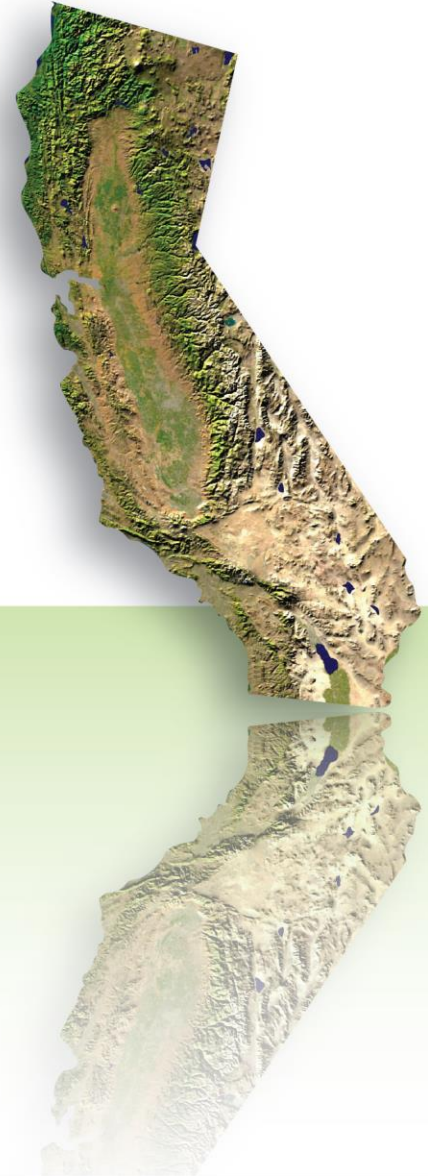


# Verifier Accreditation Training for Mandatory Greenhouse Gas Reporting



Process Emissions Specialty  
Course 4.5: Iron and Steel 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 4.5 Handouts

No handouts are used for this course.

# Course 4.5 Iron and Steel Production

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

# § 95120 Iron and Steel Production (1 of 2)

- Any facility with the following processes, emitting at least 10,000 MT CO<sub>2</sub>e (reporting threshold)
  - Taconite iron ore processing
  - Integrated iron and steel manufacturing
  - Cokemaking (not co-located with an integrated iron and steel manufacturing process)
  - **Electric arc furnace (EAF) steelmaking (not co-located with an integrated iron and steel manufacturing process)**
- Integrated iron and steel manufacturing
  - Produces steel from iron ore or iron ore pellets
  - Operates a basic oxygen furnace (BOF) for refining molten iron into steel
  - May include cokemaking processes and electric arc furnace (EAF) processes



# § 95120 Iron and Steel Production (2 of 2)

- $\geq 25,000$  MTCO<sub>2</sub>e triggers
  - Verification
  - Cap-and-Trade covered entity



Steel rolling and aluminum processing is not reported under § 95120. The product data for steel rolling is reported under § 95115 - **Subpart A** in Cal e-GGRT.



# Emissions Data Reported for Iron and Steel Production Facilities

- CO<sub>2</sub> process emissions from the following sources are reported under Subpart Q (§95120)
  - Taconite indurating furnace
  - Basic oxygen furnace (BOF)
  - Non-recovery coke oven battery combustion stack
  - Coke pushing process
  - Sinter process
  - **Electric arc furnace (EAF)**
  - Argon-oxygen decarburization vessel
  - Direct reduction furnace
- Stationary combustion emissions reported under Subpart C (§95115)
- CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emissions from flares (§95113)

# § 95120 Relation to Subpart Q

In addition to subpart Q, § 95120 also requires

- More stringent missing emissions data reporting procedures
- Covered product data
  - Annual production of primary iron and steel products
    - Facility forms steel billets which are subsequently pulled into reinforcing bar

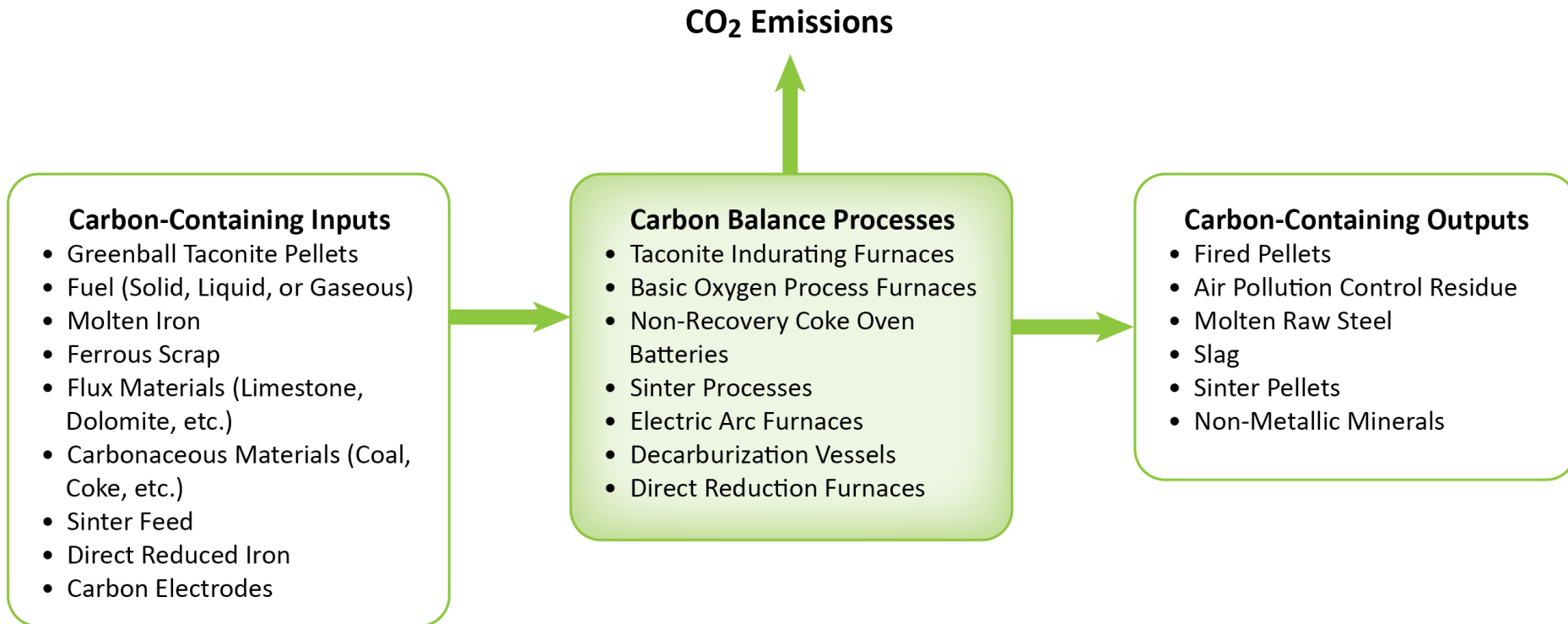


# Methods to Estimate CO<sub>2</sub> Process Emissions for Iron and Steel Facilities

- Subpart Q carbon balance equations for process emissions
  - Taconite indurating furnace emissions (Eq. Q-1)
  - Basic oxygen process furnace (BOF) emissions (Eq. Q-2)
  - Non-recovery coke oven battery emissions (Eq. Q-3)
  - Sinter process emissions (Eq. Q-4)
  - **Electric arc furnace (EAF) emissions (Eq. Q-5)**
  - Decarburization vessel emissions (Eq. Q-6)
  - Direct reduction furnace emissions (Eq. Q-7)
- Site-specific emission factor (alternative to carbon balance)
  - CO<sub>2</sub> mass emission rate (Eq. Q-8)
- Coke pushing emission factor



# Iron and Steel Production – Carbon Balance Processes



# Verifying CO<sub>2</sub> Process Emissions (1 of 2)

## Evidence to request

- Annual mass quantities of all carbon-containing inputs and outputs
  - If any process input and output category (i.e. “Flux”) contributes less than 1% of the total carbon mass, it can be excluded ( § 98.174(b)(4))
- Carbon content of each carbon-containing input and output
  - Analysis provided by supplier, or collecting and analyzing at least three samples per year, used as inputs into Cal e-GGRT
- Any other data that can validate reported data
  - Hours of operation, average outputs, financial data, and any other monitored/measured data

# Verifying CO<sub>2</sub> Process Emissions (2 of 2)

## How to evaluate evidence

- Confirm completeness of carbon-containing input and output quantities
- Confirm appropriate test methods used
- Confirm methods properly followed
- Confirm correct calculation
  - For Electric arc furnaces (EAF) emissions use carbon balance Eq. Q-5

$$CO_2 = \frac{44}{12} * \left[ (Iron) * (C_{Iron}) + (Scrap) * (C_{Scrap}) + (Flux) * (C_f) + (Electrode) * (C_{Electrode}) + (Carbon) * (C_c) - (Steel) * (C_{Steel}) - (Slag) * (C_{Slag}) - (R) * (C_R) \right] \quad (\text{Eq. Q-5})$$

# Verifying Missing Emissions Data Substitution

- For carbon content confirm missing emissions data procedures were followed
  - Estimation of missing carbon content test data is not permitted
  - New test is required
- For mass of carbon-containing inputs and outputs, confirm missing emissions data procedures were followed
  - Best available (process/accounting) data ( $\leq 20\%$  missing) or maximum production data ( $> 20\%$  missing)



# Verifying Covered Product Data

- Evidence to request
  - Monthly production data of primary iron and steel products
  - Direct measurement of production (e.g., weigh hoppers, belt weigh feeders, weighed purchased quantities in shipments or containers, combination of bulk density and volume measurements, etc.)
  - Existing plant procedures used for accounting purposes
- 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 not permitted for covered product data



# Verifying Other Data for an Iron and Steel Production Plant

- Other “non-emissions” data
  - Subpart Q requires other production-related data to be reported to U.S. EPA: e.g., annual production quantity (in metric tons) for taconite pellets, coke, sinter, iron, and raw steel
- Other production-related data are not subject to the same requirements as covered product data required under the MRR and listed in Table 9-1 of the Cap-and-Trade Regulation. However, the 40 CFR 98 production-related data elements must be verified for conformance.
- If production-related data are used to estimate covered emissions, then they could influence the evaluation of material misstatement for emissions data



# Questions and ARB Comments

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

# Group Participation Exercise 4.5.1

## Electric Arc Furnace

An electric arc furnace has the following inputs and outputs.

– Inputs

- Scrap iron -1,500,000 MT (4% C)
- Scrap ferrous metal - 50,000 MT (3% C)
- Flux (limestone) - 300,000 MT (12% C)
- Coal - 200,000 MT (67% C)
- Coke - 40,000 MT (83% C)

– Outputs

- Finished steel - 800,000 MT (0.8% C)
- Slag - 1,000,000 MT (0.16% C)
- Air pollution control residue - 5,000 MT (1.5% C)

What is the total MT CO<sub>2</sub> emitted by the furnace?

- A. 935,458 MT
- B. 935,733 MT
- C. 940,958 MT
- D. 941,233 MT

# Group Participation Exercise 4.5.1

## Electric Arc Furnace - Solution (1 of 2)

- Calculate using Eq. Q-5
- All four answers are correct
- Because ferrous scrap metal carbon is only 0.6% of the total C input, and air pollution control residue carbon is 0.9% of total C output, either or both may be excluded
- $\text{CO}_2 = (\text{Input Carbon} - \text{Output Carbon}) \times (44/12) = \text{metric tons}$

If nothing was excluded,  $(264,700 - 8,075) \times 44/12 = 940,958 \text{ MT}$

If both are excluded,  $(263,200 - 8,000) \times 44/12 = 935,733 \text{ MT}$

If only input was excluded,  $(263,200 - 8,075) \times 44/12 = 935,458 \text{ MT}$

If only output was excluded,  $(264,700 - 8,000) \times 44/12 = 941,233 \text{ MT}$

# Group Participation Exercise 4.5.1

## Electric Arc Furnace - Solution (2 of 2)

| Course 4-5; Iron and Steel Case Study  |           |        |          |                               |                 |  |
|--|-----------|--------|----------|-------------------------------|-----------------|--|
| Inputs                                 | MT        | % C    | C, in MT |                               |                 |  |
| scrap iron                             | 1,500,000 | 0.04   | 60,000   | 22.67%                        |                 |  |
| scrap ferrous metal                    | 50,000    | 0.03   | 1,500    | 0.57%                         | may be excluded |  |
| flux (limestone)                       | 300,000   | 0.12   | 36,000   | 13.60%                        |                 |  |
| coal                                   | 200,000   | 0.67   | 134,000  | 50.62%                        |                 |  |
| coke                                   | 40,000    | 0.83   | 33,200   | 12.54%                        |                 |  |
|  |           |        | 264,700  | total inputs                  |                 |  |
|  |           |        | 263,200  | total inputs minus exclusion  |                 |  |
| Outputs                                |           |        |          |                               |                 |  |
| finished steel                         | 800,000   | 0.008  | 6,400    | 79.26%                        |                 |  |
| slag                                   | 1,000,000 | 0.0016 | 1,600    | 19.81%                        |                 |  |
| APC residue                            | 5000      | 0.015  | 75       | 0.93%                         | may be excluded |  |
|  |           |        | 8,075    | total outputs                 |                 |  |
|  |           |        | 8,000    | total outputs minus exclusion |                 |  |
| MT CO2 = (input C - output C) x 44/100 |           |        |          |                               |                 |  |
| If nothing was excluded:               |           |        |          | (264,700 - 8,075) x 44/12 =   |                 |  |
|  |           |        |          | 940,958 MT                    |                 |  |
| If both are excluded:                  |           |        |          | (263,200 - 8,000) x 44/12 =   |                 |  |
|  |           |        |          | 935,733 MT                    |                 |  |
| Only input was excluded:               |           |        |          | (263,200 - 8,075) x 44/12 =   |                 |  |
|  |           |        |          | 935,458 MT                    |                 |  |
| Only output was excluded:              |           |        |          | (264,700 - 8,000) x 44/12 =   |                 |  |
|  |           |        |          | 941,233 MT                    |                 |  |



# 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
- 4.5 Iron and Steel Production

### ***Next:***

- 4.6 Pulp and Paper Manufacturing
- 4.7 Lead Production