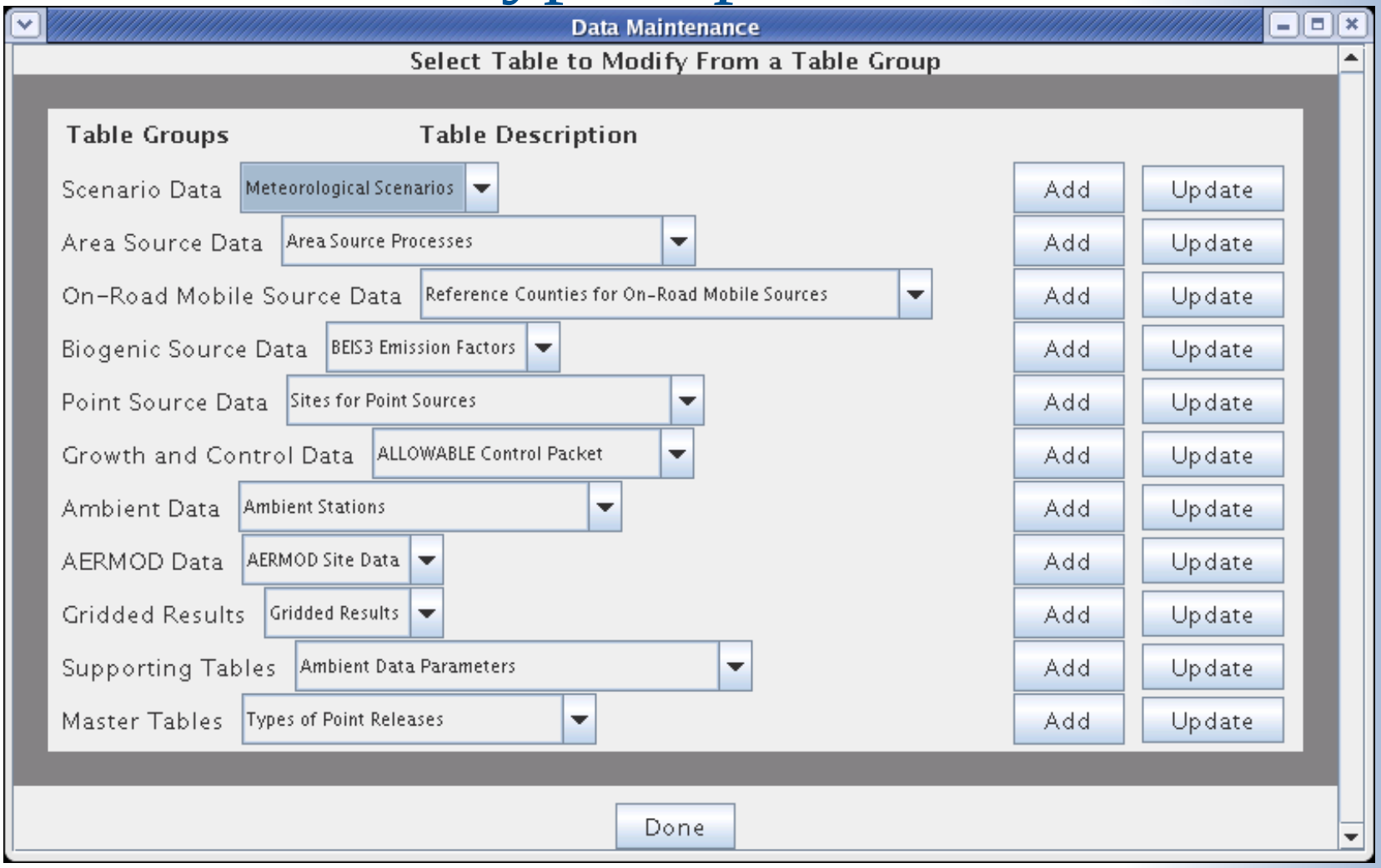
Implementation

- Flexibility
  - Minimize Programming Changes
    - Data-driven implementation
    - Change data in database tables to change data maintenance screens
- User Interface
  - Java Internationalization
    - Display based on user
    - No code changes required to support additional languages
- Limited Data Access
  - User Types
    - EIMA controls screen access to data tables by user type
    - PostgreSQL additional security

Implementation (cont.)

- Data Validation
  - Code Fields
    - SMOKE codes added to database as NIF v3 enhancement
    - Drop-down boxes for data entry
  - Avoid Duplicate Entries
    - Unique keys in database
  - No Orphaned Records
    - Support parent/child relationships during data entry and update
    - Transaction support

Data Maintenance Screen for User Type *expert*



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EIMA Meets Requirements

- EIMA version 1.0 meets all of these requirements.
- Successful installation in Beijing.
- Fulfills need to enter a new emissions inventory manually.
- Open source – released under GNU Public License.
- Implementation in PostgreSQL brings standard SQL to emissions inventory creation and processing.
  - Utilities to support ad hoc queries, to work with data structure, and to maintain data tables.
  - Supports stored procedures.
  - Interfaces provided to numerous programming languages – not just Java.

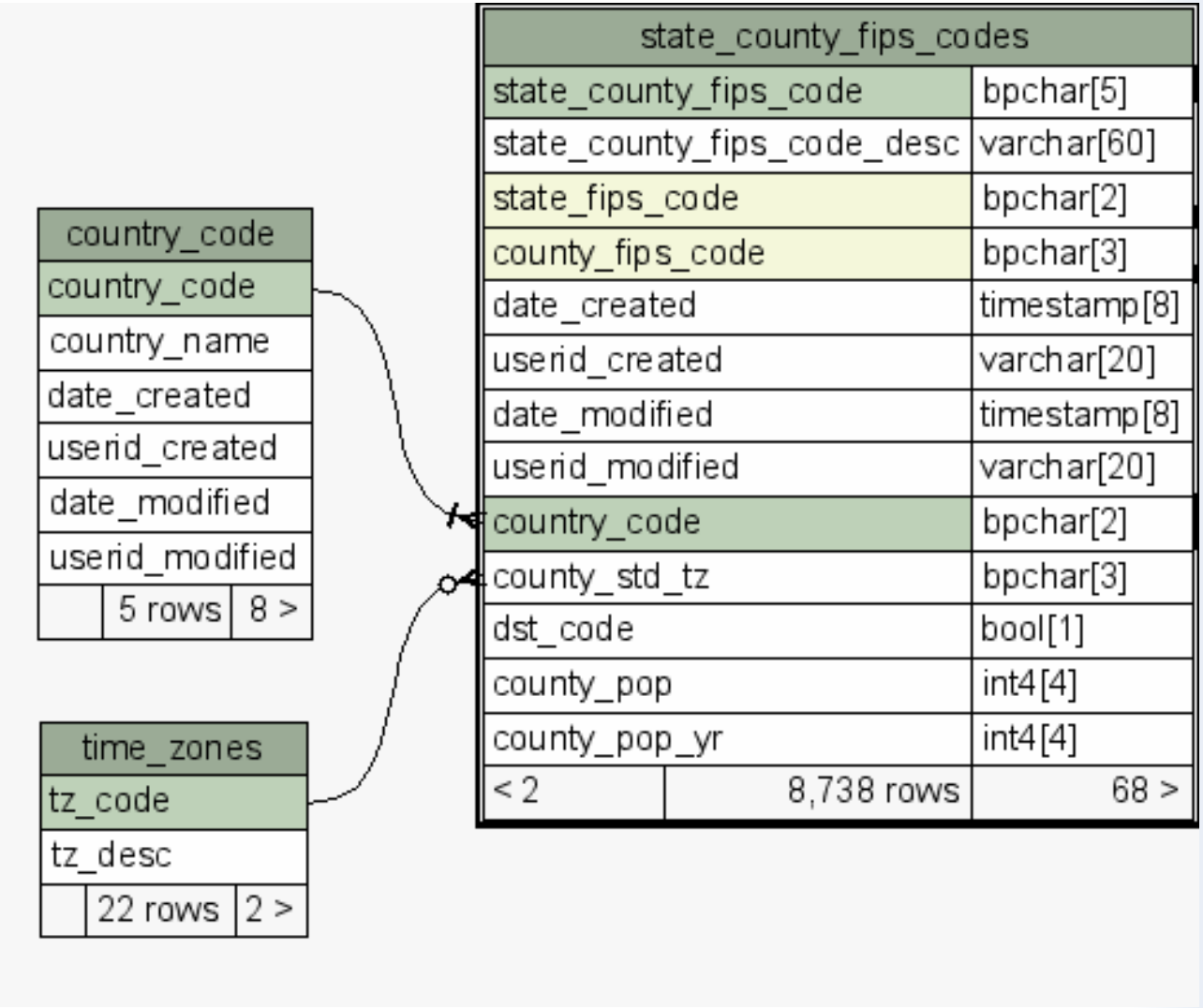
Installation Experiences in Beijing, PRC

- Installed at Beijing Municipal Environmental Protection Bureau
- System: Pentium Dual-Processor 64-bit Zenon Servers with HyperThreading
- No Internet Connection to Computational Computer
- Operating System: Red Hat Linux AS 4 with Simplified Chinese User Interface
- Java: Sun J2SE 64-bit
- Database Connectivity: PostgreSQL and its JDBC Driver
- Software Framework: MIMS and Libraries

Example Bulk Data Load

- Data Tables for Point Sources
  - Start with most basic tables
    - a.k.a. “supporting table” or “base table”
    - Not dependent on any other table
  - Load in order up the chain of dependencies

Base Tables


state_county_fips_codes
state_county_fips_code bpchar[5]
state_county_fips_code_desc varchar[60]
state_fips_code bpchar[2]
county_fips_code bpchar[3]
date_created timestamp[8]
userid_created varchar[20]
date_modified timestamp[8]
userid_modified varchar[20]
country_code bpchar[2]
county_std_tz bpchar[3]
dst_code bool[1]
county_pop int4[4]
county_pop_yr int4[4]
< 2
8,738 rows
68 >
country_code
country_code
country_name
date_created
userid_created
date_modified
userid_modified
5 rows
8 >
time_zones
tz_code
tz_desc
22 rows
2 >

Site for a Point Source (Facility)

point_source_site	
country_code	bpchar[2]
state_county_fips	bpchar[5]
pt_facility_id	varchar[15]
facility_id_2	varchar[12]
facility_category_code	bpchar[2]
cems_facility_code	varchar[6]
sic_primary	bpchar[4]
facility_name	varchar[80]
site_description	varchar[40]
location_address	varchar[50]
city	varchar[60]
county	varchar[40]
province	varchar[40]
postal_code	varchar[14]
facility_latitude	float8[8]
facility_longitude	float8[8]
facility_elevation	float4[4]
facility_location	point[16]
tri_id	varchar[20]
date_created	timestamp[8]
userid_created	varchar[20]
date_modified	timestamp[8]
userid_modified	varchar[20]
< 4	101 rows 7 >

Indexes:

Column(s)	Type
country_code + state_county_fips + pt_facility_id	Primary key
pt_facility_id	Must be unique

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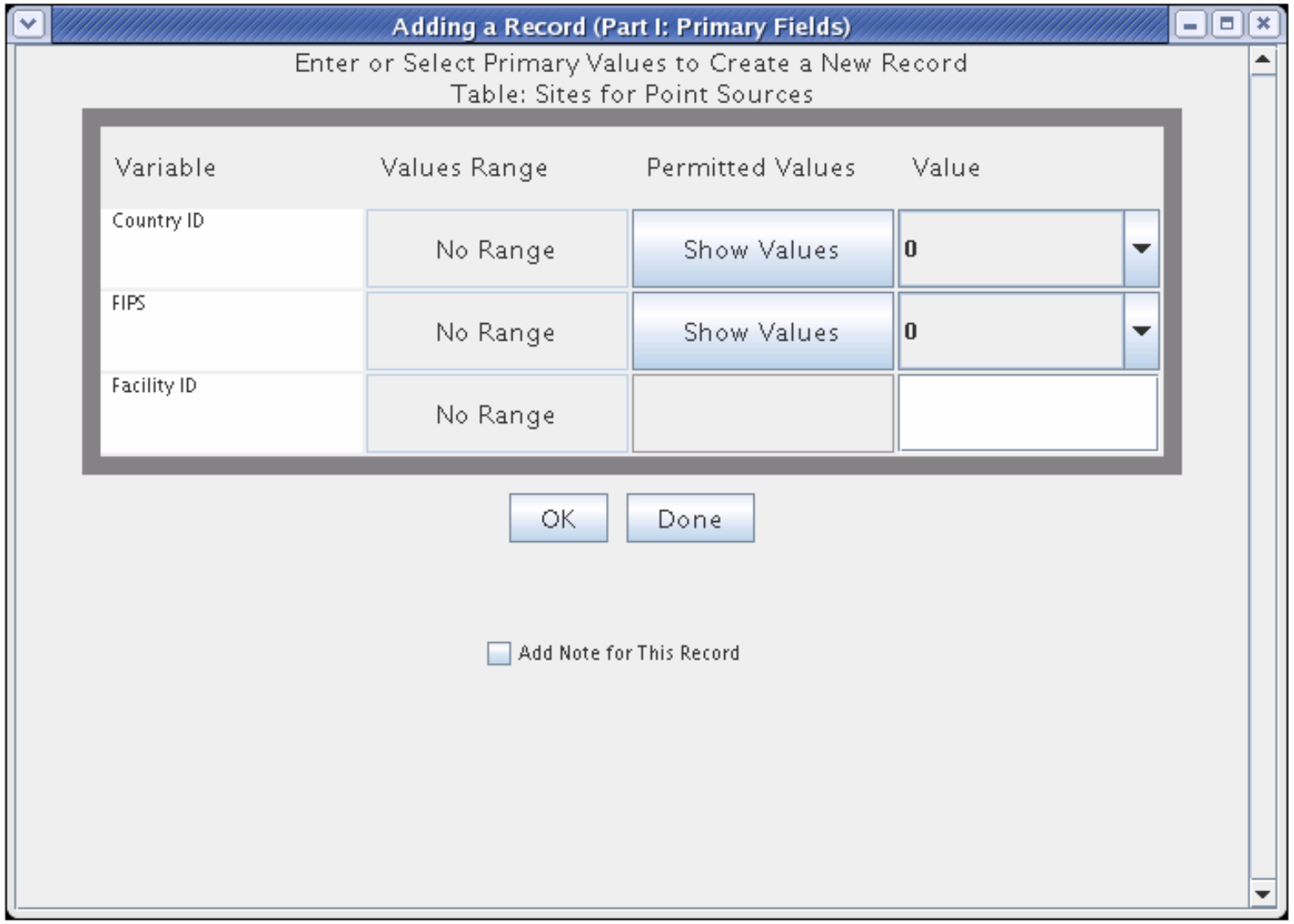
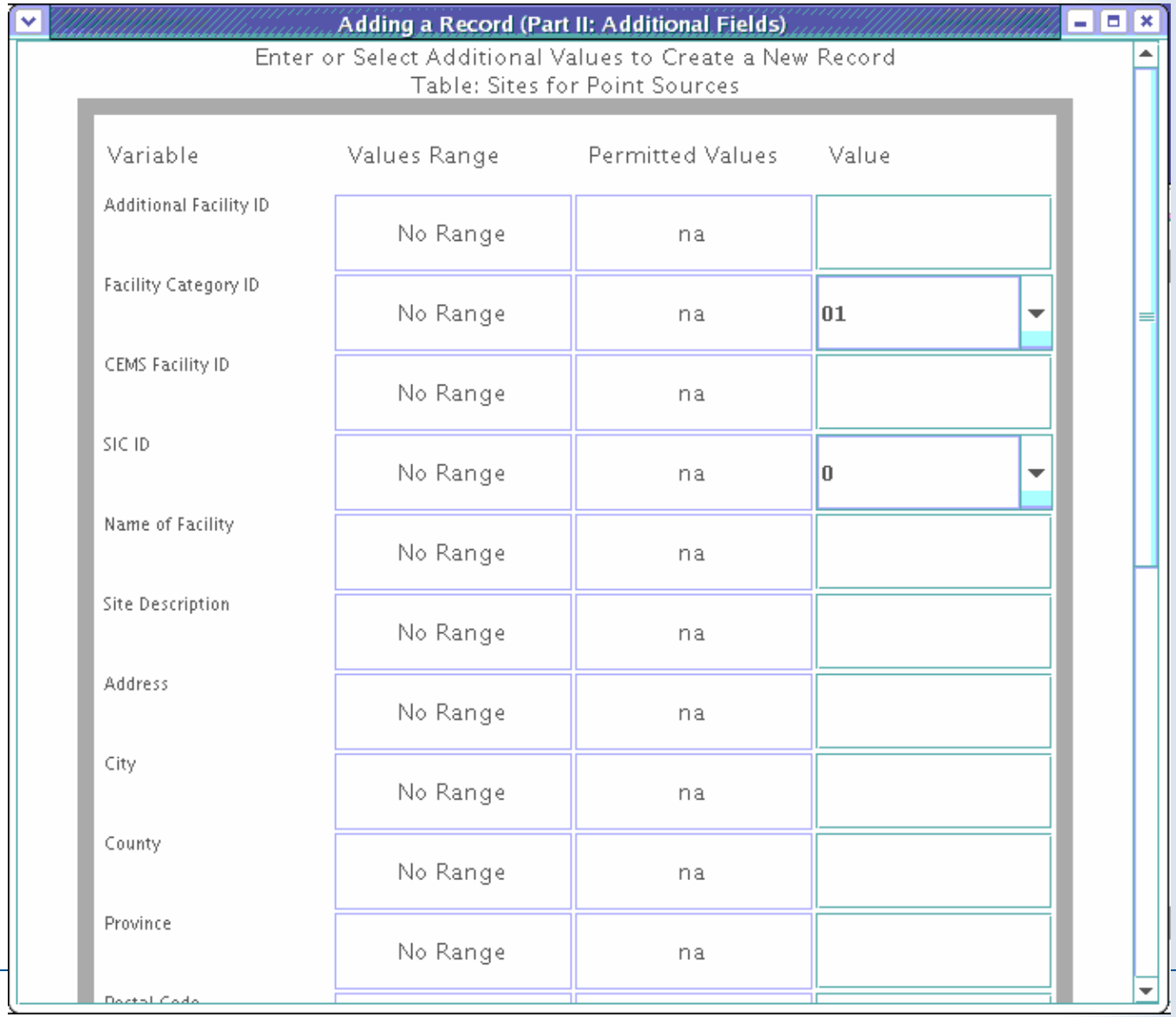
Site for a Point Source



Site: Rest of Fields



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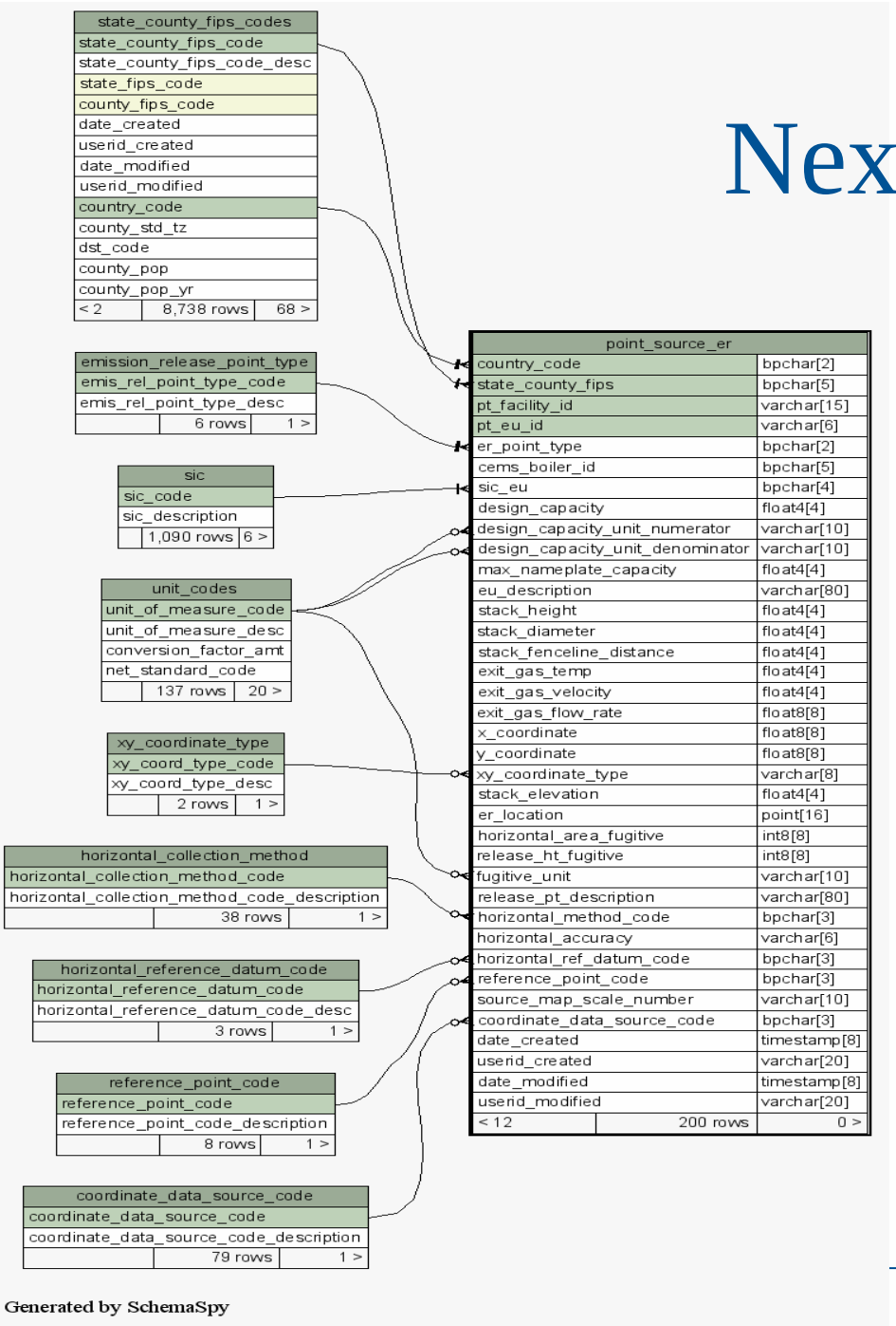
Next Level



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Conclusions

- EIMA Meets System Requirements
- EIMA Version 1 Successfully Installed in Beijing, PRC
  - User interface in both Simplified Chinese and English
  - Available under GNU Public License
- AQMDSS Links Database to SMOKE
  - Data extraction utilities create SMOKE input files from the emission inventory database
  - Code checks during data entry reduces QA errors during SMOKE processing
- Emissions Inventory Readily Accessible
  - PostgreSQL provides numerous programming and ad hoc query interfaces to emissions inventory

Questions?