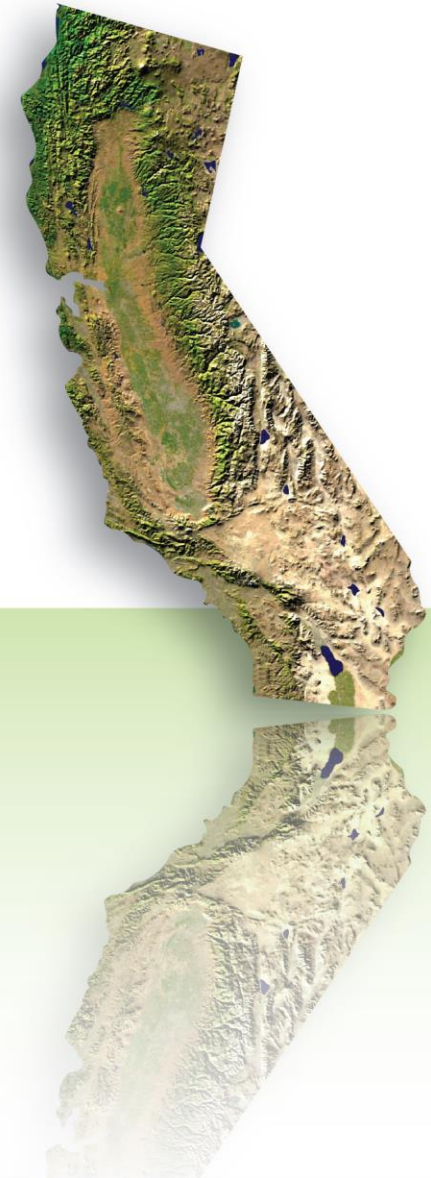
Verifier Accreditation Training for Mandatory Greenhouse Gas Reporting



Process Emissions Specialty
Course 4.4: Nitric Acid Production

California Environmental Protection Agency
Air Resources Board

Verifier Accreditation Training for Mandatory Greenhouse Gas Reporting

Course 4: Process Emissions Specialty

4.1 Cement Production

4.2 Lime Manufacturing

4.3 Glass Manufacturing

4.4 Nitric Acid Production

4.5 Iron and Steel Production

4.6 Pulp and Paper Manufacturing

4.7 Lead Production

California Environmental Protection Agency

Air Resources Board

Course 4.4 Handouts

No handouts are used for this course.

Course 4.4 Nitric Acid Production

1. Overview
2. Emissions Data
3. Verifying Emissions
4. Product Data
5. Verifying Product Data
6. Group Participation Exercise

§ 95118 Nitric Acid Production

- Nitric acid production facilities that use 1 or more trains to produce weak nitric acid (30-70% in strength) using catalytic oxidation of ammonia
- Applies to all nitric acid production facilities regardless of GHG emission levels
- ≥25,000 MT CO_2e triggers
  - Verification
  - Cap-and-Trade covered entity

Emissions Data Reported

- N_2O process emissions from individual production trains - § 95118 refers to Subpart V
- CO_2, CH_4, and N_2O emissions from stationary fuel combustion - § 95115

§ 95118 Relation to Subpart V of 40 CFR 98

§ 95118 refers to subpart V for all requirements except

- Stationary fuel combustion - Any Tier (1-4) from 40 CFR 98.33(a) is permitted by fuel type in § 95115
- Missing emissions data more prescriptive in MRR
- § 95118(d) requires reporting of covered product data for nitric acid and calcium ammonium nitrate (CAN-17, a fertilizer solution)

Calculation of N_2O Process Emissions

Subpart V equations

- Calculation of train-specific emission factor (Eq. V-1)
- Calculation of abatement utilization factor (Eq. V-2)
- Calculation of train-level emissions
  - 1 technology after test point (Eq. V-3a) - at least one plant in CA
  - 2+ technologies (in series) after test point (Eq. V-3b)
  - 2+ technologies (in parallel) after test point (Eq. V-3c)
  - 0 technologies after test point (Eq. V-3d) - at least one plant in CA
- Calculation of facility-level emissions (Eq. V-4)

Verifying N_2O Process Emissions

Evidence to request

- GHG Monitoring Plan
- Detailed facility description and schematic – individual trains, abatement technologies, performance test locations
- Performance test results – N_2O concentration, volumetric flow rate of effluent gas, production rate during test run
  - Is annual test data representative of "normal" operations
- Abatement technology information - destruction efficiencies, utilization factors, fraction control factors
- Nitric acid production
- Missing emissions data procedures and records used

Verifying Equation V-1 - Train-Specific Emission Factor

- Evidence to request
  - Equation inputs (data from performance test runs - N_2O concentration, volumetric flow rate of effluent gas, production rate during test run)
- How to evaluate evidence
  - Confirm appropriate test methods used
  - Confirm methods properly followed
  - Confirm missing emissions data procedures were followed
    - Estimation of missing test data is <u>not</u> permitted; new performance test is required
  - Confirm correct calculation

$$EF_{N2Ot} = \frac{\sum_{1}^{n} \frac{C_{N2O} * 1.14 \times 10^{-7} * Q}{P}}{n} \qquad \text{(Eq. V-1)}$$

Verifying Equation V-2 - Abatement Utilization Factor (1 of 2)

Evidence to request

- Equation inputs
  (nitric acid production - total and with abatement)
- Direct measurement records
  (flow meters, weigh scales, etc.)
- Abatement records (operation log books)

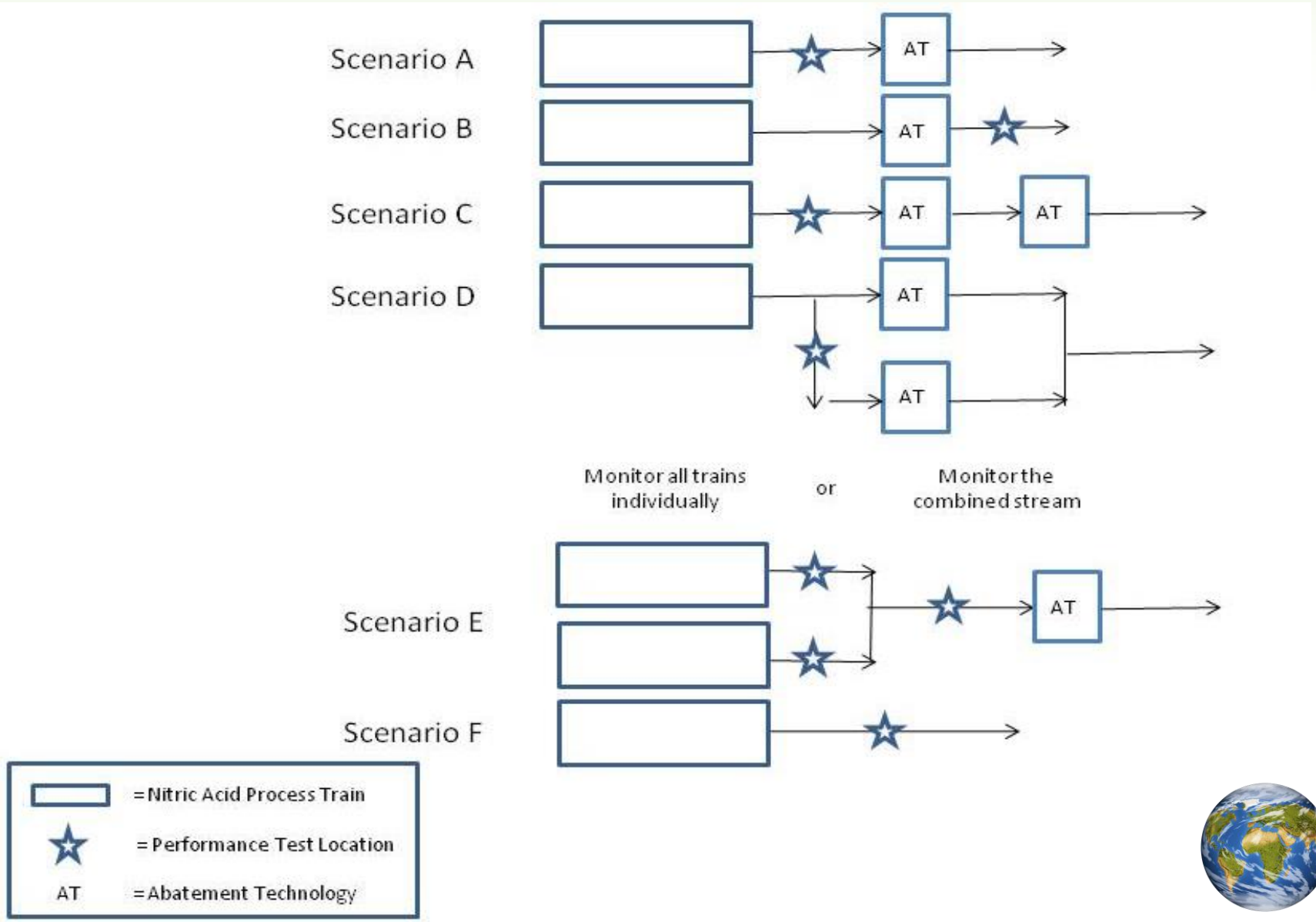
Verifying Equation V-2 - Abatement Utilization Factor (2 of 2)

How to evaluate evidence

- Confirm production record completeness
- Identify if operation periods are indicated as "abated" or "not abated" with respect to air pollution control device
- Confirm missing emissions data procedures were followed:
  - Best available (process/accounting) data (≤20% missing) or maximum production data (>20% missing)
  - Only permitted for calculation of emissions or emission factors; <u>not</u> permitted for covered product data reporting
- Confirm correct calculation

$$AR_{t,N} = \frac{P_{t,N}}{P_t} \qquad \text{(Eq. V-2)}$$

Various Nitric Acid Train Configurations



Process Emissions Equations (V-3a,b,c,d)

$$E_{N2Ot} = \frac{EF_{N2Ot} * P_t}{2205} * \left(1 - \left(DF * AF'\right)\right) \qquad \text{(Eq. V-3 a)}$$

$$E_{N2Ot} = \frac{EF_{N2Ot} * P_t}{2205} * \left(1 - \left(DF_1 * AF_1\right)\right) * \left(1 - \left(DF_2 * AF_2\right)\right) * \ldots * \left(1 - \left(DF_N * AF_N\right)\right) \qquad \text{(Eq. V-3b)}$$

$$E_{N2Ot} = \frac{EF_{N2Ot} * P_t}{2205} * \sum_{1}^{N}\left(\left(1 - \left(DF_N * AF_N\right)\right) * FC_N\right) \qquad \text{(Eq. V-3 c)}$$

$$E_{N_2Ot} = \frac{EF_{N2Ot} * P_t}{2205} \qquad \text{(Eq. V-3 d)}$$

Differences Between Equations V-3a, V-3b, V-3c, and V-3d

Equation	# of Technologies[a]	DF[b] Needed?	AF[c] Needed?	FC[d] Needed?	Configuration[e] ("Scenario" in Slide #3)
V-3a	1	Yes	Yes	No	A, E
V-3b	2+ (in series)	Yes	Yes	No	C
V-3c	2+ (in parallel)	Yes	Yes	Yes	D
V-3d	0	No	No	No	B, F

[a]Number of abatement technologies after test point
[b]Destruction efficiency
[c]Abatement utilization factor
[d]Fraction control factor
[e]Configuration identified in Checklist Table 1

Verifying Equations V-3a, V-3b, V-3c, and V-3d (1 of 2)

Specific evidence needed

- Equation inputs
  (nitric acid production, destruction efficiency, abatement utilization factor, fraction control factor)
- Basis for destruction efficiency
- Basis for fraction control factor
- Direct measurement records
  (flow meters, weigh scales, etc.)

Verifying Equations V-3a, V-3b, V-3c, and V-3d (2 of 2)

How to evaluate evidence

- Confirm production record completeness
- Confirm reasonableness of destruction efficiency
- Confirm missing emissions data procedures were followed
  - Best available (process/accounting) data (≤20% missing) or maximum production data (>20% missing)
  - Only permitted for calculation of emissions or emission factors; not permitted for product data reporting
- Confirm correct calculation

Verifying Equation V-4 - Facility-level emissions

- Evidence to request
  - Equation inputs (train level emissions)
- How to evaluate evidence
  - Confirm inclusion of all trains
  - Confirm correct calculation

Verifying Covered Product Data for Nitric Acid Production

- Evidence to request
  - Monthly nitric acid production data
  - Monthly calcium ammonium nitrate (CAN-17) solution production data
  - Direct measurement of production and concentration (e.g., flow meters, weigh scales, etc.)
  - Existing plant procedures used for accounting purposes (e.g., dedicated tank-level and acid concentration measurements, etc.)
- How to evaluate evidence
  - Confirm record completeness
  - Confirm that monthly data are summed correctly
  - Compare summed monthly data with reported production data
  - Missing data procedures only permitted for calculation of emissions or emission factors; not permitted for product data reporting

Questions and ARB Comments

1. Overview
2. Emissions Data
3. Verifying Emissions
4. Product Data
5. Verifying Product Data
6. **Group Participation Exercise**

Group Participation Exercise 4.4.1
Nitric Acid Process Emissions

- A single production train produces 40,050 tons/yr of nitric acid (100% concentration)
- Only one annual performance test was conducted using specified ASTM
- Production train "t" has one abatement technology downstream of the test location
  - Abatement Technology always operating, receives 100% of N_2O with 80% destruction efficiency
- Other Information:
  - 4.57 tons nitric acid (100% concentration) **produced during 1 hour source test**
  - [N_2O] is 500 ppm
  - Flow rate is 600,000 dscf/hr

- **How much Process N_2O is emitted?**
  - A. 11.29 MT N_2O
  - B. 27.17 MT N_2O
  - C. 100 MT N_2O
  - D. 3,955 MT N_2O

Group Participation Exercise 4.4.1 Solution

How much Process N_2O is emitted?

A. 11.29 MT N_2O
B. 27.17 MT N_2O
C. 100.0 MT N_2O
D. 3,955 MT N_2O

$$EF_{N2Or} = \frac{\sum_{1}^{n} \frac{C_{N2O} * 1.14 \times 10^{-7} * Q}{P}}{n} \quad \text{(Eq. V-1)}$$

$C(N_2O)$ = 500 ppm
Q = 600,000 dscf/hr
P = 4.57 tons HNO_3/hr*
n = 1 test run
500 x 1.14E-7 x 600,000/4.57 =
7.48 lbs N_2O/ton HNO_3 produced

* Verifier should confirm production rate ("P") during performance test is representative of normal operations

$$AF_{tN} = \frac{P_{tN}}{P_t} \quad \text{(Eq. V-2)}$$

Abatement Utilization Factor
PtN = Pt = 40,050 tons
40,050/40,050 = **1**

$$E_{N2Or} = \frac{EF_{N2Ot} * P_t}{2205} * \left(1 - \left(DF * AF\right)\right) \quad \text{(Eq. V-3a)}$$

EFN_2O = 7.48 lbs N_2O/ton HNO_3
Pt = 40,050 tons HNO_3
DF = 0.8
AF = 1
= **27.17 MT N_2O**

Questions and ARB Comments

Course 4: Process Emissions Specialty

Complete:

4.1 Cement Production

4.2 Lime Manufacturing

4.3 Glass Manufacturing

4.4 Nitric Acid Production

Next:

4.5 Iron and Steel Production

4.6 Pulp and Paper Manufacturing

4.7 Lead Production