Port Site Air Monitoring Program

1997–2001 Summary

Red Dog Operations, Alaska

Presented October 29, 2001
by
Exponent

Port Site Air Monitoring Program – Presentation Outline

- Background Overview
- Monitoring Objectives
- Elements of the Air Monitoring Program
- Summary of Findings
- Planned Future Work
- Dust Control Improvements 1997–2001

Port Site Environmental Monitoring—Background

- Previous presentation summarized 1990–1996 Port Site Monitoring Program
- Changed monitoring approach in 1997
  - To better identify sources of fugitive dust emissions
  - To better monitor improvements over time in response to continued implementation of fugitive dust control measures
- This presentation summarizes the monitoring program from 1997 to the present

Port Site Environmental Monitoring—Objectives

- The environmental monitoring, dust control, and surface water control efforts are part of a pro-active program developed to minimize operational impacts through:
  - Early identification of fugitive emissions
  - Implementation of mitigative measures
- The objective of this program is to reduce impacts during operations as well as minimize the cleanup efforts required during the closure and reclamation process in the future

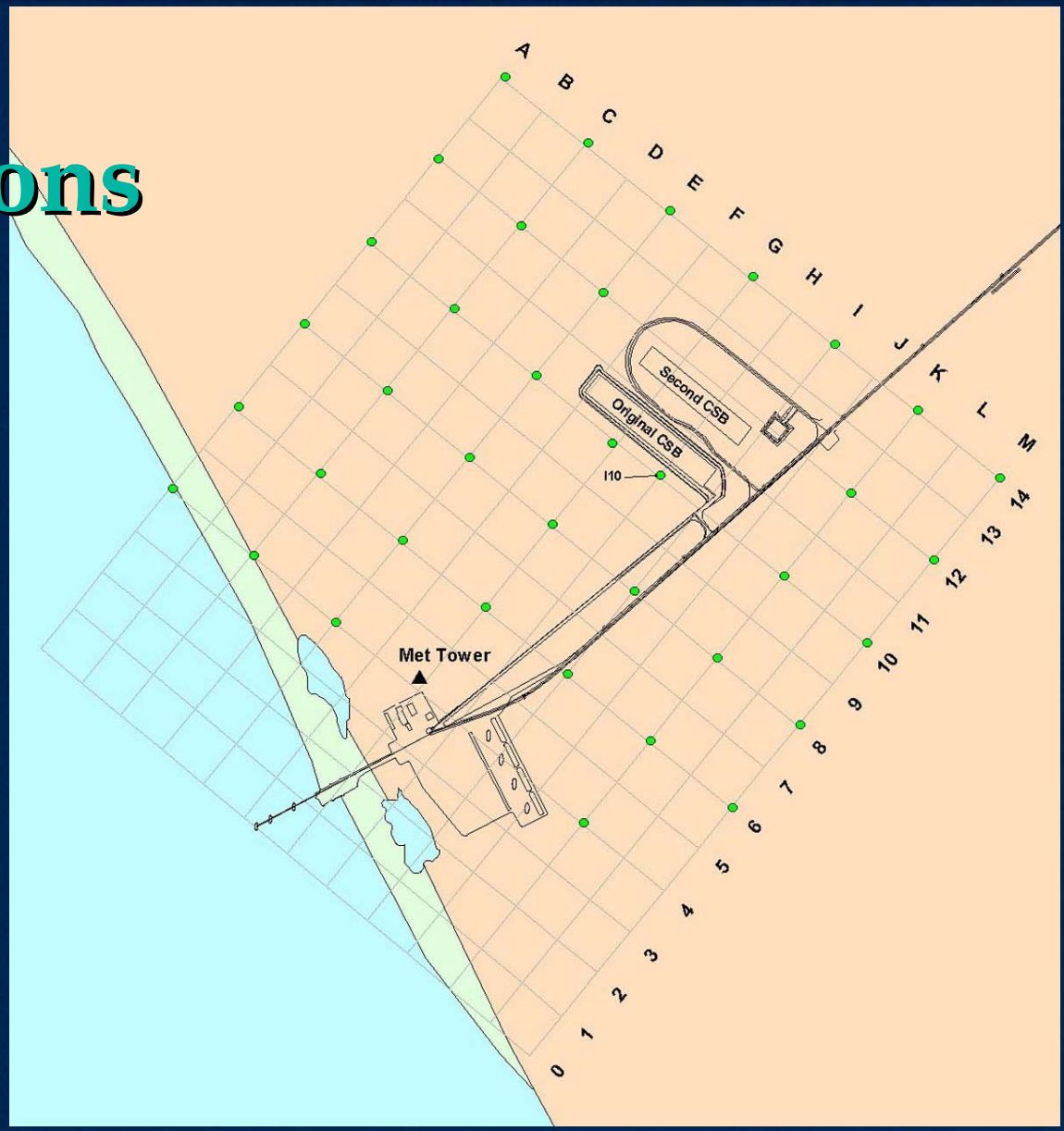
Air Monitoring Program – Elements of the Program

- Dustfall collection jars
- Snow surveys
- Direct air sampling
  - High-volume samplers
  - Tapered element oscillating microbalance (TEOM)

Dustfall Collection Jars

- Dustfall sampling initiated in 1997
- Based on ASTM method D-1739
- Collection jars at 37 locations in 1,000-ft grid pattern around the port site
- Measurements included lead, zinc, and total solids deposition

Dustfall Jar Locations



Dustfall Jar Data Sets

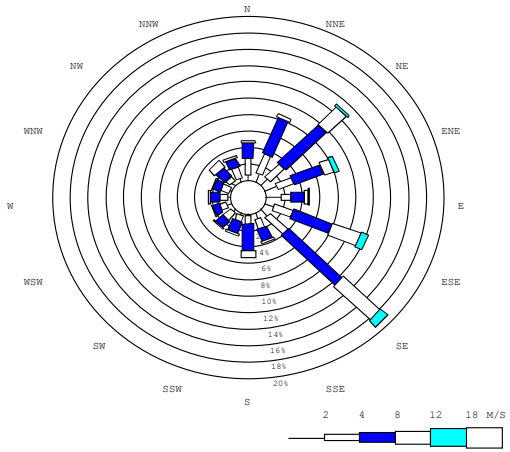
- Summer/Fall 1997 (7/18–10/30)—problems with algae growth, invalid weights
- Spring/Summer 1998 (5/20–8/1)—difficulties with sample analysis
- Summer/Fall 1998 (8/1–11/28)—complete data
- Winter 1999 (1/26–3/30)—complete data
- Summer 1999 (8/22–9/23)—complete data
- Winter 1999/2000 (9/23–1/18)—complete data (last set of dustfall data collected)

Dustfall Jar Results

- Total solids data highly variable due to influences by bird droppings, insects, etc.
- Lead and zinc data indicate that primary sources of fugitive dust are south end of the concentrate storage buildings (CSBs) and roadway where the trucks exit (primarily toward the dock)
- Data set is too limited and too highly variable to identify any systematic changes or trends over time

Dustfall Jar Results with Windrose

8/1–11/28/98



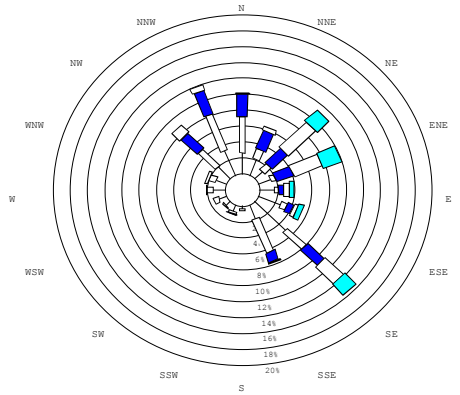
Lead

Zinc

Note: Deposition rates are plotted in micrograms/day.

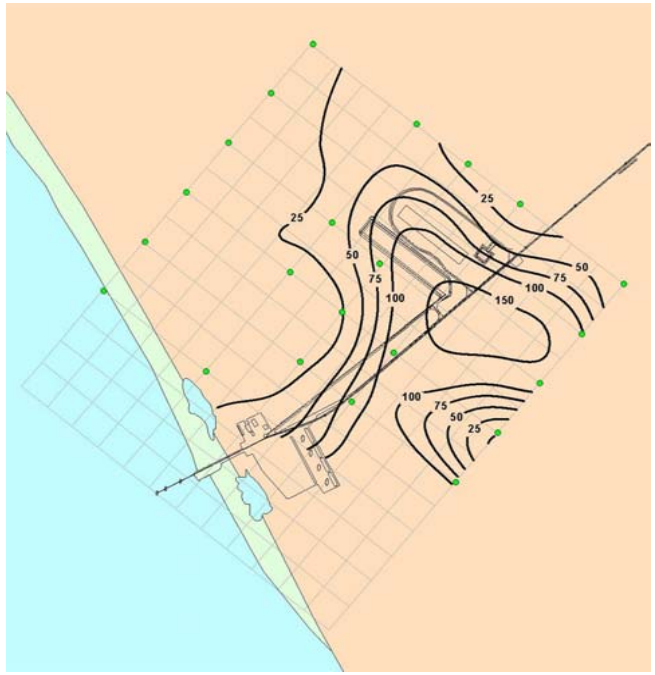
Dustfall Jar Results with Windrose

1/26–3/30/99



Lead

Zinc



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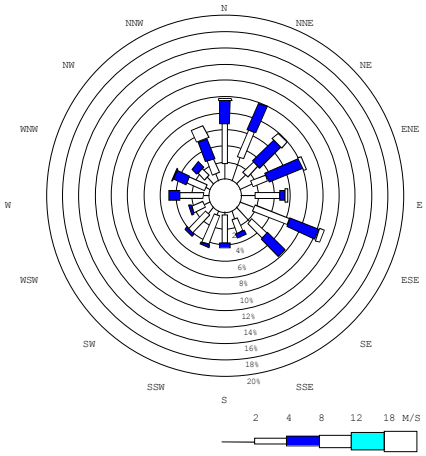
Dustfall Jar Results with Windrose

8/22–9/23/99



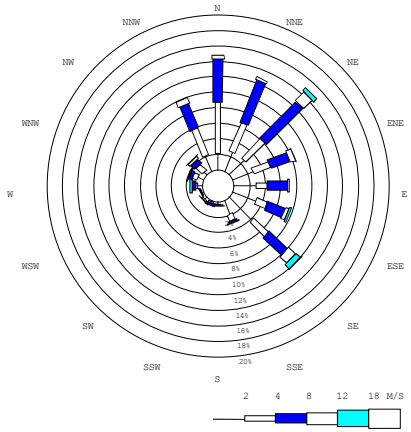
Lead

Zinc

Note: Deposition rates are plotted in micrograms/day.

Dustfall Jar Results with Windrose

9/23/99–1/18/00



Lead

Zinc

Notes:
1. Deposition rates are plotted in micrograms/day.
2. Deposition rates during this monitoring period were affected by replacement of the P8 conveyor (parallel to the road) and removal of its gravel foundation pad.

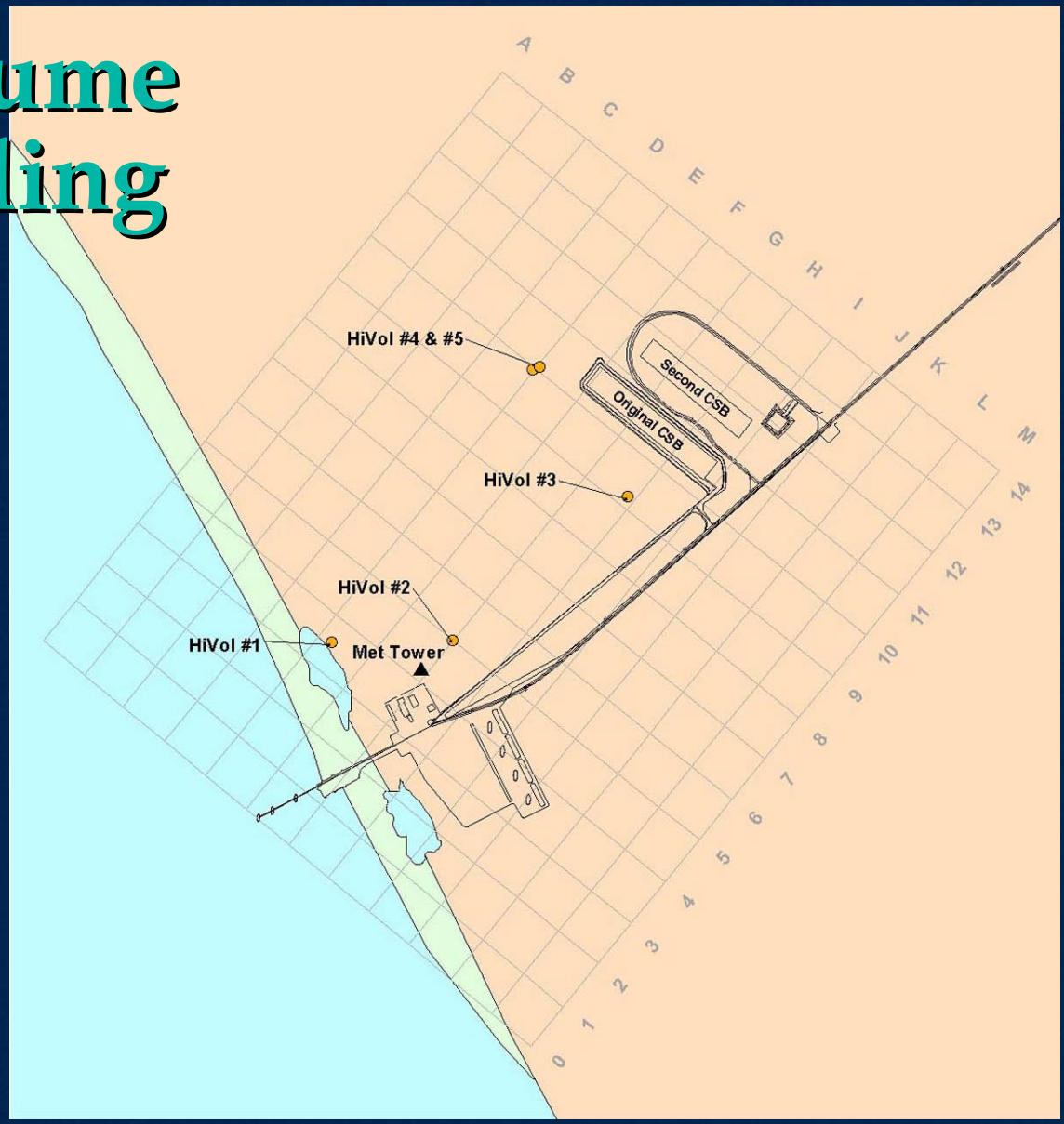
Snow Surveys

- Two sampling events: April 1997 and February 1998
- Analytes: Lead, zinc, and cadmium
- Findings: Showed probable sources of fugitive dust primarily where trucks exit original CSB and along road toward dock from CSB
- Limitations: Affected by variable snow cover and topography-dependent drifting and deposition

High-Volume Air Sampling

- Conducted since 1997
- Samples generally collected from June/July through October each year, which includes the shipping season
- Five samplers at the port site
- Total suspended particulates (TSP) measured at four locations
- PM10 measured at one location
- A subset of samples also analyzed for lead and zinc

High-Volume Air Sampling Locations



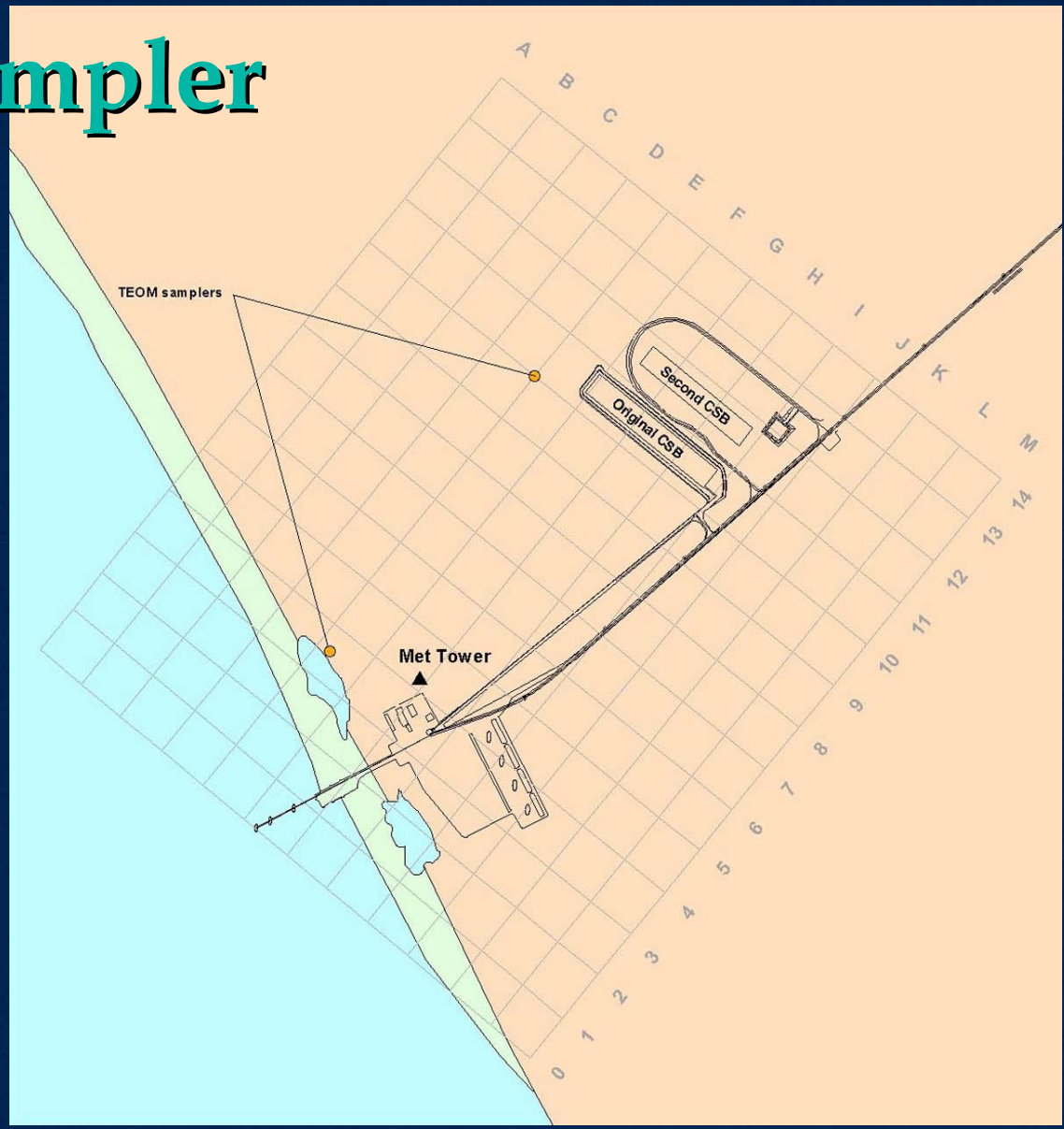
High-Volume Air Sampling Results

- Air Sciences Inc. (Boulder, CO) reviewed data and implicated the following sources of fugitive dust:
  - Primary: Haul road between CSBs and dock
  - Secondary: Surge bin[1] and doors at ends of CSBs
- Data were insufficient to identify temporal trends

Tapered Element Oscillating Microbalance (TEOM) Air Sampling

- Device for measuring ambient particulate air concentrations in real time
- Installation and pilot operation began September 24, 2000
- After operation for more than 1 year, data from similar time periods in different years can be compared

TEOM Sampler Locations



Port Site Air Monitoring Program—Summary of Findings

Sources—primary remaining sources of fugitive dust appear to be:

- **Doors at ends of CSBs**
- **Roadway where trucks exit after being unloaded (tracking in either direction)**
- **Surge bin**

Port Site Air Monitoring Program—Summary of Findings
(continued)

Trends over time:

- **Dustfall jar data showed no conclusive temporal trends**
- **High-volume air sampling results showed no conclusive temporal trends**
- **TEOM pilot program sampling began September 24, 2000**

Port Site Air Monitoring Program—Summary of Findings
(continued)

Difficulties with temporal trend analysis:

- **Large number of controlling variables between time periods:**
  - **Meteorological (wind speed and direction, precipitation)**
  - **Shipping or operational status**
  - **Changes in facility and equipment (e.g., new CSB, new trucks)**

Port Site Air Monitoring Program—Planned Future Work

Approach to address difficulty of temporal trend analysis:

- **Normalize dustfall data by one or more variables (e.g., number of truck trips, number of tons of concentrate shipped during monitoring period)**
- **Collect information in more discrete time increments (e.g., collect hourly TEOM data and compare with meteorological data and port operations data)**

Port Site Air Monitoring Program—Planned Future Work
(continued)

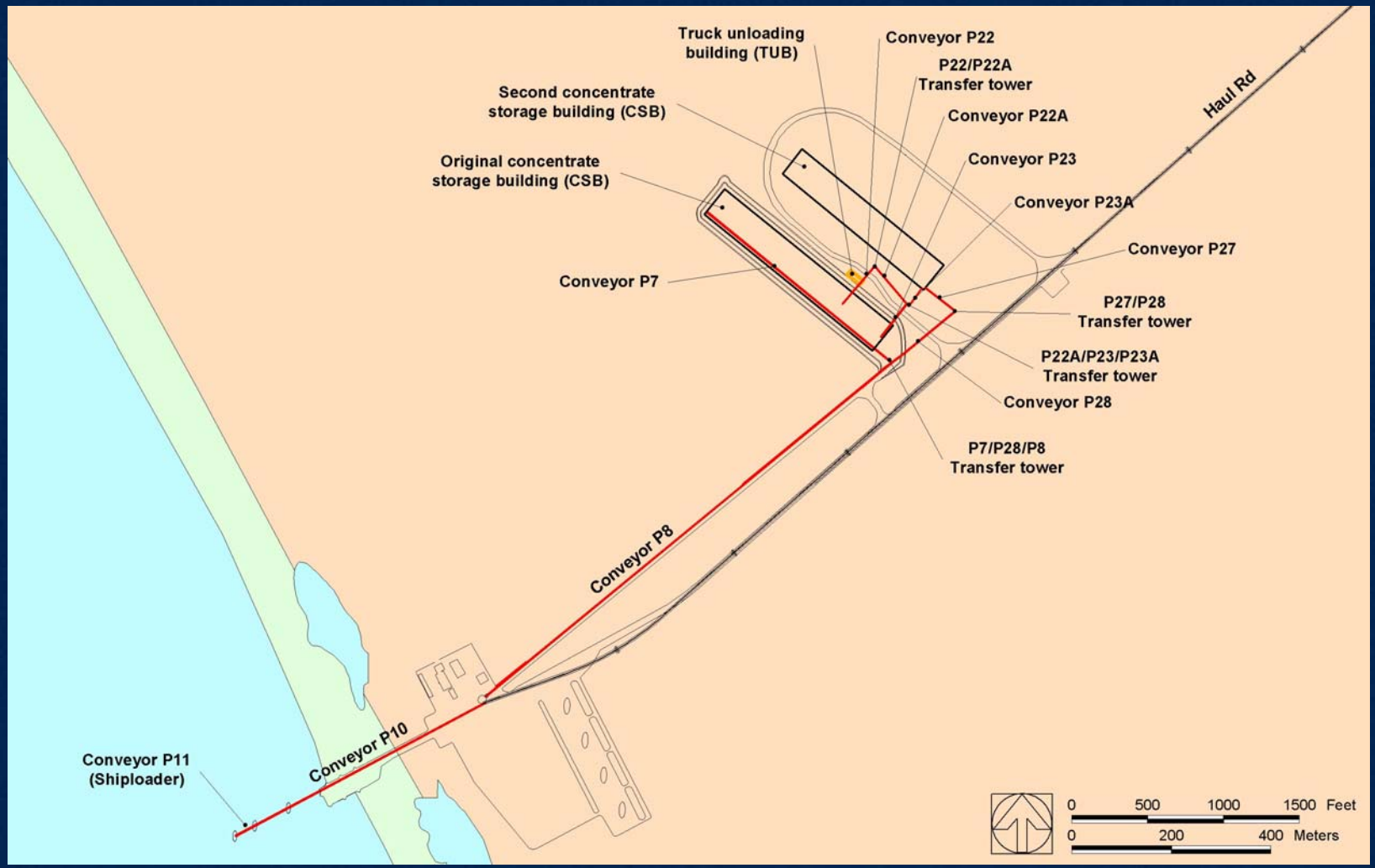
Continuation of the following:

- **Port Site dustfall sampling**
- **TEOM sampling**

Dust Control Improvements 1997-2001

- 1996–1998 Port Site upgrade[1] (production rate increase)
  - Upgraded conveyor system (all new conveyors enclosed in steel tubes and additional baghouses[2] at P22, P22-A, P23, P23-A, P27, P28)
  - Enclosed P7/P8 transfer point in steel building
- Winter 1996–97
  - Changed trailer wing deflectors to stainless steel for reduced adhesion and carry-out from truck unloading building (TUB)

Port Site Features Map



Dust Control Improvements 1997-2001
(continued)

- 1998–1999
  - Switched to reinforced covers on concentrate trailers (improved spill control)
- Winter 1998–99
  - Began using Bobcat loader bucket to clean up TUB dumping platform between dump events (reduces concentrate track-out from TUB)
  - Began using Chem-Loc® release agent in concentrate trailers to minimize residual and carry-out following dumping (reduced need for air-lancing trucks)

Dust Control Improvements 1997-2001
(continued)

- Spring 1999
  - Added a spill deflector gate in TUB and removed deflector wings from concentrate truck trailers (to minimize carry-out from TUB)
- Fall 1999
  - Slab added to south door of TUB

Dust Control Improvements 1997-2001
(continued)

- 1999–2000
  - Upgraded to rotary valves on the baghouses
- Spring 2000
  - Added man-door to TUB control room (personnel can enter/exit building without opening large doors)
- 2000
  - Completed steel tube enclosure of P8 conveyor

Dust Control Improvements 1997-2001
(continued)

- Winter 2000/2001
  - Upgraded to motorized conveyor belt scrapers from standard blade scrapers
- Spring 2001
  - Replaced covers on P11 shiploader conveyor
- Summer 2001
  - Began installation of stilling curtains in TUB
  - Added truck wash outside TUB

Dust Control Improvements 1997-2001
(continued)

- 2001—Obtained new self-dumping trailers with:
  - Hydraulically operated hard covers to minimize spills
  - Fewer exterior surfaces to minimize carry-out from the TUB
  - No side doors to eliminate potential for concentrate leakage

Current and Near Future Dust Control Improvements

- Fall 2001
  - Completing the extension of the TUB to accommodate length of new trailers
  - Continuing permitting process with ADEC to add baghouse to TUB hopper
- Winter 2001/2002
  - Testing new type of bag in baghouses
  - Updating standard operating procedures

Current and Near Future Dust Control Improvements
(continued)

- Spring 2002
  - Planning replacement of covers on P10 conveyor
- 2002
  - Planning replacement of all man-doors (access points) to improve seals
  - Considering replacement of baghouse at transfer from conveyor P22 to P22-A with a dustless transfer system