July 11 [and September 12], 1983 DNR comments. 1983

[s.l.]: [s.n.], 1983

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July 11, 1983 DNR Comments (initial responses were sent to the DNR's January 26, 1983 comment letter)

Comment No. 1

During the May 17, 1983 meeting between D. Ziege, T. Steidl and myself from the WDNR and J. DeMarte, D. Herbst and other staff from Exxon it was made clear that if the air pollution control permit for the Crandon Project requires the use of the emission control equipment (e.g. venturi scrubbers, fabric filter baghouses, etc.) specified in the permit application, stationary source particulate emissions will be less than 250 tons per year (TPY) and the Crandon Project will be exempt from the federal Prevention of Significant Deterioration of Air (PSD) program. Additionally, if adequate control of the dust emission during MWDF construction is included in the permit, total particulate emissions from stationary and fugitive dust sources combined should be less than 250 TPY and the Crandon Project will be a minor air pollution source as defined by Wisconsin Statutes.

Response:

Comment acknowledged. Exxon expects to maintain the conditions provided in its air pollution control permit application and to abide by the conditions of the air permit. As a result, the Crandon Project will be exempt from the federal PSD program and a minor air pollution source as defined by Wisconsin Statutes.

Comment No. 2

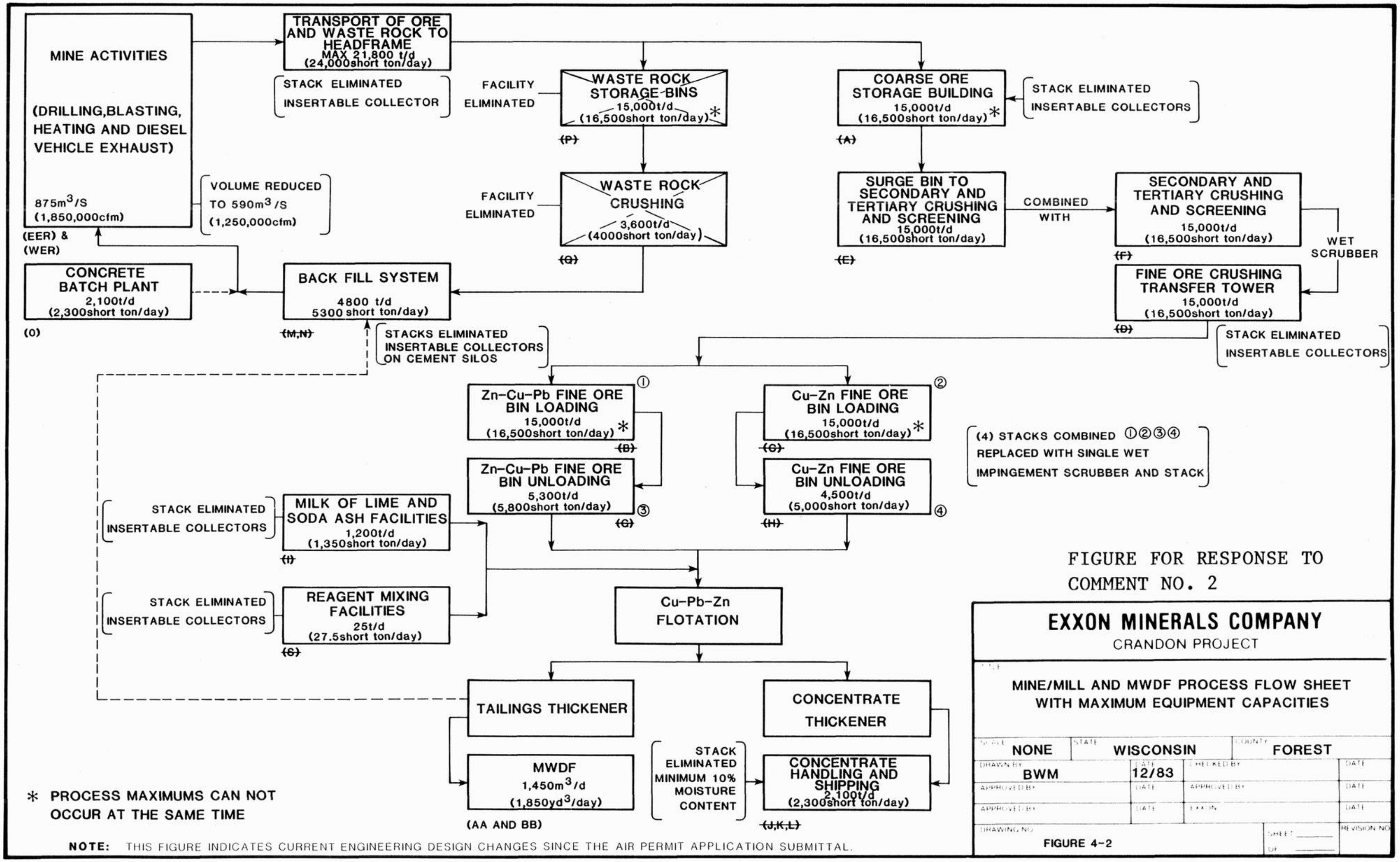
Accurate emission estimates require that the type of operation and the maximum throughput of material be known. Figure 4-2 in the air permit application provides daily throughput for each surface operation. If these throughput rates are the capacity of the equipment to be installed, then they can be used for emission estimates. Otherwise, the maximum daily throughput for each operation should be provided. The average annual treatment rate of 9100 metric tons per day is useful for estimating the annual emission expected. However, the air quality modeling predicts maximum 24 hour particulate impacts for each source which require maximum daily emissions, and hence, maximum daily throughput.

Response:

The daily process maximums presented in Figure 4-2 of the air permit application will be revised as shown (see attached Figure 4-2) to indicate the current estimate of peak daily operation throughputs. As previously noted on Figure 4-2, individual maximums can not occur simultaneously because of downstream or upstream limiting processes.

Comment No. 3

The effectiveness of any control equipment will be dependent on the particle size distribution in the gas stream exhausting through it, as indicated in your reference in U.S. EPA publication AP-42. Please provide a particle size distribution analysis estimated for each gas stream exhausting through control equipment and specific design parameters of each piece of equipment


MINE ACTIVITIES
(DRILLING,BLASTING, HEATING AND DIESEL VEHICLE EXHAUST)
875m3/S (1,850,000cfm)
(EER) & (WER)
VOLUME REDUCED TO 590m3/S (1,250,000cfm)
TRANSPORT OF ORE AND WASTE ROCK TO HEADFRAME MAX 21,800 t/d (24,000short ton/day)
STACK ELIMINATED INSERTABLE COLLECTOR
FACILITY ELIMINATED
WASTE ROCK STORAGE BINS 15,000t/d (16,500short ton/day) *
(P)
COARSE ORE STORAGE BUILDING 15,000t/d (16,500short ton/day) *
(A)
STACK ELIMINATED INSERTABLE COLLECTORS
FACILITY ELIMINATED
WASTE ROCK CRUSHING 3,600t/d (4000short ton/day)
(Q)
SURGE BIN TO SECONDARY AND TERTIARY CRUSHING AND SCREENING 15,000t/d (16,500short ton/day)
(E)
COMBINED WITH
SECONDARY AND TERTIARY CRUSHING AND SCREENING 15,000t/d (16,500short ton/day)
(F)
WET SCRUBBER
CONCRETE BATCH PLANT 2,100t/d (2,300short ton/day)
(0)
BACK FILL SYSTEM 4800 t/d 5300 short ton/day)
(M,N)
STACKS ELIMINATED INSERTABLE COLLECTORS ON CEMENT SILOS
FINE ORE CRUSHING TRANSFER TOWER 15,000t/d (16,500short ton/day)
(D)
STACK ELIMINATED INSERTABLE COLLECTORS
Zn-Cu-Pb FINE ORE BIN LOADING 15,000t/d (16,500short ton/day) * ①
(B)
Cu-Zn FINE ORE BIN LOADING 15,000t/d (16,500short ton/day) * ②
(C)
(4) STACKS COMBINED ①②③④ REPLACED WITH SINGLE WET IMPINGEMENT SCRUBBER AND STACK
Zn-Cu-Pb FINE ORE BIN UNLOADING 5,300t/d (5,800short ton/day) ③
(G)
Cu-Zn FINE ORE BIN UNLOADING 4,500t/d (5,000short ton/day) ④
(H)
STACK ELIMINATED INSERTABLE COLLECTORS
MILK OF LIME AND SODA ASH FACILITIES 1,200t/d (1,350short ton/day)
(I)
STACK ELIMINATED INSERTABLE COLLECTORS
REAGENT MIXING FACILITIES 25t/d (27.5short ton/day)
(S)
Cu-Pb-Zn FLOTATION
TAILINGS THICKENER
CONCENTRATE THICKENER
MWDF 1,450m3/d (1,850yd3/day)
(AA AND BB)
STACK ELIMINATED MINIMUM 10% MOISTURE CONTENT
CONCENTRATE HANDLING AND SHIPPING 2,100t/d (2,300short ton/day)
(J,K,L)
* PROCESS MAXIMUMS CAN NOT OCCUR AT THE SAME TIME
NOTE: THIS FIGURE INDICATES CURRENT ENGINEERING DESIGN CHANGES SINCE THE AIR PERMIT APPLICATION SUBMITTAL.
FIGURE FOR RESPONSE TO COMMENT NO. 2
EXXON MINERALS COMPANY
CRANDON PROJECT
MINE/MILL AND MWDF PROCESS FLOW SHEET WITH MAXIMUM EQUIPMENT CAPACITIES
SCALE NONE
STATE WISCONSIN
COUNTY FOREST
DRAWN BY BWM
DATE 12/83
CHECKED BY
APPROVED BY
DRAWING NO. FIGURE 4-2
SHEET OF
REVISION NO.

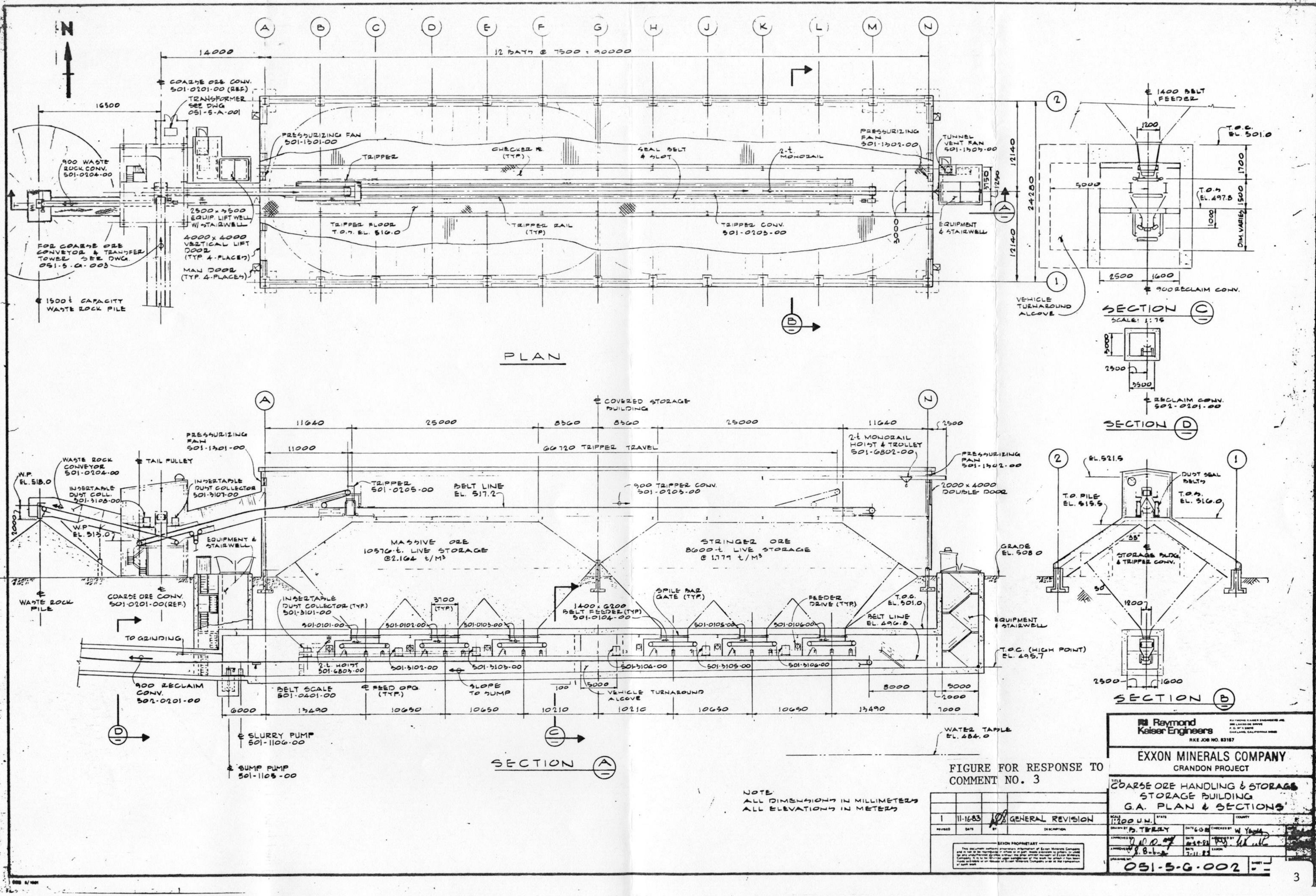
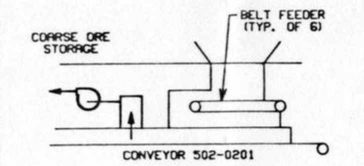
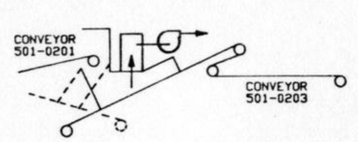
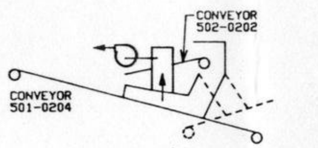


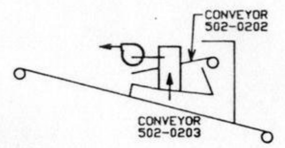
FIGURE FOR RESPONSE TO COMMENT NO. 3

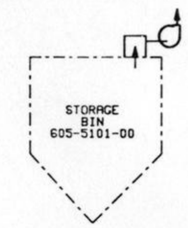
SYSTEM DIAGRAM

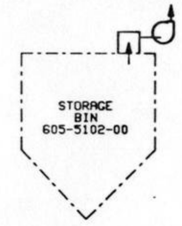


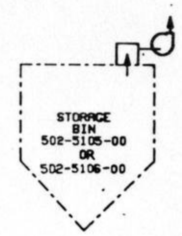






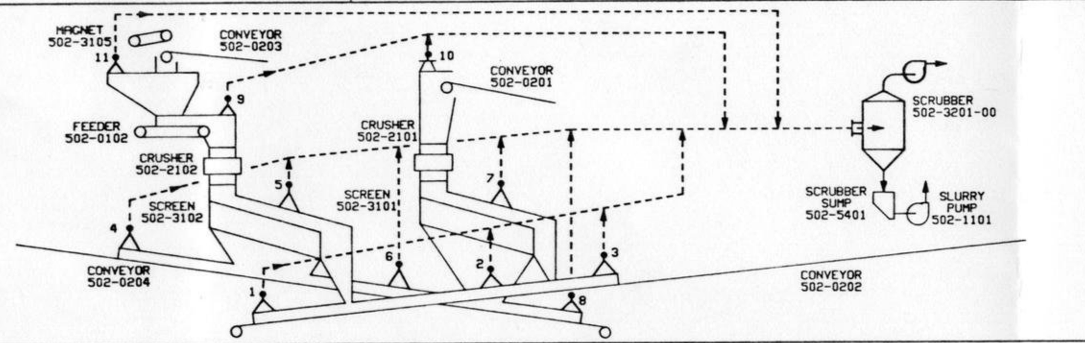


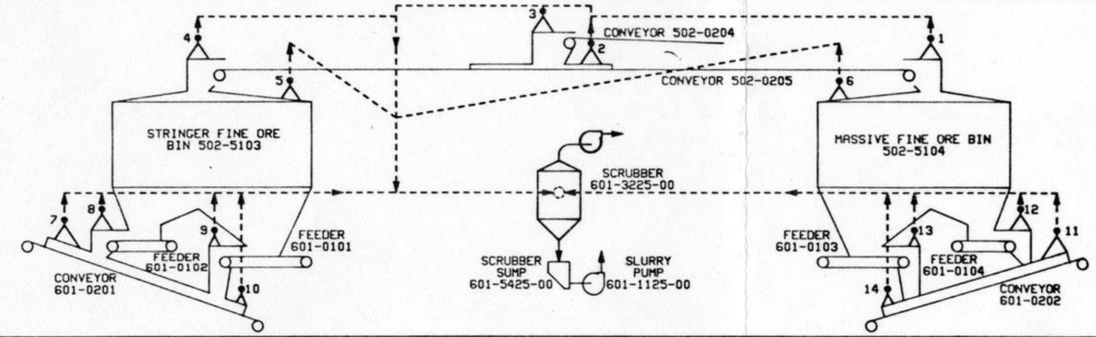




LOCATION/SYSTEM	RECLAIM TUNNEL	TRANSFER TOWER - TRIPPER CONVEYOR	TRANSFER TOWER - WASTE ROCK CONVEYOR	TRANSFER TOWER - FINE CRUSHING	STORAGE BIN - CONCENTRATOR	STORAGE BIN - CONCENTRATOR	STORAGE SILO - CONCENTRATOR
DUST COLLECTOR EQUIP. NO.	(6 REQ'D) 501-3101-00 THRU 501-3106-00	501-3107-00	501-3108-00	502-3103-00	605-3101-00	605-3102-00	(2 REQ'D) 502-3115-00 & 502-3116-00
FAN EQUIPMENT NO.	-	-	-	-	-	-	-
MATERIAL	STRINGER ORE/MASSIVE ORE	STRINGER ORE/MASSIVE ORE	WASTE ROCK	STRINGER ORE/MASSIVE ORE	BURNT LIME	SODA ASH	CEMENT
SYSTEM VOLUME M^3/SEC	1.0	1.65	1.65	1.65	0.71	0.71	1.42
FAN STATIC PRESS. Kg/cm^2	0.018	0.018	0.018	0.018	0.018	0.018	0.018
FAN HORSEPOWER	5	5	7.5	7.5	5	5	5
REFERENCE DRAWING	051-5-C-002	051-5-C-002	051-5-C-002	051-5-C-005	051-6-C-008	051-6-C-008	051-6-C-007

SYSTEM DIAGRAM





LOCATION/SYSTEM	FINE ORE CRUSHING AND SCREENING	FINE ORE STORAGE AND MILL FEED	
DUST COLLECTOR EQUIP. NO.	502-3201-00	502-3202-00	
FAN EQUIPMENT NO.	-	-	
MATERIAL	STRINGER ORE/MASSIVE ORE	STRINGER ORE/MASSIVE ORE	
PICK-UP POINT 1 M^3/SEC	0.35	0.70	
PICK-UP POINT 2 M^3/SEC	1.18	1.40	
PICK-UP POINT 3 M^3/SEC	1.18	0.70	
PICK-UP POINT 4 M^3/SEC	1.18	0.70	
PICK-UP POINT 5 M^3/SEC	3.76	0.70	
PICK-UP POINT 6 M^3/SEC	1.18	0.70	
PICK-UP POINT 7 M^3/SEC	3.76	1.18	
PICK-UP POINT 8 M^3/SEC	0.35	0.82	
PICK-UP POINT 9 M^3/SEC	1.06	0.82	
PICK-UP POINT 10 M^3/SEC	0.60	0.35	
PICK-UP POINT 11 M^3/SEC	1.22	1.18	
PICK-UP POINT 12 M^3/SEC	-	0.82	
PICK-UP POINT 13 M^3/SEC	-	0.82	
PICK-UP POINT 14 M^3/SEC	-	0.35	
SYSTEM VOLUME M^3/SEC	15.80	11.30	
FAN STATIC PRESS. Kg/cm^2	0.043	0.043	
REFERENCE DRAWING	051-5-C-005	051-5-C-004	

NOTES
1. ALL FANS TO BE SELECTED FOR VOLUME = 1.15 X SYSTEM VOLUME.

FIGURE FOR RESPONSE TO COMMENT NO. 3

24-AUG-83
KEI5270

REVISED	DATE	BY	DESCRIPTION
1	11-23-83	[signature]	GENERAL REVISION

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Raymond Kaiser Engineers
RAYMOND KAISER ENGINEERS INC.
300 LAKESIDE DRIVE
P. O. BOX 23210
OAKLAND, CALIFORNIA 94623
RKE JOB NO. 83157

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
DUST COLLECTOR SCHEDULE

SCALE NONE | STATE | COUNTY
DRAWN BY RDS | CHECKED BY [signature] | DATE 8-26-83
APPROVED BY [signature] | DATE 8-26-83 | APPROVED BY [signature]
APPROVED BY S. Bubuo | DATE 8-26-83 | EXXON
DRAWING NO 051-1-M-001 | SHEET 1 OF 1 | REVISION 1

ALIGN AND SCALE

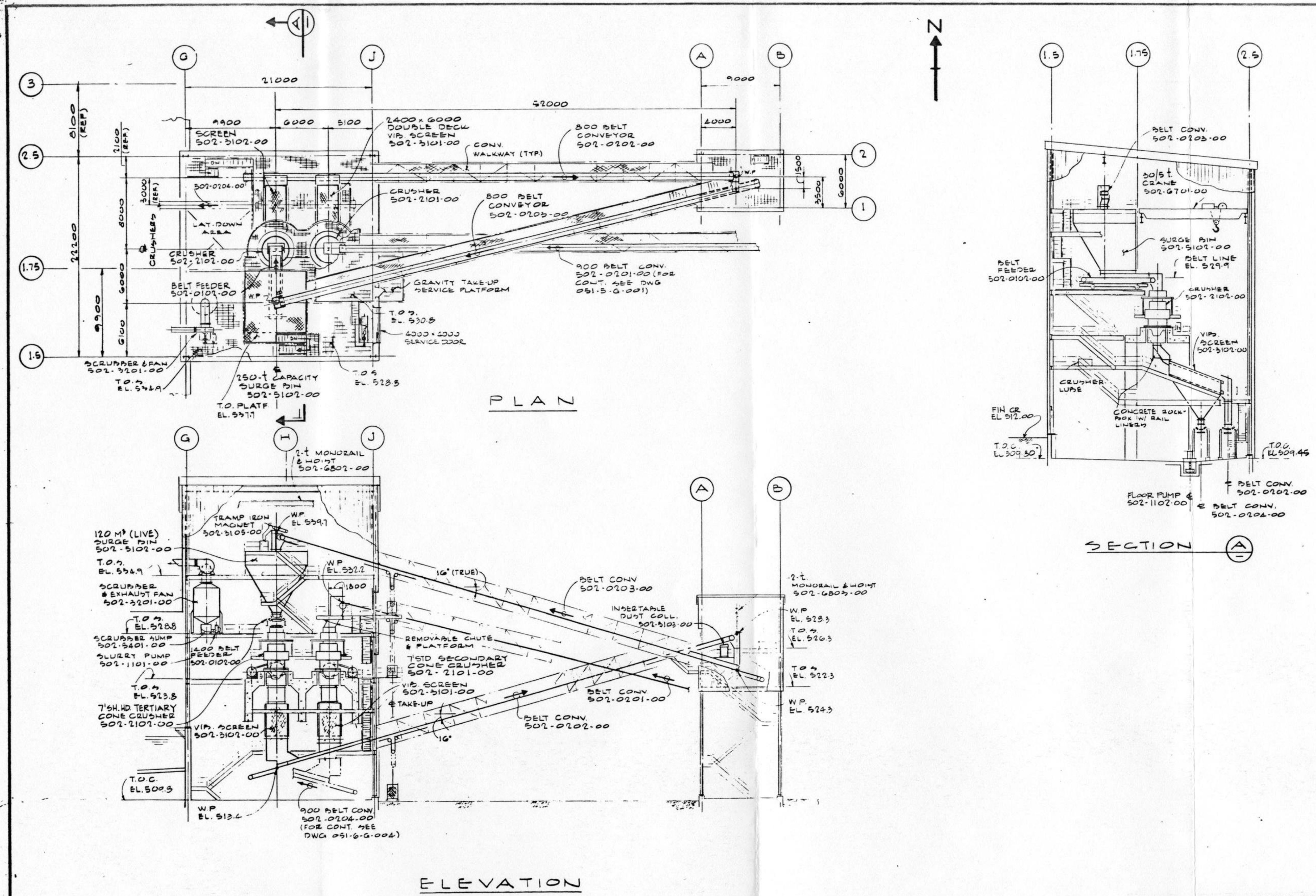


FIGURE FOR RESPONSE TO
COMMENT NO. 3

NOTE:
ALL DIMENSIONS IN MILLIMETERS
ALL ELEVATIONS IN METERS

REV.	DATE	BY	DESCRIPTION
2	11-16-83		GENERAL REVISION
1	8-22-83		REVISED FLR & WORK PT. ELEV., ADDED STAIRS & RELOCATED SERVICE DOOR

EXXON PROPRIETARY

Raymond Kaiser Engineers
RKE JOB NO. 83157

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE: FINE ORE CRUSHING & STORAGE
CRUSHING & SCREENING
G.A. PLAN & SECTIONS

SCALE 1:200

DRAWN BY P. STEVENS

DRAWING NO. 051-5-G-005 REVISION NO. 2

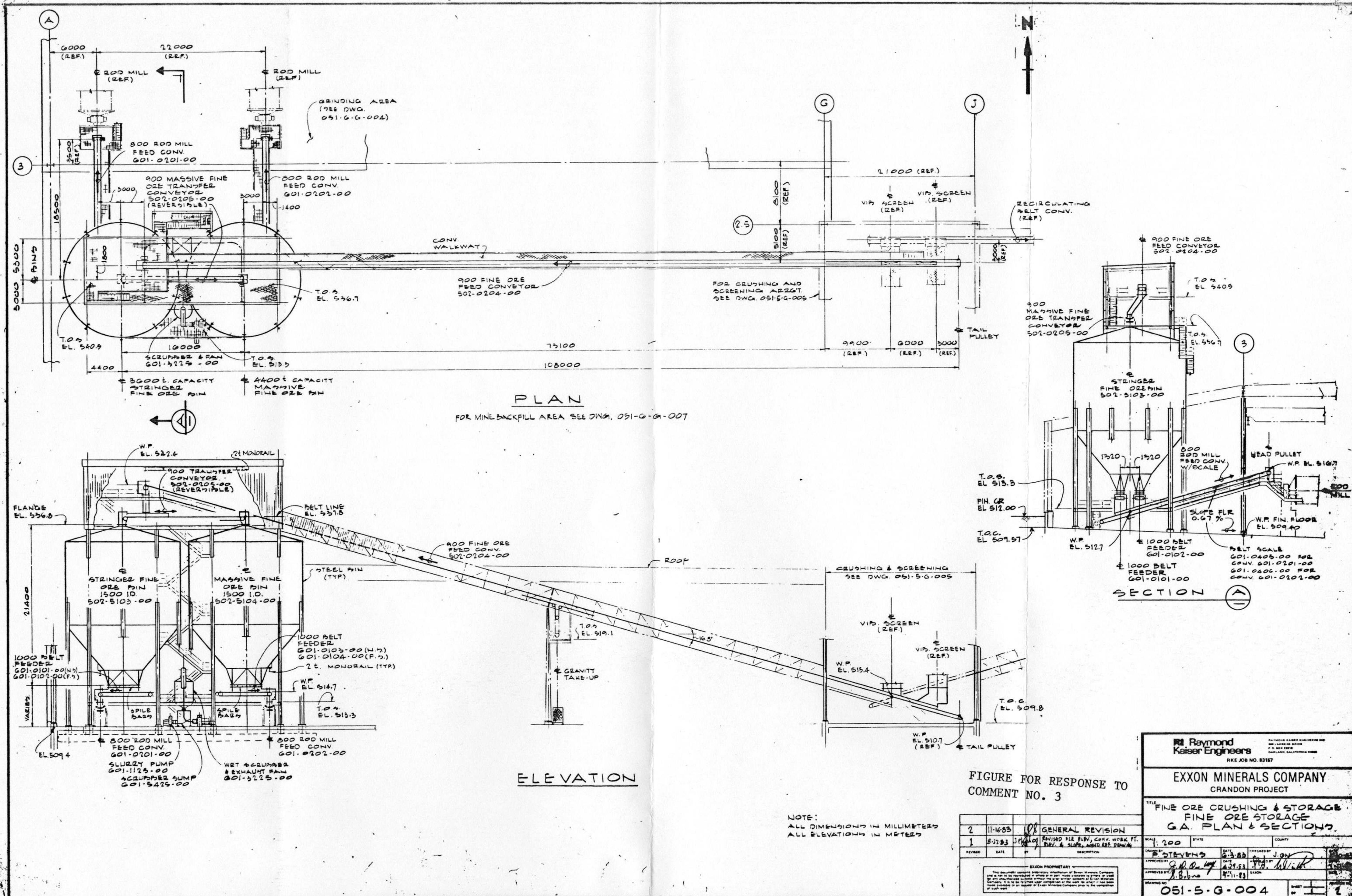


FIGURE FOR RESPONSE TO COMMENT NO. 3

(e.g. water flow rates for impingement scrubbers and venturi scrubbers, pressure drop for venturi scrubbers, air to cloth ratio and fabric material for fabric filter and baghouse collectors).

Response:

The processes which are exhausted through scrubbers or baghouses prior to air venting from external stacks to the atmosphere are listed below with specifics about estimated particle size distributions, water flow rates, air to cloth ratios, and fabric materials. The control equipment is for the current engineering design and these changes will be included in the air permit application.

Coarse ore storage building - Within this operational facility will be eight individual insertable particle collectors as air pollution control equipment for the various activities. This type of collector discharges the collected particles back to the process belts, and will have no external environment exhaust stack. Locations of individual units are presented in Drawing No. 051-5-G-002 (see attached) and specifics of operation are presented in Drawing No. 051-1-M-001 (see attached). Each insertable collector contains 323 sq ft of 16-oz Dacron filter material and has an air to cloth ratio of 6.6 (CFM) per 1.0 (ft^2). The equipment is similar to a DCE-Vokes Model DLMV 30/1 - F10 (i.e. all facility insertable collectors will be of this type). Particulate removal efficiencies by particle size are as follows:

	< 5 um	5 to 10 um	10 to 20 um	20 to 44 um	>44 um
% passed	0.25	0	0	0	0
% collected	99.75	100	100	100	100

Secondary and tertiary crushing and screening - Air from these processes will be vented through one wet scrubber labelled No. 502-3201-00 in Drawing No. 051-5-G-005 (see attached). Pickup points and air volumes are presented in the drawing titled "Dust Collector Schedule" (No. 051-1-M-001). The water rate necessary to operate (i.e. recirculation) a Ducon Model 126-UW-4 wet scrubber is 134 gpm. Particulate removal efficiencies by particle size for this scrubber are as follows:

	< 5 um	5 to 10 um	10 to 20 um	20 to 44 um	>44 um
% passed	0.2	0.08	0.05	0	0
% collected	99.8	99.92	99.95	100	100

Cu-Pb-Zn and Cu-Zn fine ore bins loading and unloading - Air from these processes will also be vented through one wet scrubber labelled No. 601-3225-00 in Drawing No. 051-5-G-004 (see attached). Pickup points and air volumes are presented in the drawing titled "Dust Collector Schedule" (Drawing No. 051-1-M-001). The water rate necessary to operate (i.e. recirculation) a Ducon Model 108-US-4 wet scrubber is 96 gpm. Particulate removal efficiencies by particle size for this scurbber are as follows:

	< 5 um	5 to 10 um	10 to 20 um	20 to 44 um	>44 um
% passed	1.2	0.3	0.2	0	0
% collected	98.8	99.7	99.8	100	100

Comment No. 4

A map was provided by J. DeMarte of your staff on June 21st.

Response:

Comment acknowledged.

Comment No. 5

See Item 8.

Response:

Comment acknowledged.

Comment No. 6

Adequate response.

Response:

Comment acknowledged.

Comment No. 7

Adequate response.

Response:

Comment acknowledged.

Comment No. 8

Particulate emissions due to underground activities such as blasting, or handling and crushing operations will exhaust to the surface via the east and west exhaust raises. It is essential to quantify the dust emissions expected from the raises in order to accurately estimate the impact of the Crandon Project. The assumption that the mine drifts and air exhaust shafts will act similarly to a spray tower is not acceptable. The fine water spray of a spray tower is absent from the mine drifts and exhaust shafts.

As discussed with Joe DeMarte on June 21st, I think it would be more appropriate to compare the mine drifts and exhaust shafts as elongated settling chambers. If the particle distribution is known for the dust generated by underground activities, the settling velocity can be determined for various size categories. If a given dust particle is present in the mine long enough to settle onto the walls of the drifts and shafts, it will not be emitted. The underground humidity and wetted rock surfaces should insure that settled dust will not likely be reentrained into the air exhausting to the surface. This approach should be used to estimate the collection efficiency of the mine drifts and air exhaust shafts.

Response:

See response to Comment No. C1.

Comment No. 9

Adequate response.

Response:

Comment acknowledged.

Comment No. 10

Adequate response.

Response:

Comment acknowledged.

Comment No. 11

Please provide data on the maximum liquid sulfur dioxide (SO_2) usage and the subsequent SO_2 emissions expected from the soda ash scrubber in units of pounds per hour.

Response:

Further engineering design for the concentrator has eliminated the soda ash scrubber. Approximately 4 to 5 tank trucks per month containing liquid sulfur dioxide will be delivered to the bulk storage tanks. The liquid sulfur dioxide will be transferred directly from the tanker to the bulk storage tanks using a compressor. Liquid sulfur dioxide will be metered directly into the process streams. As a result there will be no sulfur dioxide emissions to the atmosphere from storage and distribution of sulfur dioxide in this segment of the operations.

Comment No. 12

Adequate response.

Response:

Comment acknowledged.

Comment No. 13

The emission source tables in the air permit application (Tables 2.1-2.7) should accurately summarize the emission sources for the Crandon Project and should not be altered to reflect any air quality modeling efforts. Please revise Table 2.6 and 2.7 if any sources were incorrectly added or omitted.

Response:

Comment acknowledged and the amended air polluton control permit application will contain revised Tables 2.6 and 2.7.

Comment No. 14

Adequate maps were received from Joe DeMarte on June 21st.

Response:

Comment acknowledged.

Comment No. 15

Adequate response.

Response:

Comment acknowledged.

Comment No. 16

Adequate response.

Response:

Comment acknowledged.

Comment No. 17

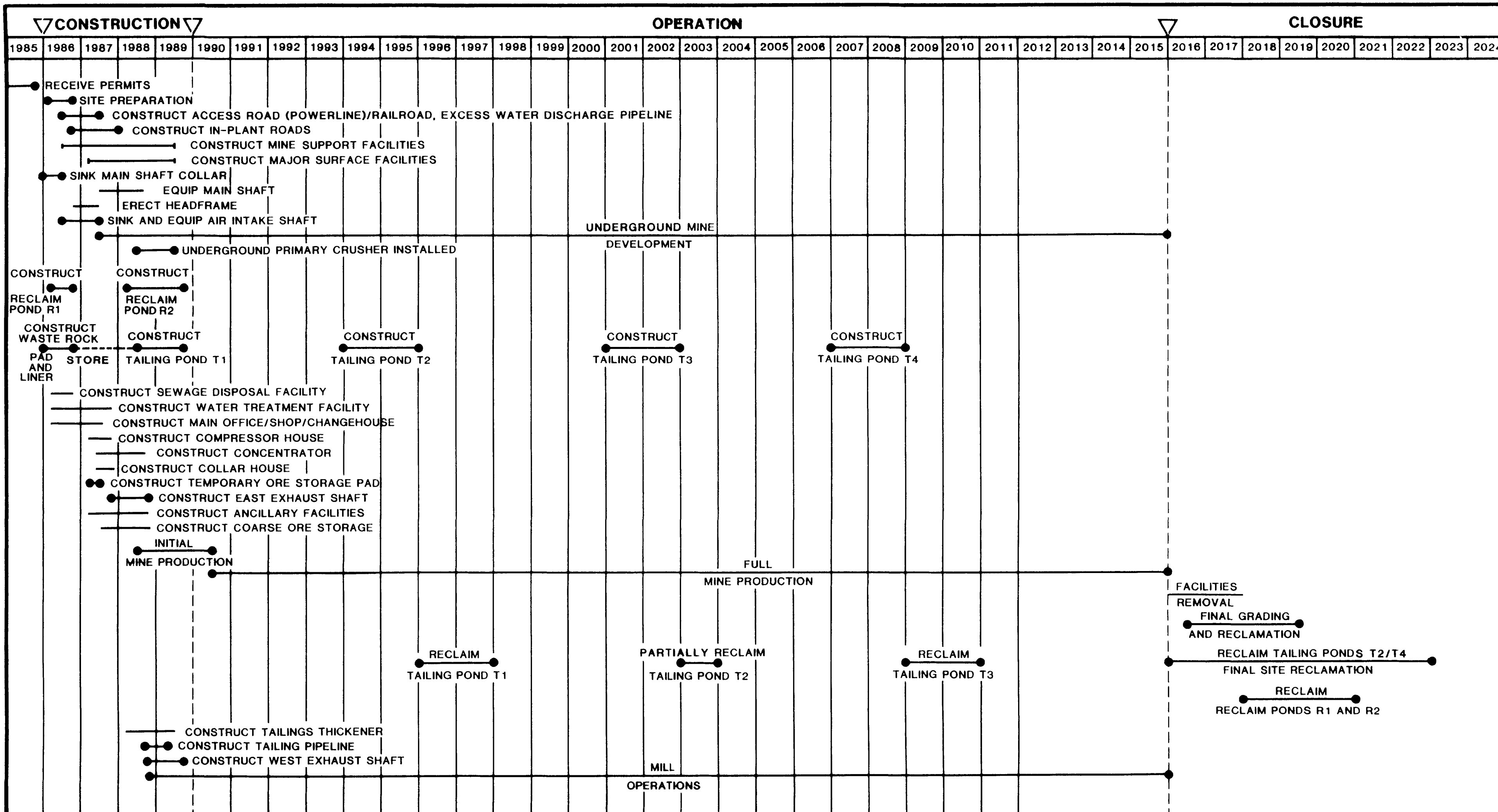
Even if reclamation phase emissions will be less than those during construction activities, these emissions should be calculated and summarized. This will further justify the logic used to choose appropriate years and sources for air quality modeling used to estimate worst case impact.

During my meeting with Joe DeMarte, it was indicated that a figure summarizing the Crandon Project activities and their emissions during the lifetime of the mine would be useful for the air quality analysis. This figure could be similar to Figure 1-1 in the air permit application but would include the yearly emissions expected for each activity. The total emissions for each year could then be summarized. This would clearly indicate the years when emissions are highest, air quality impact could be expected to be the greatest and for which air quality modeling would be appropriate.

EXXON MINERALS COMPANY

CRANDON PROJECT

SCHEDULE



LEGEND

- (line with end ticks) TOTAL CATEGORY ACTIVITIES TIME FRAME
- (plain line) FACILITY FABRICATION AND INTERNAL CONSTRUCTION- NO EMISSIONS ESTIMATED
- (line with dot ends) CONSTRUCTION, OPERATION AND/OR CLOSURE PHASE ACTIVITIES-AIR EMISSIONS ESTIMATED (SEE TABLES 1.1 AND 1.2 OF THESE RESPONSES)

FIGURE FOR RESPONSE TO COMMENT NO. 17

EXXON MINERALS COMPANY
CRANDON PROJECT

LOCATION: **WISCONSIN**

TITLE: SCHEDULE OF CONSTRUCTION, OPERATION, AND CLOSURE PHASES

SCALE: NONE

DRAWN BY	DMC.JM	DATE	12/83	CHECKED BY		DATE	
APPR./REV. BY	RPH	DATE	12/83	APPR./REV. BY		DATE	
APPR./REV. BY		DATE		ORIGINATOR	RPH	DATE	
DRAWING NUMBER	FIGURE 1-1	SCALE		REVISION NUMBER		SHEET OF	

483-2-18MA

Response:

The following calculations estimate the reclamation phase TSP air emissions as provided in Tables 1.1 and 1.2 and Figure 1.1 of these responses (see attached). Example calculations for these activities are provided below.

The general emission factor for TSP of 1.2 st/acre/month provided in U.S. EPA AP-42, Section 11.2.4 represents an emission rate for heavy construction activities (i.e. blasting, soil excavation, cut-and-fill operations, and particular facility construction) in an area with soil silt content of approximately 30% and in a semi-arid climate with precipitation and soil moisture conditions of PE 50 (PE = Thornwaite's precipitation-evaporation index). A silt content of approximately 15% (i.e. based on site area soil classification) was previously used for the till at the Crandon mine/mill site and the soil moisture content is considerably higher (i.e. PE 120 based on site area precipitation and evaporation rates) than soils in semi-arid areas. These two factors, silt content and soil moisture, heavily influence the fugitive particulate (TSP) emission rate. Although a specific relationship has not been verified, the use of an emission rate of 1.2 st/acre/month to calculate emissions from construction activities at the site area will result in a conservatively high estimate. However, this factor was used in all of the revised calculations without any correction factors to estimate TSP emissions from construction and operation phase activities.

Examples:

Reclaim Tailing Pond T1 - Earthmoving, regrading, and replanting activities will occur to develop final grades, surface water drainage patterns and final use compatibility with the Reclamation Plan.

Emission Factors and Source: AP-42, Section 11.2.4
TSP-EF = 1.2 short tons/acre/month

Process Rate: 24 months for 82 acres or approximately 3.4 acres/month

Duration: 24 months (1996-97)

Control Method and Efficiency: Watering of disturbed area if necessary.

Example Calculation:
Process Rate x Emission Factor x Duration = Emission Rate
3.4 acres/month x 1.2 st/acre/month x 12 months/yr = 49.0 st/yr

Reclaim Tailing Pond T2 (partial)

Process Rate: 12 months for 54 acres or approximately 4.5 acres/month

Duration: 12 months (2003)

Example Calculation:
4.5 acres/month x 1.2 st/acre/month x 12 months/yr = 64.8 st/yr

Table 1.1

Schedule associated with Project activities during construction and operation phases and the estimated TSP air emissions from proposed sources.

	CONSTRUCTION				OPERATION																	
Project Activities ( )**	1986	1987	1988	1989	1990	1991-92	1993	1994	1995	1996	1997	1998-2000	2001	2002	2003	2004	2005-06	2007	2008	2009	2010	2011-15
Site Preparation (trees & brush)																						
1. Mine Shafts (A1)	17.6																					
2. Mill/Mill Site (A3, B1)	77.3																					
3. MWDF Area		112.8					112.8					112.8[a]					112.8[b]					
4. Access Road/Powerline (A3, D5, D7)	2.7	3.2	3.24	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
5. Railroad Spur (A3, D4)	4.2	0.14	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
6. Haul Road (B1)	4.0																					
7. Water Discharge Pipeline (B5)	10.2																					
8. In-Plant Roads (B2, D5)	4.8	48.9	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9. Mobile Sources (Table 2.3)	8.0	*	*	*																		
10. Concrete Batch Plant (Table 2.3)	2.7	*	*	*																		
Construct Mine Support Facilities																						
1. Sink Main Shaft	10.6	4.1																				
2. Sink and equip air intake shaft	3.0	2.5																				
3. Construct east exhaust shaft			0.8																			
4. Construct west exhaust shaft				0.8																		
5. Power Generation (A2, C3)	4.2	0.2	*	*																		
Construct Major Surface Facilities																						
1. Construct Reclaim Pond R1	59.3																					
2. Construct Reclaim Pond R2		18.0	18.0																			
3. Construct Temporary Ore Storage Pad	Included in Mine Shafts																					

Table 1.1 (continued)

Schedule associated with Project activities during construction and operation phases and the estimated TSP air emissions from proposed sources.

	CONSTRUCTION				OPERATION																	
Project Activities ( )**	1986	1987	1988	1989	1990	1991-92	1993	1994	1995	1996	1997	1998-2000	2001	2002	2003	2004	2005-06	2007	2008	2009	2010	2011-15
<u>Construct MWDF Facilities</u>																						
1. Construct Tailing Pipeline			6.0	6.0																		
2. Install Liner (E4)	1.0		1.0	1.0				1.0	1.0				1.0	1.0				1.0	1.0			
3. Waste Rock Handling (A4)				40.3																		
4. Construct Tailing Pond T1 (E1)			96.3	96.3																		
5. Construct Tailing Pond T2 (E1)								96.3	96.3													
6. Reclaim Tailing Pond T1 (17)										49.0	49.0											
7. Construct Tailing Pond T3 (E1)													96.3	96.3								
8. Reclaim Tailing Pond T2 (partial) (17)															64.8							
9. Construct Tailing Pond T4 (E1)																		96.3	96.3			
10. Reclaim Tailing Pond T3 (17)																				60.5	60.5	
<u>Underground Mine Development</u>																						
1. Develop Drifts and Stopes		0.2	1.4	3.9	3.3																	
<u>Mine Production</u>																						
1. Initial (A4)					12.7																	
2. Full (C1)																						
a. Blasting						13.6	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
b. Rock handling						7.9	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
c. Mobile equipment						5.5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
d. Mine air heating						0.6	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 1.1 (continued)

Schedule associated with Project activities during construction and operation phases and the estimated TSP air emissions from proposed sources.

Project Activities ( )**	CONSTRUCTION				OPERATION																	
	1986	1987	1988	1989	1990	1991-92	1993	1994	1995	1996	1997	1998-2000	2001	2002	2003	2004	2005-06	2007	2008	2009	2010	2011-15
Mill/Concentrator Operations																						
1. Coarse Ore Transport (A4)					12.7	*																
2. Crushing and Screening					8.4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3. Fine Ore Loading (Table 2.4)					0.7	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
4. Fine Ore Unloading (Table 2.4)					1.1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
5. Concrete Batch Plant (D3)					0.1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
6. Facility Heating					0.9	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7. Emergency Diesel Generators (C3)					0.2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
TOTAL	209.6	200.7	186.7	211.5	92.4	104.0	204.1	188.6	188.6	140.3	140.3	204.1	188.6	188.6	156.1	91.3	204.1	188.6	188.6	151.8	151.8	91.3

* Means previous annual estimate is used for this year.

** Number within parentheses identifies this letter's response or air permit application source for the information.

[a] In the year 2000 only.

[b] In the year 2006 only.

Table 1.2

Schedule associated with Project activities during closure (reclamation phase) and the estimated TSP air emissions from proposed sources.

Project Activities ( )*	CLOSURE						
	2016	2017	2018	2019	2020	2021	2022
Reclamation Phase							
1. Remove Surface Facilities							
2. Reclaim Tailing Pond T4 (17.)					40.3	40.3	40.3
3. Reclaim Reclaim Ponds R1 and R2 (17.)			30.2	30.2	30.2		
4. Reclaim Tailing Pond T2 (remainder) (17.)	43.2	43.2					
5. Final Site Reclamation (17.)	20.9	41.8	41.8	20.9			
a. Reclaim Railroad Spur (17.)					24.5	24.5	
b. Reclaim Access Road (17.)						21.6	21.6
TOTAL	64.1	85.0	72.0	51.1	95.0	86.4	61.9

* Number within parentheses identifies this letter's response or air permit application source for the information.

Reclaim Tailing Pond T3

Process Rate: 24 months for 100 acres or approximately 4.2 acres/month

Duration: 24 months (2009-10)

Example Calculation:
4.2 acres/month x 1.2 st/acre/month x 12 months/yr = 60.5 st/yr

Reclaim Tailing Pond T2 (remainder)

Process Rate: 18 months for 54 acres or approximately 3.0 acres/month

Duration: 18 months (2016-17)

Example Calculation:
3.0 acres/month x 1.2 st/acre/month x 12 months/yr = 43.2 st/yr

Reclaim Mine/Mill Site

Process Rate: 36 months for 104 acres or approximately 2.9 acres/month

Duration: 36 months (2016-19)

Example Calculation:
2.9 acres/month x 1.2 st/acre/month x 12 months/yr = 41.8 st/yr

Reclaim Tailing Pond T4

Process Rate: 36 months for 99 acres or approximately 2.8 acres/month

Duration: 36 months (2020-22)

Example Calculation:
2.8 acres/month x 1.2 st/acre/month x 12 months/yr = 40.3 st/yr

Reclaim Ponds R1 and R2

Process Rate: 36 months for 75 acres or approximately 2.1 acres/month

Duration: 36 months (2018-20)

Example Calculation:
2.1 acres/month x 1.2 st/acre/month x 12 months/yr = 30.2 st/yr

Reclaim Railroad Spur

Process Rate: 24 months for 40 acres or approximately 1.7 acres/month

Duration: 24 months (2020-21)

Example Calculation:
1.7 acres/month x 1.2 st/acre/month x 12 months/yr = 24.5 st/yr

Reclaim Access Road

Process Rate: 24 months for 35 acres or approximately 1.5 acres/month

Duration: 24 months (2021-22)

Example Calculation:
1.5 acres/month x 1.2 st/acre/month x 12 months/yr = 21.6 st/yr

July 11, 1983 DNR comments - continued (initial responses were sent to DNR's February 24, 1983 comment letter)

Comment No. 5

The emission rates used in the air quality modeling should be the maximum allowable rate for each source. These maximum allowable emissions are those which would be allowed under Chapter NR 154, Wisconsin Administrative Code, for each source, or any more restrictive emission rate (and control measure) which would become a condition of the air permit once issued.

As discussed during the meeting on May 17th, these more restrictive emission rates would be used to make the major-minor source determination for the Crandon Project.

Response:

Comment acknowledged.

Comment No. 8

Your response to these comments would be appreciated. I am preparing additional questions concerning the sources and air pollution emissions expected from the Crandon Project. After these have been answered, I feel we can meet to discuss new air quality modeling of the project.

Response:

Comment acknowledged.

September 12, 1983 DNR Comments

A. Mine Construction

Comment No. A1

Prior to development of mine shafts and stopes beneath the surface, it is anticipated that excavation work will be required on the surface. Please estimate the fugitive dust generated during the initial stages of construction of the mine due to this excavation work to determine if it will be a significant source of emissions.

Response:

The surface construction activities necessary to prepare for sinking of the Main mine and Intake air shafts, East and West exhaust shafts (i.e. raises), and the road to the potable water supply well were included in the original estimates provided under the heading of mine/mill surface facilities construction. The estimated TSP air emissions for the construction of these individual areas are provided below for your information.

Emission Factor and Source: AP-42, Section 11.2.4.
TSP-EF - 1.2 st/acre/month

Access road to potable water supply well with pad - outside fence

Process Rate:

Road - $\frac{235 \text{ m} \times 6 \text{ m}}{4047 \text{ m}^2/\text{acre}} = 0.35$ acres

Pad - $\frac{\pi(25 \text{ m}/2)^2}{4047 \text{ m}^2/\text{acre}} = 0.12$ acres

0.47 acres

Access road to east exhaust shaft with pad - outside fence

Process Rate:

Road - $\frac{135 \text{ m} \times 6 \text{ m}}{4047 \text{ m}^2/\text{acre}} = 0.20$ acres

Pad - $\frac{20 \text{ m} \times 20 \text{ m}}{4047 \text{ m}^2/\text{acre}} = 0.10$ acres

0.30 acres

Access road to west exhaust shaft with pad - outside fence

Process Rate:

Road - $\frac{45 \text{ m} \times 6 \text{ m}}{4047 \text{ m}^2/\text{acre}} = 0.07$ acres

Pad - $\frac{20 \text{ m} \times 20 \text{ m}}{4047 \text{ m}^2/\text{acre}} = 0.10$ acres

0.17 acres

Access road to explosives magazine and pad - outside fence

Process Rate:

Road - $\frac{88 \text{ m} \times 6 \text{ m}}{4047 \text{ m}^2/\text{acre}}$ = 0.13 acres

- $\frac{527 \text{ m} \times 8 \text{ m}}{4047 \text{ m}^2/\text{acre}}$ = 1.04 acres

Pad - $\frac{55 \text{ m} \times 120 \text{ m}}{4047 \text{ m}^2/\text{acre}}$ = 1.63 acres

2.80 acres

Access road to preproduction ore storage and pad - outside fence

Process Rate:

Road - $\frac{240 \text{ m} \times 24 \text{ m}}{4047 \text{ m}^2/\text{acre}}$ = 1.42 acres

Pad - $\frac{188 \text{ m} \times 188 \text{ m}}{4047 \text{ m}^2/\text{acre}}$ = 8.70 acres

- $\frac{125 \text{ m} \times 25 \text{ m}}{4047 \text{ m}^2/\text{acre}}$ = 0.80 acres

10.92 acres

Total All = 14.7 acres

Duration: Assume all activities occur in the same month.
Control Method and Efficiency: Watering of disturbed area if necessary.
Example Calculation:
TSP - 1.2 st/acre/month x 14.7 acres = 17.6 st

Comment No. A2.

If temporary diesel generators are to be used prior to installation of electrical power lines, supply the expected fuel usage rates and predict the maximum hourly, daily and yearly air pollutant emissions for these generators (page 1.3-4 of the EIR).

Response:

The use of temporary diesel generators may be necessary for the first 6 months of the construction phase if transmission line electrical power is not available at the site. One 2500-kw unit will be required during these months to supply electrical power for mine shaft and mine/mill surface facilities construction (i.e. another 2500-kw unit will be installed for emergency purposes only for construction and operation). Fuel consumption for a 2500-kw unit is estimated to average 161 gallons per hour, 3,864 gallons per day, and 108,192 gallons per month. The resultant emissions from this unit were estimated as follows:

Diesel Generator:

Emission Factors and Source: AP-42, Appendix - C, Internal Combustion - electric generation - diesel

TSP - 13.0 $lbs/10^3$ gal
SO_x - 140.0 $lbs/10^3$ gal
NO_x - 370.0 $lbs/10^3$ gal
CO - 225.0 $lbs/10^3$ gal
HC - 37.0 $lbs/10^3$ gal

Process Rate: 161 gal/hr, 3,864 gal/day, and 108,192 gal/month

Duration: First 6 months of construction phase.

Control Method and Efficiency: None

Example Calculation:
TSP - 108,192 gal/month x 13.0 $lbs/10^3$ gal x 6 months x st/2000 lbs = 4.2 st/yr

	st/yr
TSP:	4.2
SO_x:	45.4
NO_x:	120.0
CO :	73.0
HC :	12.0

Comment No. A3.

Tree stumps and brush will be either burned or mulched for use in land restoration (page 1.3-2 of the EIR). Estimate the quantities of stumps and brush which will be burned during this phase of construction, provide the method which will be employed to insure clean, pollution-free burning and estimate the resultant emissions.

Response:

The following calculations estimate the air emissions if burning instead of mulching occurs for the tree stumps and brush accumulated from the mine/mill site, access road and railroad spur construction. Burning will be on the surface in an open area.

Emission Factors and Source: AP-42, Table 2.4-2, Forest residues - unspecified

Particulate (TSP)	NO_x	CO	HC
lb/st	lb/st	lb/st	lb/st
17	4	140	24.7

Process Rate: Total burn.
Duration: 12 months
Control Method and Efficiency: None
Example Calculations:

<u>Mine/Mill Site</u> - 1732 st of Forest residues for 104 acres

TSP: st of brush/yr x TSP lbs/st x st/2000 lbs =
1732 st/yr x 17 lb/st x st/2000 lbs =
TSP = 14.7 st/yr

NO_x:	1732 x 4	÷ 2000 =	3.5	st/yr
CO :	1732 x 140	÷ 2000 =	121.2	st/yr
HC :	1732 x 24.7	÷ 2000 =	21.4	st/yr

<u>Access Road</u> - 316 st of Forest residues for 37 acres

TSP:	316 x 17	÷ 2000 =	2.7	st/yr
NO_x:	316 x 4	÷ 2000 =	0.6	st/yr
CO :	316 x 140	÷ 2000 =	22.1	st/yr
HC :	316 x 24.7	÷ 2000 =	3.9	st/yr

<u>Railroad Spur</u> - 497 st of Forest residues for 45 acres

TSP:	497 x 17	÷ 2000 =	4.2	st/yr
NO_x:	497 x 4	÷ 2000 =	1.0	st/yr
CO :	497 x 140	÷ 2000 =	34.8	st/yr
HC :	497 x 24.7	÷ 2000 =	6.1	st/yr

Comment No. A4

Approximately 551,000 short tons of preconstruction ore along with waste rock will be transported to the waste rock disposal area by truck prior to construction of the ore processing facilities (page 1.2-27 of the EIR). Estimate the fugitive dust generated by the transport, dumping and storage of this material during the mine construction phase to determine if it will be a significant source of emissions.

Response:

During the construction phase, waste rock and preproduction ore will be utilized or stored on the following schedule.

Year	Waste Rock Hauled (k-st)	Waste Rock In Storage (k-st)	Ore Handled (k-st)	Ore In Storage (k-st)
1986	11	11	-	-
1987	66	77	11	9*
1988	763	840	523	532
1989	1146	1986	366	898
1990	-	-	898	-

* 2 k-st (k = thousand) processed in pilot plant.

Estimates of fugitive dust (TSP) generated from various activities associated with waste rock and preproduction ore handling and storage are presented below.

Transportation emissions:

Emission Factor and Source: AP-42, Section 11.2.1.3

$$TSP\text{-}EF = k\ 5.9\ (s/12)(S/30)^{2*}(W/3)^{0.7}(w/4)^{0.5}(d/365) = \text{lb/veh-mile}$$

k = particle size multiplier (AP-42)
s = silt content (%)
S = vehicle speed (mph)
W = vehicle weight (st)
w = number of vehicle tires
d = number of dry days per year

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* Note: For speeds less than 30 mph the square of the ratio of $(S/30)^2$ [i.e. $(5/30)^2$] is used as recommended by the Wyoming Department of Environmental Quality (Fugitive dust emission factors. WDEQ, Division of Air Quality. January 24, Memorandum from Charles A. Collins, 1979).

Waste rock transport

k = 0.8	Maximum transport year = 1989
s = 6%	Tons hauled in year 1989 = 1,146,000 st
S = 15 mph	At 35 st/haul = 32,743 hauls
W = 51 st average (33 st truck empty)	Average haul distance = 4.4 miles/round trip
	Total mile haulage in 1989 = 144,069 veh-miles
w = 6 tires	
d = 230 dry days	

$$EF = (0.8)\ 5.9\ (6/12)(15/30)^2(51/3)^{0.7}(6/4)^{0.5}(230/365) = \text{lb/veh-mile}$$
$$= 3.3\ \text{lb/veh-mile}$$

Emissions (uncontrolled) = 3.3 lb/veh-mile x 144,069 veh-miles/yr x st/2000 lbs
= 237.7 st/yr

Emissions (controlled) = 237.7 st/yr x 0.15** = 35.7 st/yr

**85% control with chemical stabilization

Ore transport

k = 0.8	Maximum transport year = 1990
s = 6%	Tons hauled in year 1990 = 898,000 st
S = 15 mph	At 35 st/haul = 25,657 hauls
W = 51 st average (33 st truck empty)	Average haul distance = 1.0 mile/round trip
w = 6 tires	Total mile haulage in 1990 = 25,657 hauls x
d = 230 dry days	1.0 veh-mile/haul = 25,657 veh-miles

$$TSP\text{-}EF = (0.8)\ 5.9(6/12)(15/30)^2(51/3)^{0.7}(6/4)^{0.5}(230/365)$$
$$= 3.3 \text{ lb/veh-mile}$$

Emissions (uncontrolled) = 25,668 miles x 3.3 lb/veh-mile x st/2000 lbs
= 42.4 st

Emissions (controlled) = 42.4 st x 0.15* = 6.4 st

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* 85% control with chemical stabilization

Loading and Dumping Emissions:

Emission Factors and Source: AP-42, Section 11.2.3, Aggregate Storage

$$TSP\text{-}EF\ (\text{lb/st}) = \frac{(f)(0.33)}{(PE/100)^2}$$

f = Decimal fraction of total emissions from individual activity
PE = Thornwaite's precipitation-evaporation index

Waste rock loading and dumping

1,146,000 st loaded and dumped in 1989
f = 0.12 for loading, and 0.15 for dumping
PE = 120 for site area

$$TSP\text{-}EF = \frac{(0.12)(0.33)}{(120/100)^2} = 0.0275 \text{ lb/st for loading}$$

$$= \frac{(0.15)(0.33)}{(120/100)^2} = 0.0344 \text{ lb/st for dumping}$$

Emissions (uncontrolled) = 0.0619 lb/st x 1,146,000 st/yr x st/2000 lbs
= 35.5 st/yr

Emissions (controlled) = 35.5 x 0.10** = 3.6 st/yr

** 90% control with water and chemical stabilization of storage pile.

Ore loading and dumping

898,000 tons loaded and dumped in 1990

EF's same as for waste rock

Emissions (uncontrolled) = 0.0619 lb/st x 898,000 st/yr x st/2000 lbs
= 27.8 st/yr

Emissions (controlled) = 27.8 st/yr x 0.10* = 2.8 st/yr

* 90% control with water and chemical stabilization of storage pile.

Wind-blown emissions:

Emission Factors and Source: See air permit application, Appendix B, p. B-29, PEDCO - Environmental Specialists, Inc., 1976. Evaluation of Fugitive Dust Emissions from Mining Task 1 Report. Identification of Fugitive Dust Sources Associated with Mining. Cincinnati, Ohio.

TSP-EF = a I K C L V**

a = Portion of total wind erosion losses measured as suspended particles (a = 0.025 for waste rock and preproduction ore)

I = Soil erodibility, tons/acre/year = 38 for waste rock and preproduction ore

K = Accounts for resistance to wind erosion provided by ridges and furrows or large soil clumps in the field. Ranges from 0.5 for a field with optimum ratio of ridge height to ridge spacing, to 1.0 (no reduction) for field with smooth surface. surface.

Assume 0.75 for storage areas and MWDF.

C = Climatic factor = 0.05 in site area
L = Unsheltered field width = 0.7
V = Vegetation cover factor. Assume unvegetated. V = 1.0

** Universal soil loss equation (see also response E3 for definition of variables.)

Waste rock wind-blown emissions

Assume 40 acres disturbed in 1989

TSP-EF = a I K C L V
a = 0.025
I = 38
K = 0.75
C = 0.05
L = 0.7
V = 1

TSP-EF = (0.025)(38)(0.75)(0.05)(0.7)(1) = 0.02494 st/acre/yr

Emissions (uncontrolled) = 40 acres x 0.02494 st/acre/yr = 1.0 st/yr

Ore wind-blown emissions

Total disturbed area in 1989 = 8 acres
TSP-EF = a I K C L V
a = 0.025
I = 38
K = 0.75
C = 0.05
L = 0.7
V = 1.0
EF = 0.02494 st/acre/yr

Emissions (uncontrolled) = 0.02494 st/acre/yr x 8 acres = 0.2 st/yr

Totals for construction phase hauling and storage of waste rock and preproduction ore are:

Source	Emissions (st/yr)	Maximum Year
Waste rock transport	35.7	1989
Waste rock loading and dumping	3.6	1989
Waste rock wind-blown emissions	1.0	1989
Ore transport	6.4	1990
Ore loading and dumping	2.8	1990
Ore wind-blown emissions	0.2	1990

Preproduction Ore Crushing and Handling:

Emission Factors and Source: AP-42, Table 8.23-1
TSP-EF = 0.5 lb/st - Primary Crushing
= 0.12 lb/st - Materials Handling

Process Rate: 440 st/hr, 5,510 st/day, 898,000 st/yr
Duration: 18 months (maximum in year 1990)

Control Method and Efficiency: Baghouse collector, 99% efficiency

Example Calculation:
TSP - 898,000 st/yr x 0.5 lb/st x (1-.99) x st/2000 lbs = 2.2 st/yr
898,000 x 0.12 x 2 x (1-.99) x st/2000 lbs = 1.1 st/yr
Total = 3.3 st/yr

B. Mine/Mill Surface Facilities Construction

Comment No. B1

Fugitive emissions from earthmoving and excavation activities were estimated using an emission factor (EF) of 0.0555 tons/acre/month corrected for silt content and precipitation data. Section 11.2.4 of U.S. EPA publication AP-42, however, states that: "Test data are not sufficient to derive the specific dependence of dust emissions on correction parameters." The original EF of 1.2 tons/acre/month provided in AP-42 should be used for these calculations unless adjustment of this value can be sufficiently justified. Additionally, the 6% soil silt content used to adjust the emission factor appears too low. Soils of Wisconsin published by the University of Wisconsin Press indicates silt contents of the native soils in the proposed mine site area range from 50% to 70%.

The fugitive dust emission calculations for the mine/mill site construction activities (page B-6 of the air permit application appendix) indicates construction will occur only 9 months per year, 5 during winter and 4 during summer. If this is in error and construction occurs at the summer level for 7 months during the year, the estimated fugitive dust emissions for the mine/mill site construction activities should be revised.

Response:

Major mine/mill surface facilities development will be completed within the first 12 months of the construction phase (see also response 17).

Emission Factors and Source: Two emission factors are used to represent fugitive dust (TSP) emissions from site area construction activities. On-site construction activities will be represented by the general factor described in response 17, (i.e. 1.2 st/acre/month). This general factor was not adjusted based on the site area estimated silt content of 15% from soil classification tests. However, some of the surface till will be hauled to the MWDF. Hauling emissions will be based on the following factor from AP-42.

$$\text{TSP-EF (lbs/veh-mile)} = k5.9\ (s/12)(S/30)^2(W/3)^{0.7}(w/4)^{0.5}\ (d/365)$$

The silt content (i.e. 6%) used in this calculation was as recommended by the DNR in comment E(D)1. Further, the calculations estimating the emissions are for the total year and not just the summer months.

(See responses 17, A4 and E1 for further definition of variables)

Example Calculations:

On-site construction

Site preparation completed in 12 months
Mine/mill site = 104 acres
Area disturbed/month = 104 ÷ 12 = 8.7 acres

Emissions (uncontrolled) = 1.2 st/acre/month x 8.7 acres x 12 months/yr
= 125.3 st/yr

Emissions (controlled) = 125.3 x 0.5* = 62.6 st/yr

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* Control factor for watering from AP-42, Section 11.2.4.

Hauling of excavated till from mine/mill site to MWDF

Total soil material hauled:

96,396 yd^3 x 2,970 lb/yd^3 x st/2,000 lbs = 143,148 st
Assume 35 st/haul truck
Total number of trips = 4,090
Round trip miles from mine/mill site to MWDF = 4 miles
Total miles = 4,090 trips x 4 miles/trip = 16,360 miles
TSP-EF = $(0.8)5.9(s/12)(S/30)^2(W/3)^{0.7}(w/4)^{0.5}(d/365)$ = lb/veh-mile
= $(0.8)5.9(6/12)(15/30)^2(51/3)^{0.7}(6/4)^{0.5}(230/365)$
= 3.3 lb/veh-mile

Emissions (uncontrolled) = 3.3 lb/veh-mile x 16,360 miles x st/2,000 lb
= 27.0 st/yr

Emissions (controlled) = 27.0 st x 0.15** = 4.0 st/yr

** 85% control with chemical stabilization

Total TSP emissions from mine/mill site development including earthmoving excavation activities = 66.6 st/yr.

Comment No. B2

Estimate the fugitive dust emissions produced from use of the existing gravel roads before the construction of the access road is completed.

Response

Emissions of fugitive dust (TSP) from using existing gravel roads will be primarily from delivery of bentonite from the Woodlawn siding 6 miles east of the MWDF before the railroad spur is completed during 1987. Emission estimates are based on the following assumptions:

1) The access road and railroad will be constructed during the first 12 months of Project development;

2) Most traffic prior to construction of the new access road will use Sand Lake road to a 1/2 mile gravel access road to the mine/mill site;

3) Distance from the Woodlawn siding to MWDF is approximately 6 miles;

4) Construction personnel traffic during the first 12 months is estimated to be: 413 vehicles/day (i.e. 1.6 persons/vehicle and 1 mile round trip per vehicle).

5) Bentonite hauled during the first year would be 2,000 tons in 25 ton tractor trailers at 15 miles/hr along the 6 mile distance from the Woodlawn siding to the MWDF; and

6) An additional 12 service trucks, and 3 equipment delivery trucks would come on-site per day (i.e. 1 mile round trip).

Fugitive dust (TSP) emissions on gravel roads are based on the following factor:

$$TSP\text{-}EF = (0.8)5.9(s/12)(S/30)^2(W/3)^{0.7}(w/4)^{0.5}(d/365)$$

(See response to comment No. A4 for definition of variables)

Personnel traffic:

Assume average vehicle weighs 1.75 tons with 4 wheels.

$$TSP\text{-}EF = (0.8)5.9(12/12)(15/30)^2(1.75/3)^{0.7}(4/4)^{0.5}(230/365) = \text{lb/veh-mile}$$
$$= 0.5 \text{ lb/veh-mile}$$

Total miles traveled = 413 veh-miles/day x 5 days/week x 50 weeks/yr = 103,250 veh-miles/yr

Emissions (uncontrolled)= 103,250 veh-miles/yr x 0.5 lbs/veh-mile x st/2000 lbs = 25.8 st/yr

Emissions (controlled) = 25.8 st/yr x 0.15* = 3.9 st/yr

* 85% control with chemical stabilization

Equipment truck traffic:

Assume average weight of heavy equipment trucks = 10 st, and service trucks = 5 st.

Heavy equipment truck traffic

3 truck miles/day x 5 days/week x 50 weeks/yr = 750 veh-miles/yr

$$TSP\text{-}EF = (0.8)5.9(12/12)(15/30)^2(10/3)^{0.7}(18/4)^{0.5}(230/365) = \text{lb/veh-mile}$$
$$= 3.7 \text{ lb/veh-mile}$$

Emissions (uncontrolled) = 3.7 lb/veh-mile x 750 veh-mile/yr st/2000 lbs = 1.4 st/yr

Emissions (controlled) = 1.4 x 0.15* = 0.2 st/yr

Service truck traffic

12 truck miles/day x 5 days/week x 50 weeks/yr = 3,000 veh-mile/yr

TSP-EF = $(0.8)5.9(1)(0.25)(5/3)^{0.7}(10/4)^{0.5}(0.6)$ = lb/veh-mile
= 1.7 lb/veh-mile

Emissions (uncontrolled) = 1.7 lb/veh-mile x 3,000 veh-mile/yr x st/2000 lbs = 2.6 st/yr

Emissions (controlled) = 2.6 st/yr x 0.15* = 0.4 st/yr

Bentonite haulage

2,000 tons in 1986 ÷ 25 ton hauls in truck = 80 trips
80 trips x 12 miles per trip = 960 veh-miles
Average vehicle weight = (20 tons empty + 45 tons loaded) ÷ 2 = 33 tons

TSP-EF = $(0.8)(5.9)(1)(0.5)^{2}(33/3)^{0.7}(6/4)^{0.5}(0.6)$ = lb/veh-mile
= 4.6 lbs/veh-mile

Emissions (uncontrolled) = 4.6 lbs/veh-mile x 960 veh-miles/yr x st/2000 lbs = 2.2 st/yr

Emissions (controlled) = 2.2 st/yr x 0.15* = 0.3 st/yr

* 85% control with chemical stabilization

Total TSP emissions from use of gravel roads are 4.8 st/yr.

Comment No. B3

As with mine construction, if temporary diesel generators are to be used prior to installation of electrical power lines, supply the expected fuel usage rates and predict the maximum hourly, daily and yearly air pollulant emissions for these generators (page 1.3-4 of the EIR).

Response:

The estimated air emissions from the temporary diesel generators necessary during the mine/mill surface facilities construction phase is included in response A2.

Comment No. B4

As with mine construction, estimate the quantities of tree stumps and brush which will be burned during this phase of construction, provide the method which will be employed to insure clean, pollution-free burning and estimate the resultant emissions.

Response:

See response to Comment No. A3.

Comment No. B5

Estimate the fugitive dust generated during construction of the water discharge pipeline to determine if it will be a significant source of emissions.

Response:

Construction of the wastewater discharge pipeline will not be an important source of TSP emissions based on the following calculations.

Assume:

Total construction area	= 15 acres
Pipeline distance	= 6.1 miles
Total disturbed width	= 20 ft
Sand and gravel backfill	= 3,500 yd^3
Average haul distance	= 3 miles
Pipeline construction period	= 6 months

Emissions are primarily generated from general excavation, and stripping and hauling of sand and gravel.

General Construction:

TSP-EF = 1.2 st/acre/month
Area disturbed/month = 15 acres/6 months = 2.5 acres/month

Emissions (uncontrolled) = 1.2 st/acre/month x 2.5 acres/month x 6 months
= 18 st

Emissions (controlled) = 18 st x 0.5* = 9 st

Hauling:

3,500 yd^3 sand and gravel ÷ 5 yd^3/haul = 700 hauls
700 hauls at 6 miles round trip/haul = 4,200 veh-miles

$$\text{TSP-EF} = (0.8)5.9(15/12)(10/30)^2(10/3)^{0.7}(6/4)^{0.5}(230/365) = \text{lb/veh-mile}$$
$$= 1.2 \text{ lb/veh-mile}$$

Emissions (uncontrolled) = 1.2 x 4,200 veh-miles x st/2000 lb = 2.5 st/yr

Emissions (controlled) = 2.4 st/yr x 0.5^* = 1.2 st/yr

* 50% control with watering.

Total construction phase TSP emissions for the wastewater discharge pipeline are conservatively estimated to be 10.2 st/yr.

Comment No. B6

Provide the capacity and number of diesel and gasoline storage tanks to be used during the construction phase of the Crandon Project.

Response:

The mine/mill surface facilities development will require the following fuel storage tanks during the construction phase. For initial site construction, one 20,000-gallon temporary tank will be used for diesel fuel storage. Also, one 1,000-gallon temporary tank will be used for gasoline storage. Both of these tanks will be replaced 24 months after start of construction with the following:

Diesel fuel storage tanks

1. Two 15,000-gallon main tanks - above ground;
   4 m in diameter x 5 m height
   with fixed roofs.

2. Two 3,000-gallon transfer tanks - above ground;
   2.5 m in diameter x 3 m height
   with fixed roofs.

Fueling station, diesel and gasoline tanks

1. One 4,000-gallon underground tank (diesel)
2. One 1,000-gallon underground tank (gasoline)

The maximum use of diesel fuel and gasoline during the construction phase is estimated to occur in months 9 through 13. During this period peak fuel consumption rates for diesel fuel and gasoline are estimated to be 6,000 gallons per day and 125 gallons per day, respectively.

C. Mine Operations

Comment No. C1

When calculating the dust emissions from mine operations, each ore transfer operation should be addressed as a source of emissions. The discussion of ore transport and primary crushing (page 1.4-4 of the EIR) indicates approximately twelve (12) transfers for which the appropriate emission factor should be applied. Emissions from blasting should be estimated separately. It is assumed that dust emissions from the east and west exhaust raises will be recalculated treating the mine as a settling chamber as discussed in Item 8, page 2 of my July 11, 1983 letter to yourself.

Response:

The mine emission values initially submitted were calculated without the aid of the recently published AP-42, Sections 8.23 and 8.24, emission factors. Therefore, a rework of the estimates with the new emission factors and the use of gravity settling has led to the following peak rates for TSP emissions from the entire underground mine. Procedures used in derivation of these values are attached for your information. As per the DNR comment, the mine was treated as a settling chamber using the specific air velocity rates in the mine to determine the residence settling times for each activity.

Previous reference to a control efficiency similar to that found in spray towers was more directly related to conditions typically experienced in mine exhaust shafts. For example, in the mine exhaust shafts moisture saturated air ascends the exhaust shafts and loses its ability to retain moisture. The air physics experienced in mine exhaust shafts are similar to those for an ideal gas, as presented by the equation PV = nRT; where P = pressure, V = volume, n = weight of air in pounds (lbs), R = universal gas constant (i.e. 53.3) and T = temperature. In this equation the decrease in pressure and the increase in volume, causes a decrease in temperature (i.e. 2°F per 1000 ft rise); therefore, supersaturation occurs and water droplets form. These droplets begin to fall as they combine with other droplets. Some of the condensed moisture contacts the shaft walls as it falls and some are deposited at the shaft bottom or re-evaporated and distributed with the air as it rises in the exhaust shaft.

In the mine exhaust shafts only the smallest droplets remain in the air stream and eventually are discharged from the shaft. Once outside the shafts, the contained moisture will condense further (i.e. cold conditions) and deposit rapidly or evaporate (i.e. warm conditions). These conditions will definitely affect the retention and settling of particles. The majority of the particles in the mine exhaust air stream will deposit within the shaft or settle in close proximity to the point of discharge. This process serves to assist the settling rates used in the attached calculation. However, credit for this "spray tower" effect was not used, and in addition, the conservative emission rates derived from blasting factors for surface coal mining (i.e. none are available for hard rock mining which would be lower) were utilized to calculate the estimated TSP emissions.

<u>Underground Blasting Emissions:</u> Blasting of rock using 90% ANFO and 10% water gel in production stope blasting and drift development.

Emission Factor and Source: AP-42, Table 8.24-2, Blasting-surface coal mining

TSP-EF = $\leq$ 30 um

$$\text{TSP-EF} = \frac{344(A)^{0.8}}{(D)^{1.8}\,(M)^{1.9}}$$

where;
A = Area blasted - m^2
D = Hole depth - m
M = Material moisture content - %

Process Rate:

Production Stopes

A = 45 m x 20 m = 900 m^2
D = 1/2 Depth of stope drillhole - 60 m
M = Material moisture content - 4 % minimum

$$\text{TSP-EF} = \frac{344(900)^{0.8}}{(60)^{1.8}(4)^{1.9}} = 3.6 \text{ kg/blast}$$

Stope blast material weight (W) = Volume (V) x Density
V = 900 m^2 x 60 m = 54,000 m^3/stope blast
Density = 3.026 t/m^3

W = 54,000 m^3/stope blast x 3.026 t/m^3 = 163,404 t/stope blast
3,276,000 t/yr ÷ 163,404 t/stope blast x 3.6 kg/blast x t/1000 kg = 0.07 t/yr

Development Headings

A = 3.5 m x 5 m = 17.5 m^2
D = Depth of heading drill hole - 3.66 m
M = Material moisture content - 4%

$$\text{TSP-EF} = \frac{344(17.5)^{0.8}}{(366)^{1.8}(4)^{1.9}} = 23.6 \text{ kg/blast}$$

W = V x Density
V = 17.5 m^2 x 3.2 m = 56 m^3
Density = 3.026 t/m^3

W = 56 m^3/heading blast x 3.026 t/m^3 = 169.5 t/heading blast
353,000 t/yr ÷ 169.5 t/heading blast x 23.6 kg/heading blast x t/1000 kg = 49.1 t/yr

Total TSP (underground blasting) = 49.2 t/yr before gravity settling.

Underground Blasting Emissions with Gravity Settling:

Production Stopes and Development Headings - using average distances and velocities to the mine exhaust shafts (Use 350 m level stope 3-18 as a typical scheme).

Mine ventilation air stream branch velocities:

Horizontal Velocity ft/minute	Distance ft	Time minutes
137	345	2.5
86	267	3.1
621	628	1.0
417	510	1.2
732	979	1.3

Total = 9.1 minutes (546 seconds) - (i.e. horizontal airways only) for travel time from blast area to exhaust shaft

Emission Factor and Source: AP-42, Appendix A-1, Stone quarrying and processing - crushing

Particle size distribution

< 5 um	5 to 10 um	10 to 20 um	20 to 30 um	>30 um
25%	25%	25%	25%	0

Settling velocity: Particle density: 3.026 t/m^3

Settling height, average: 2.0 m

Weight Percent	Particle Size (um)	Vertical Settling Velocity (m/sec)		Time (sec)		Settled Distance
25%	<5.	0.0036	x	546	=	1.96 m passed
25%	7.5 (5-10)	0.00637	x	546	=	3.48 m settled
25%	15 (10-20)	0.0254	x	546	=	13.87 m settled
25%	25 (20-30)	0.058	x	546	=	31.67 m settled

Determination of % Control (i.e. percent settled): Using a settling height of 2 m, all particles in the <5 um range are assumed to remain in the air stream. Therefore, 75% overall control (i.e. percent settled) is estimated for gravity settling of blasting TSP emissions.

Total TSP (underground blasting) with gravity settling estimated in the air stream from mine exhaust shafts.

49.3 t/yr x 0.25 (i.e. 1 - decimal fraction settled) = 12.3 t(13.6 st)/yr

Handling Emissions at Stope Drawpoints and Development Headings:

Rock handling performed by LHD equipment. A maximum of 12 in operation at any given time.

Emission Factor and Source: AP-42, Table 8.23-1, p. 8.23-4.

The use of this AP-42 section is not directly applicable because of the large size of the mined rock. However, the ore and waste rock is expected to have a moisture content of no less than 4% by weight and is considerably larger than that encountered after coarse rock crushing. Therefore, the values presented in EPA Table 8.23-1 are a conservative estimate of TSP emissions.

TSP-EF = 0.005 kg/t - Handling of high moisture rock

Process Rate: 900 t/hr, 16,000 t/day, 3,629,000 t/yr for ore and waste rock at maximum production rate.

Duration: As noted in process rate.
Control Method and Efficiency: Wetting dry piles.

Example Calculation:
TSP - 3,629,000 t/yr X 0.005 kg/t ÷ 1000 kg/t = 18.1 t/yr

Total TSP (drawpoints and development headings) = 18.1 t/yr before gravity settling.

Handling Emissions at Stope Drawpoints and Development Headings with Gravity Settling:

Emission Factor and Source: AP-42, Appendix A, Table A-1, p.A-3, Stone quarrying and processing - crushing

Particle size distribution

<5 um	5 to 10 um	10 to 20 um	20 to 44 um	>44 um
5%	5%	5%	10%	75%

Settling parameters and mine ventilation air stream branch velocities are the same as for the underground blasting emissions.

Weight Percent	Particle size (um)	Vertical Settling Velocity (m/sec)		Time (sec)		Settled Distance
5%	<5.	0.0036	x	546	=	1.96 m passed
5%	7.5 (5-10)	0.00637	x	546	=	3.48 m settled
5%	15. (10-20)	0.0254	x	546	=	13.87 m settled
10%	25. (20-44)	0.058	x	546	=	31.67 m settled
75%	>44.	0.181	x	546	=	98.83 m settled

Determination of % Control (i.e. percent settled):
Using a settling height of 2 m, all particles >5 um are assumed to settle. Therefore, 95% overall control (i.e. percent settled) is estimated for gravity settling of stope and development headings rock handling.

Total TSP (drawpoints and development headings) with gravity settling estimated in the air stream from the mine exhaust shafts.

18.1 t/yr x 0.05 (i.e. 1 - decimal fraction settled) = 0.9 t(1.0 st)/yr

Emissions from Handling at Orepasses and Waste Rock Passes:

Emission Factor and Source: AP-42, Table 8.23-1.
TSP-EF = 0.005 kg/t - Handling of high moisture rock

Process Rate: 900 t/hr, 16,000 t/day, 3,629,000 t/yr
Duration: As noted in process rate.
Control Method and Efficiency: Wetting if necessary.

Example Calculation:
TSP - 3,629,000 t/yr x 0.005 kg/t ÷ 1000 kg/t = 18.1 t/yr

Total TSP (orepasses and waste rock passes) = 18.1 t/yr before gravity settling.

Emissions from Handling at Orepasses and Waste Rock Passes with Gravity Settling:

Mine ventilation air stream branch velocities:

Horizontal Velocity ft/minute	Distance ft	Time minutes
621	628	1.0
417	510	1.2
732	979	1.3
		Total = 3.5 minutes (210 seconds) - (i.e. horizontal airways only) for air travel time from load area to exhaust shaft

Emission Factor and Source: AP-42, Appendix A, Table A-1, p. A-3, Stone quarrying and processing-crushing

Particle size distribution

< 5 um	5 to 10 um	10 to 20 um	20 to 44 um	> 44 um
5 %	5 %	5 %	10 %	75 %

Settling parameters are the same as for the underground blasting emissions.

Weight Percent	Particle size (um)	Vertical Settling Velocity (m/sec)		Time (sec)		Settled Distance
5	< 5	0.0036	x	210	=	0.76 m passed
5	7.5 (5 to 10)	0.00637	x	210	=	1.34 m passed
5	15.0 (10 to 20)	0.0254	x	210	=	5.33 m settled
10	25.0 (20 to 44)	0.058	x	210	=	12.18 m settled
75	>44	0.181	x	210	=	38.01 m settled

Determination of % control (i.e. percent settled): Using a settling height of 2 m, all particles > 10 um are assumed to settle. Therefore, 90% overall control (i.e. percent settled) is estimated for gravity settling for rock handling at orepasses and waste rock passes.

Total TSP (orepasses and waste rock passes) with gravity settling estimated in the air stream from mine exhaust shafts.

18.1 t/yr x 0.10 (i.e. 1 - decimal fraction settled) = 1.8 t(2.0 st)/yr

Emissions from Handling - Chute to Rail Car:

Emission Factor and Source: AP-42, Table 8.23-1
TSP-EF = 0.005 kg/t - Handling of high moisture ore
Process Rate: 700 t/hr, 14,000 t/day 3,276,000 t/yr
Duration: As noted in process rate.
Control Method and Efficiency: Wetting if necessary.

Example Calculation:
TSP - 3,276,000 t/yr x 0.005 kg/t ÷ 1000 kg/t = 16.4 t/yr

Total TSP (chute to railcar) = 16.4 t/yr before gravity settling.

Emissions from Handling - Chute to Railcars with Gravity Settling:

Particle size ranges are the same as for handling at orepasses and waste rock passes.

Mine ventilation air stream branch velocities:

Horizontal Velocity ft/minute	Distance ft	Time minutes
285	50	.18
285	100	.35
1156	1235	1.07
1077	498	.46
1268	479	.38
1268	403	.32
2536	160	.06

Total = 2.82 minutes (169 seconds) - (i.e. horizontal airways only) for travel time from load area to exhaust shaft.

Settling parameters are the same as for the underground blasting emissions.

Weight Percent	Particle Size (um)	Vertical Settling Velocity (m/sec)		Time (sec)		Settled Distance
5	5	.0036	x	169	=	0.61 m passed
5	7.5 (5 to 10)	.00637	x	169	=	1.08 m passed
5	15 (10 to 20)	.0254	x	169	=	4.29 m settled
10	25 (20 to 44)	.058	x	169	=	9.80 m settled
75	> 44	.181	x	169	=	30.59 m settled

Determination of % control (i.e. percent settled): Same as for handling at orepasses and waste rock passes.

Total TSP (chute to railcar) with gravity settling estimated in the air stream from mine exhaust shafts.

16.4 t/yr x 0.10 (i.e. 1 - decimal fraction settled) = 1.6 t(1.8 st)/yr

Handling from Railcars into Crusher Feed Bins:

Emission Factor and Source: AP-42, Table 8.23-1
TSP-EF = 0.005 kg/t - Handling of high moisture ore

Process Rate: 700 t/hr, 14,000 t/hr, 3,276,000 t/yr
Duration: As noted in process rate.
Control Method and Efficiency: Wetting if necessary.

Example Calculation:
TSP - 3,276,000 t/yr X 0.005 kg/t ÷ 1000 kg/t = 16.4 t/yr

Total TSP (railcar to crusher feed bins) = 16.4 t/yr before gravity settling.

Handling from Railcars into Crusher Feed Bins with Gravity Settling:

Particle size ranges are the same as for handling at orepasses and waste rock passes.

Mine ventilation air stream branch velocities:

Horizontal Velocity ft/minutes	Distance ft	Time minutes
200	100	.50
379	136	.36
427	165	.39
513	632	1.23
513	632	1.23
606	543	.90
768	714	.93
1609	890	.55
1612	360	.22
1610	242	.15

Total = 6.46 minutes (387 seconds) - (i.e. horizontal airways only) for travel time from loadout area to exhaust shaft.

Settling parameters are the same as for the underground blasting emissions.

Weight Percent	Particle Size (um)	Vertical Settling Velocity (m/sec)		Time (sec)		Settled Distance
5	5	.0036	x	387	=	1.39 m passed
5	7.5 (5 to 10)	.00637	x	387	=	2.47 m settled
5	15 (10 to 20)	.0254	x	387	=	9.83 m settled
10	25 (20 to 44)	.058	x	387	=	22.45 m settled
75	> 44	.181	x	387	=	70.05 m settled

Determination of % control (i.e. percent settled): Same as for handling at stope drawpoints and development headings.

Total TSP (railcar to crusher feed bins) with gravity settling estimated in the air stream from mine exhaust shafts.

16.4 t/yr x 0.05 (i.e. 1 - decimal fraction settled) = 0.8 t(0.9 st)/yr

Crusher Feeder Bins to Primary Crusher:

Emission Factor and Source: AP-42, Table 8.23-1
TSP = 0.005 kg/t - Handling of high moisture rock
Process Rate: 1200 t/hr, 16,000 t/day, 3,629,000 t/yr
Duration: As noted in process rate.
Control Method and Efficiency: Wetting if necessary.

Example Calculation:
TSP - 3,629,000 t/yr x 0.005 kg/t ÷ 1000 kg/t = 18.1 t/yr

Total TSP (feed bins to crusher) = 18.1 t/yr before gravity settling.

Crusher Feed Bins to Primary Crusher with Gravity Settling:

Particle size ranges, mine ventilation air stream branch velocities, settling parameters, and determination of % settled are the same as for handling from railcars into crusher feed bins.

Total TSP (feed bins to crusher) with gravity settling estimated in the air stream from mine exhaust shafts.

18.1 t/yr x 0.05 (1 - decimal fraction settled) = 0.9 t(1.0 st)/yr

Coarse Crushing to -150 mm (-6 inches):

Emission Factor and Source: AP-42, Table 8.23-1
TSP = 0.01 kg/t - Primary crushing of high moisture rock
Process Rate: 1200 t/hr, 16,000 t/day, 3,629,000 t/yr
Duration: As noted in process rate.

Control Method and Efficiency: Insertable Dust Collector, similar to DCE Vokes Model No. DLMV 45/15 F1 - 99% Efficiency.

Example Calculation:
TSP - 3,629,000 t/yr x 0.01 kg/t ÷ 1000 kg/t x (1-.99) = 0.4 t(0.4 st)/yr

Crusher Discharge to Picking Belt:

Emission Factor and Source: AP-42, Table 8.23-1
TSP - 0.005 kg/t - Transfer of high moisture rock
Process Rate: 1200 t/hr, 14,700 t/day, 3,629,000 t/yr
Duration: As noted in process rate.

Control Method And Efficiency: Insertable Dust Collector, similar to DCE Vokes Model No. DLMV 45/15 F1 - 99% Efficiency.

Example Calculation:
TSP - 3,629,000 t/yr x 0.005 kg/t ÷ 1000 kg/t x (1-.99) = 0.2 t(0.2 st)/yr

Transfer from Picking Belt to Loading Belt:

Emission Factor and Source: AP-42, Table 8.23-1
TSP - 0.005 kg/t - Transfer of high moisture rock
Process Rate: 1200 t/hr, 14,400 t/day, 3,629,000 t/yr
Duration: As noted in process rate.

Control Method and Efficiency: Insertable Dust Collector, similar to DCE Vokes Model No. DLMV 45/15 Fl - 99% Efficiency.

Example Calculation:
TSP - 3,629,000 t/yr x 0.005 kg/t ÷ 1000 kg/t x (1-.99) = 0.2 t(0.2 st)/yr

Transfer From Loading Belt to Hoisting Pocket:

Emission Factor and Source: AP-42, Table 8.23-1
TSP - 0.005 kg/t - Transfer of high moisture rock
Process Rate: 1200 t/hr, 14,400 t/day, 3,629,000 t/yr
Duration: As noted in process rate.

Control Method and Efficiency: Insertable Dust Collector, similar to DCE Vokes Model No. DLMV 45/15 Fl - 99% Efficiency.

Example Calculation:
TSP - 3,629,000 x 0.005 kg/t ÷ 1000 kg/t x (1 - .99) = 0.2 t(0.2 st)/yr

Transfer from Hoisting Pocket into Skip:

Emission Factor and Source: AP-42, Table 8.23-1
TSP = 0.005 kg/t - Transfer of high moisture rock
Process Rate: 1100 t/hr, 14,400 t/day, 3,629,000 t/yr
Duration: As noted in process rate.

Control Method and Efficiency: Insertable Dust Collector, similar to DCE Vokes Model No. DLMV 45/15 Fl. - 99% Efficiency.

Example Calculation:
TSP - 3,629,000 t/yr x 0.005 kg/t ÷ 1000 kg/t x (1-.99) = 0.2 t(0.2 st)/yr

Mobile Equipment:

Use of diesel equipment to move personnel, materials, and rock. Diesel fuel will contain 0.4 weight percent sulfur maximum.

Emission Factor and Source: "Emission control of a Deutz F6L-714 diesel engine, derated for underground use, by application of water/oil fuel emissions" by A. Lawson, E. W. Simmons, and M. Piett. March 30, 1979.

TSP -	11.0 $lb/10^3$ gal	(1.61 g/kg)	- Lawson, et al. 1979. p. 62
SO_x -	31.0 $lb/10^3$ gal	(4.54 g/kg)	- off road construction equipment from EPA NEDS.
NO_x -	108.5 $lb/10^3$ gal	(15.9 g/kg)	- Lawson, et al. 1979. p. 81
CO -	2.01 $lb/10^3$ gal	(0.295 g/kg)	- Lawson, et al. 1979. p. 69
HC -	1.97 $lb/10^3$ gal	(0.289 g/kg)	- Lawson, et al. 1979. p. 66

Process Rate: 879 l/hr, 15,841 l/day, 3,654,000 l/yr
Duration: As noted by process rate.

Control Method and Efficiency: Use of clean burning air cooled Deutz engines with a catalytic scrubber.

Example Calculation:

$$\text{TSP} - \frac{3{,}654{,}000 \text{ l/yr} \times 0.845 \text{ kg/l} \times .00161 \text{ kg(TSP)/kg}}{1000 \text{ kg/t}} = 5 \text{ t}(5.5 \text{ st})/\text{yr}$$

Mine Air Heating:

Use of natural gas (heat content 1000 BTU/SCF) for direct-fired mine air heating.

Emission Factor and Source: EPA NEDS - Source classification codes, Appendix C, p. C-5, 12/75.

TSP -	10.0 $lb/10^6$ SCF	($4.54 kg/10^6$ SCF)
SO_x -	0.6 $lb/10^6$ SCF	($0.27 kg/10^6$ SCF)
NO_x -	120.0 $lb/10^6$ SCF	($54.48 kg/10^6$ SCF)
CO -	20.0 $lb/10^6$ SCF	($9.08 kg/10^6$ SCF)
HC -	8.0 $lb/10^6$ SCF	($3.63 kg/10^6$ SCF)

Process Rate: - 91,800 SCF/hr, 2.203×10^6 SCF/day, 110.6×10^6 SCF/yr
Duration: When weather conditions require.
Control Method and Efficiency: Use of natural gas.

Example Calculation:
TSP - 110.6×10^6 SCF/yr $\times$ 4.54 $kg/10^6$ SCF $\div$ 1000 kg/t = 0.5 t(0.6 st)/yr

TOTAL Estimated Underground Emissions

	TSP (st/yr)
Blasting	13.6
Rock Handling	
Drawpoints and development headings	1.0
Orepasses and waste rock passes	2.0
Chute to railcar	1.8
Railcar to crusher feed bins	0.9
Feed bins to primary crusher	1.0
Coarse crushing	0.4
Crusher discharge to picking belt	0.2
Picking belt to loading belt	0.2
Loading belt to hoisting pocket	0.2
Hoisting pocket into skip	0.2
Mobile Equipment	5.5
Mine Air Heating	0.6
Total	27.6

Comment No. C2

Four storage tanks for diesel fuel will be located within the mine for use by mine mobile equipment (page 1.2-10 of the EIR). Please provide the size, throughput and emissions of these tanks.

Response:

The present mine engineering specifies two underground diesel fuel storage tanks, one on the 350 m level and another on the 695 m level. Each tank has a storage capacity of 14,000 l (3,700 gal). Total mine fuel consumption peak volumes are estimated to be 813 l (215 gal) per hour, 15,850 l (4,188 gal) per day, and 3,655,000 l (965,655 gal) per year.

Diesel Fuel Underground Storage Tanks:

Filling, breathing loss, and dispensing loss of two - 3,700 gallon storage tanks with diesel fuel.

Emission Factors and Source: AP-42, Table 4.44

HC - gasoline - Submerged filling - 7.3 $lb/10^3$ gal
- Breathing loss - 1.0 $lb/10^3$ gal
- Displacement losses (vehicle filling) - 9.0 $lb/10^3$ gal

$$\text{Diesel Fuel Correction} - \frac{(0.0064\ vp)(130\ mw)\ (\text{Diesel})}{(5.2\ vp)(66\ mw)\ (\text{Gasoline})} = 0.0024\ \text{Multiplier}$$

vp = vapor pressure
mw = molecular weight

Process Rate: 3700 gal/hr, 7400 gal/day, 965,655 gal/yr
Control Method and Efficiency: Submerged filling.

Example Calculation:

Submerged filling

HC - 7.3 $lb/10^3$ gal x 965,655 gal/yr x 0.0024 x st/2000 lbs
= 0.008 st/yr

Breathing loss

HC - 1.0 $lb/10^3$ gal x 965,655 gal/yr x 0.0024 x st/2000 lbs
= 0.001 st/yr

Displacement losses (vehicle filling)

HC - 9.0 $lb/10^3$ gal x 965,655 gal/yr x 0.0024 x st/2000 lbs
= 0.01 st/yr

Total = 0.02 st/yr

Estimated emission totals for hydrocarbons (HC) from the underground fuel storage tanks are 0.02 st/yr.

Comment No. C3

How large will the emergency back-up electrical generators be? How often and how much fuel will be used when the generators are tested (page 1.2-11 of the EIR).

Response:

The use of 3 emergency (i.e. back-up) diesel generators are required to supply electrical power in the event transmission line service is interrupted to the Project facilities. For this purpose two 2500-and one 1000-kw units will supply emergency power for the mine and for the mill facilities, respectively. These units are intended for use only in emergencies. However, to assure their ability to perform, weekly operation of each unit is necessary for a maximum of 1 hour. Also, emergency operation was estimated to be 2.5 hours per year. Total diesel fuel usage will be 192 gallons per hour per 2500 kw unit, 461 gallons per day (i.e. weekly test), and 25,125 gallons per year including the weekly and emergency operation of each unit.

Emergency Diesel Generators:

Use of two 2500-kw for the mine and one 1000-kw generator for the mill for emergencies.

Emission Factors and Source: EPA, AP-42, Appendix-C, Internal combustion-electric generation-diesel, p. C-6.

TSP - 13.0 $lbs/10^3$ gal
SO_x - 140.0 $lbs/10^3$ gal
NO_x - 370.0 $lbs/10^3$ gal
HC - 37.0 $lbs/10^3$ gal
CO - 225.0 $lbs/10^3$ gal

Process Rate: 192 gal/hr, 461 gal/day, 25,125 gal/yr
Duration: Each unit will be operated a maximum of 1 hr/wk, and estimated emergency purposes are 2.5 hr/yr.
Control Method and Efficiency: None

Example Calculation:
TSP - 25,125 gal/yr x 13.0 $lbs/10^3$ gal x st/2000 lbs = 0.2 st/yr

Estimated emissions are as follows:

	st/yr
TSP:	0.2
SO_x:	1.8
NO_x:	4.7
HC :	0.5
CO :	2.8

D. Mine/Mill Surface Facilities Operation

Comment No. D1

The backfill storage facility will have area reserved for the storage of approximately 165,000 short ton of backfill (page 1.2-24 of the EIR). Estimate fugitive dust from the storage of backfill to determine if it will be a significant source of emission.

Response:

Current engineering design has eliminated the area for the backfill storage facility. A smaller area has been designed for storage of the preproduction ore. For estimated emissions from this area, see response A4.

Comment No. D2

Please provide a flow diagram of ore handling and treatment operations indicating pick-up points for dust generated and the emission control equipment.

Response:

The attached drawings (see Responses 2 and 3) and technical information below are the design specifications for the mill operation phase process, and air pollution control, equipment.

Mine/Mill Activities		Original	Revised
EER & WER*	Ventilation exhaust shafts (i.e., raises)	875 m^3/s (1.85 x 10^6 ft^3/min)	590 m^3/s (1.25 x 10^6 ft^3/min)
R.	Transport of ore to headframe	21,800 t(24,000 st)/day	Stack eliminated - insertable collector
P.	Waste rock storage bins	15,000 t(16,500 st)/day	Facilities eliminated
Q.	Waste rock crushing	3,600 t(4,000 st)/day	Facilities eliminated
A.	Coarse ore storage building	15,000 t(16,500 st)/day	Stack eliminated - insertable collectors
E.	Surge-bin to secondary & tertiary crushing and screening	15,000 t(16,500 st)/day	15,000 t (16,500 st)/day
F.	Secondary & tertiary crushing and screening	15,000 t(16,500 st)/day	15,000 t (16,500 st)/day
D.	Fine ore crushing transfer tower	15,000 t(16,500 st)/day	Stack eliminated - insertable collectors
B.	Cu-Pb-Zn fine ore bin loading**	15,000 t(16,500 st)/day	Ducted to single scrubber. Discharged through single common stack. Rates remain the same for B, G, C, and H.
G.	Cu-Pb-Zn fine ore bin unloading	5,300 t(5,800 st)/day	
C.	Cu-Zn fine ore bin loading**	15,000 t(16,500 st)/day	
H.	Cu-Zn fine ore bin unloading	4,500 t(5,000 st)/day	
I.	Milk of Lime storage	1,200 t(1,350 st)/day	Stack eliminated - insertable collectors on soda ash and lime silos.
S.	Reagent mixing facilities	25 t(27.5 st)/day	Stack eliminated
AA. & BB.	Concentrate handling and shipping	2,100 t(2,300 st)/day	Stack eliminated - material moisture content 10% minimum.
MN.	Backfill system	4,800 t(5,300 st)/day	Stacks and passive filters eliminated and replaced with insertable collectors on cement storage silo
O.	Batch plant	38.3 m^3(50 yd^3)/day	38.3 m^3(50 yd^3)/day

*See Air Permit Application, Figure 2-2, p. 2-4.

**Combined process and/or individual rates and resultant emissions will not exceed stated value of either one [i.e. 15,000 t (16,500 st)/day].

Comment No. D3

The emission calculations for the concrete batch plant (page B-18 of the air permit application appendix) appear to use an incorrect process flow rate. The flow rate given is 38.3 m^3 of concrete. If this is an hourly rate, then at 2400 kg per m^3 the process flow rate is 92 tons per hour. The rate used for the calculations is 10.7 tons per hour. Please recalculate these emissions.

Response:

The process rate for the concrete batch plant presented on page B-18 of the Air Permit Application Appendix B should have stated 50 yd^3 (38.3 m^3) per 8 hour shift (i.e. 1-shift per day or 38.3 m^3 concrete/day). The hourly process rate should have been 11.5 t/hr rather than the 10.7 t/d shown on p. B-19. Estimated TSP emissions are recalculated as follows and the Air Permit Application will be revised accordingly.

Concrete Batch Plant

Emission Factor and Source: AP-42, Table 8.10-1
TSP-EF = 0.12 kg/m^3

Process Rate: 38.3 m^3/shift, 1 shift/day, 5 days/wk, 52 wks/yr

Control Method and Efficiency: Baghouse with ducting - overall collection efficiency for "good controlled" batch plant is 90% (i.e. AP-42, Table 8.10-1).

Example Calculation:
TSP - 38.3 m^3/day x 5 day/wk x 52 wks/yr x 0.12 kg/m^3 x (1-.90) x t/1000 kg = 0.1 t(0.1 st)/yr

Comment No. D4

Please provide a copy of the reference used to calculate the emissions from locomotive exhaust, or use AP-42 emissions factors in Section 3.2.2 instead.

Response:

The diesel locomotive used during mine/mill surface facilities operation has been resized. Present design will use a unit with emissions estimated using EPA, NEDS sources (see attached, source No. 45).

01	Residential Anthracite Coal
02	Residential Bituminous Coal
03	Residential Distillate Oil
04	Residential Residual Oil
05	Residential Natural Gas
06	Residential Wood
07	Comm-Inst Anthracite Coal
08	Comm-Inst Bituminous Coal
09	Comm-Inst Distillate Oil
10	Comm-Inst Residual Oil
11	Comm-Inst Natural GAs
12	Comm-Inst Wood
13	Industrial Anthracite Coal
14	Industrial Bituminous Coal
15	Industrial Coke
16	Industrial Distillate Oil
17	Industrial Residual Oil
18	Industrial Natural Gas
19	Industrial Wood
20	Industrial Process Gas
21	Residential On-Site Incineration
22	Industrial On-Site Incineration
23	Comm-Inst On-Site Incineration
24	Residential Open Burning

SOURCE NO. 45 FOR RESPONSE
TO COMMENT NO. D4

25	Industrial Open Burning
26	Comm-Inst Open Burning
27	Light Duty Gasoline Vehicles-Limited Access Roads
28	Light Duty Gasoline Vehicles-Rural Roads
29	Light Duty Gasoline Vehicles-Suburban Roads
30	Light Duty Gasoline Vehicles-Urban Roads
31	Medium Duty Gasoline Vehicles-Limited Access Roads
32	Medium Duty Gasoline Vehicles-Rural Roads
33	Medium Duty Gasoline Vehicles-Suburban Roads
34	Medium Duty Gasoline Vehicles-Urban Roads
35	Heavy Duty Gasoline Vehicles-Limited Access Roads
36	Heavy Duty Gasoline Vehicles-Rural Roads
37	Heavy Duty Gasoline Vehicles-Suburban Roads
38	Heavy Duty Gasoline Vehicles-Urban Roads
39	Off Highway Gasoline Vehicles
40	Heavy Duty Diesel Vehicles-Limited Access Roads
41	Heavy Duty Diesel Vehicles-Rural Roads
42	Heavy Duty Diesel Vehicles-Suburban Roads
43	Heavy Duty Diesel Vehicles-Urban Roads
44	Off Highway Diesel Vehicles
45	Railroad Locomotives
46	Military Aircraft LTO's
47	Civil Aircraft LTO's
48	Commercial Aircraft LTO's

SOURCE NO. 45 FOR RESPONSE
TO COMMENT NO. D4

49	Coal Vessels
50	Diesel Oil Vessels
51	Residual Oil Vessels
52	Gasoline Vessels
53	Solvent Purchased
54	Gasoline Marketed
55	Unpaved Road Travel
56	Unpaved Air Strip LTO's
57	Construction
58	Miscellaneous Wind Erosion
59	Land Tilling
60	Forest Wild Fires
61	Managed Burning (Slash/Prescribed Burning)
62	Agricultural Field Burning
63	Frost Control (Orchard Heaters)
64	Structural Fires
97*	New Category Designated by Coder
98*	New Category Designated by Coder
99*	New Category Designated by Coder

*These codes may be used to add emissions for a category not included in sections 1-5 of the coding form. At present, a maximum of 3 categories may be added for any one county.

SOURCE NO. 45 FOR RESPONSE
TO COMMENT NO. D4

EMISSION FACTORS FOR
THE NATION

EMISSION FACTOR FILE REPORT

FILE CREATE DATE: FRIDAY JULY 23, 1982

SOURCE CATEGORY	TSP	SOX	NOX	HC/VOC	CO	SOURCE CATEGORY	TSP	SOX	NOX	HC	CO
01	10.000	39.000	3.000	10.000	90.000	33	4.051	0.180	4.040	3.520	26.480
02	15.000	31.000	3.000	10.000	90.000	34	4.951	0.180	3.320	5.170	47.470
03	2.500	144.000	18.000	0.700	5.000	35	2.220	0.360	12.650	7.280	126.000
04	16.900	159.000	18.000	0.700	5.000	36	2.220	0.360	12.210	7.640	121.970
05	3.000	0.600	100.000	5.300	20.000	37	4.920	0.360	11.320	9.100	134.790
06	25.000	0.130	1.000	1.700	180.000	38	5.820	0.360	9.970	15.860	241.780
07	0.950	39.000	11.400	0.070	0.600	39	10.000	5.085	108.400	306.310	3530.000
08	0.500	36.200	12.100	0.550	7.200	40	4.330	2.800	26.930	2.040	6.350
09	2.000	144.000	20.000	0.300	5.000	41	4.330	2.800	24.440	2.180	6.400
10	18.800	159.000	55.000	1.100	5.000	42	7.030	2.800	22.380	2.650	7.450
11	3.000	0.600	100.000	5.300	20.000	43	7.930	2.800	25.800	4.280	13.430
12	8.800	0.130	1.500	1.700	4.000	44	39.350	31.000	376.200	56.400	112.300
13	0.500	39.000	12.300	0.070	0.600	45	25.000	57.000	370.000	89.860	130.000
14	0.700	39.000	19.400	0.070	2.500	46	16.170	1.080	8.320	19.400	39.660
15	15.200	38.000	10.000	0.200	5.000	47	0.073	0.044	0.330	1.060	21.110
16	2.880	144.000	32.500	0.490	7.700	48	0.967	2.220	22.440	21.680	64.560
17	19.200	159.000	55.000	0.300	5.000	49	60.000	62.000	3.000	10.000	90.000
18	3.000	0.600	140.000	2.800	35.000	50	24.000	30.000	224.000	35.280	78.400
19	1.900	0.130	1.500	1.700	4.000	51	19.300	254.400	41.800	1.990	1.400
20	60.000	250.000	280.000	6.000	7.000	52	0.000	6.300	23.800	887.040	3016.000
21	32.000	0.500	1.000	90.000	270.000	53	0.000	0.000	0.000	2000.000	0.000
22	12.500	2.500	2.500	11.300	16.800	54	0.000	0.000	0.000	19.000	0.000
23	7.600	2.400	3.600	4.400	10.400	55	0.000	0.000	0.000	0.000	0.000
24	21.500	0.800	5.500	29.000	92.000	56	0.000	0.000	0.000	0.000	0.000
25	16.300	0.700	5.500	28.400	99.600	57	0.000	0.000	0.000	0.000	0.000
26	16.000	1.000	6.000	30.000	85.000	58	0.000	0.000	0.000	0.000	0.000
27	1.339	0.130	3.140	2.440	17.200	59	0.000	0.000	0.000	0.000	0.000
28	1.339	0.130	3.020	2.500	17.780	60	17.000	0.150	4.000	24.000	140.000
29	4.039	0.130	3.510	3.230	27.100	61	20.000	0.150	4.000	18.000	112.000
30	4.939	0.130	2.860	4.700	48.400	62	14.300	0.000	2.000	16.900	94.000
31	1.351	0.180	3.600	2.650	16.540	63	0.200	0.100	0.000	43.000	22.000
32	1.351	0.180	3.460	2.720	17.100	64	143.000	0.400	17.000	107.000	582.000

@ADD,PL TPF$.CONTROL-CARD

SOURCE NO. 45 FOR RESPONSE
TO COMMENT NO. D4

Diesel Locomotive - Used for on-site location and switching of railroad cars.

Emission Factors and Source: NEDS specific codes, emission factor file report, 7/23/82.

TSP - 25 $lb/10^3$ gal
SO_x - 57 $lb/10^3$ gal
NO_x - 370 $lb/10^3$ gal
CO - 130 $lb/10^3$ gal
HC - 90 $lb/10^3$ gal

Process Rate: 5 gal/hr, 30 gal/day, 10,800 gal/yr
Duration: 2 hrs/shift, 3 shifts/day, 360 days/yr (included in process rate).
Control Method and Efficiency: None

Example Calculation:
TSP - 10,800 gal/yr x 25.0 $lb/10^3$ gal x st/2000 lbs = 0.14 st/yr

Emission rates for the diesel locomotive are estimated to be as follows:

	st/yr
TSP:	0.14
SO_x:	0.3
NO_x:	2.0
CO :	0.7
HC :	0.5

Comment No. D5

Please recalculate the fugitive dust emissions from vehicle travel on paved roads using the attached emission factor - Figure 5-5 taken from Iron and Steel Plant Open Source Fugitive Emission Evaluation, U.S. EPA publication EPA-600/2-79-103, May, 1979. This is more recent and considered more accurate. Use 1000 pounds per mile for the surface dust loading (L) if better data is not available. Silt content of the paved road surface material should be near 20%. In addition, indicate how the total vehicle mileage of 5308 miles was obtained. Indicate which roads and areas of the mine site are paved and included in these calculations.

Response:

The estimated vehicle mileage of 5,308 miles/day was based on an assumption of approximately 400 employee vehicles traveling to the mine/mill site per day at 5 miles round trip, plus on-site plant operation daily vehicle traffic which was estimated to be approximately 155 hours per day at 19.6 miles/hour (AP-42, Chapter 3). Therefore, employee traffic was 400 vehicles x 5 miles/vehicle = 2,000 miles. Plant operation traffic was 155 hours at 19.6 miles/hour = 3,038 miles. Total estimated miles were presented as 5,308 miles, but should have read 5,038 miles. Paved roads within the site are shown on the attached Drawing No. 051-1-C-003 (Paving General Arrangement).

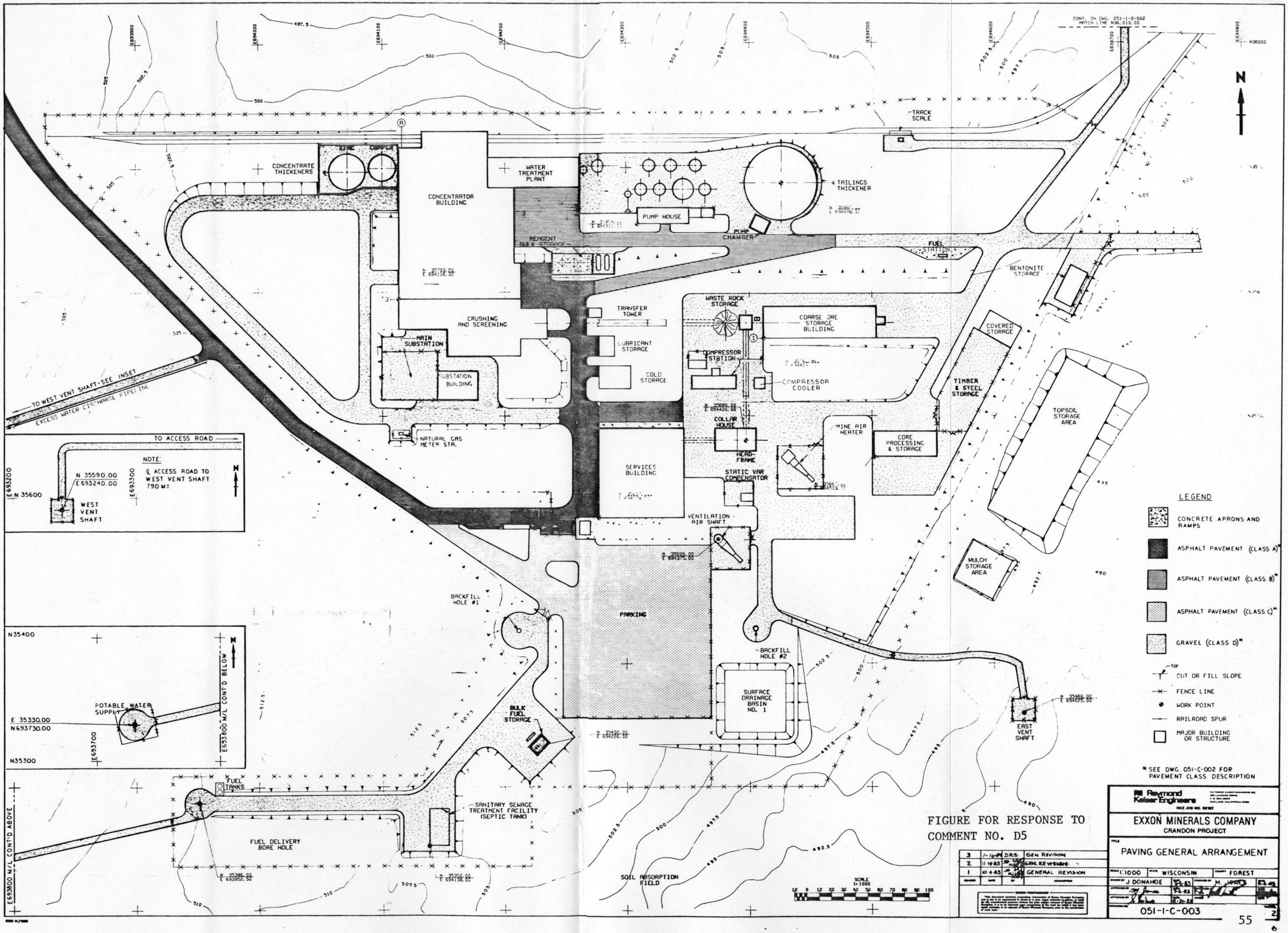

FIGURE FOR RESPONSE TO COMMENT NO. D5

The recalculation of fugitive dust (TSP) emissions from vehicle travel is based on the most recent EPA AP-42 update (i.e. May, 1983), and current estimates of employee traffic loads of 439 (703 ÷ 1.6; see response D7) vehicles per day (i.e. 439 x 5 = 2195 miles/day) and the currently estimated mine/mill plant operation traffic load of 186 miles/day. A conservative assumption was used in that the estimated plant operation miles traveled will be 186 miles/day on paved and 186 miles/day gravel roads. The calculations, therefore, overestimate the potential TSP emissions since only portions of the miles traveled will be on either road surface.

Mine/Mill Site Fugitive Dust TSP Emissions from Traffic During Operations:

Access Road

Emission Factors and Source: AP-42, Table 11.2.5-1
TSP-EF = 0.012 lb/veh-mile

Process Rate: 2195 miles/day for employee vehicles
(i.e. 439 vehicles x 5 miles/round trip)
100 miles/day for off-site delivery vehicles
(i.e. 20 vehicles x 5 miles/round trip)
Total miles traveled/day on access road =
2295 veh-miles/day

Duration: 230 dry days/yr
Control Method and Efficiency:

Example Calculation:

$$\text{TSP} - \frac{\text{2295 veh-miles}}{\text{day}} \times \frac{\text{230 dry days}}{\text{yr}} \times \frac{\text{0.012 lbs}}{\text{veh-mile}} \times \frac{\text{st}}{\text{2000 lbs}} = \text{3.2 st/yr}$$

Mine/Mill Site-Paved Roads

Emission Factors and Source: AP-42 (i.e. May 1983),
Section 11.2.6 - Industrial Paved Roads

$$\text{TSP-EF} = k(0.09)\ I\ (4/n)(s/10)(L/1000)(W/3)^{0.7} = \text{lb/veh-mile}$$

where:

k	=	particle size multiplier	=	0.86
I	=	industrial augmentation factor	=	3.5 for LDGV
			=	7.0 for HDGV and HDDV
n	=	number of traffic lands	=	2
s	=	surface material silt content (%)	=	20%
L	=	surface dust loading (lb/mile)	=	1000
W	=	average vehicle weight (tons)	=	2 st (i.e. 4000 lbs) - for light duty gasoline vehicles (LDGV)
			=	5 st avg. - heavy-duty gasoline vehicle (HDGV)
			=	15 st avg. - heavy-duty diesel vehicle (HDDV)

Light Duty Gas Vehicle (LDGV)

(Pick-up Trucks)
Assume: 20 miles/hr
4 wheels
W = 2 st
230 dry days per year

Duty	miles/day
Environmental	25
Inspections	45
Security	50
Maintenance	10
Warehouse	2.5
Total	132.5

Heavy Duty Gas Vehicle (HDGV)

Assume: 15 miles/hr
6 wheels
W = 5 st (average)
230 dry days per year

Duty	miles/day
Water Truck	20
Trucks	6.5
Total	26.5

Heavy Duty Diesel Vehicle (HDDV)

Assume: 10 miles/hr
6 wheels
W = 15 st (average)
230 dry days per year

Duty	miles/day
Grader	5
Backhoe	0.5
60 st Crane	0.5
10 st Crane	0.5
Tractor/trailer	0.5
Forklifts	20
Total	27

Control Method and Efficiency: Paving - asphalt.

Example Calculation:

$$\text{LDGV TSP-EF} = k(0.09)\ I\ (4/n)(s/10)(L/1000)(W/3)^{0.7} = \text{lb/veh-mile}$$
$$= 0.86\ (0.09)\ 3.5\ (4/2)(20/10)(1000/1000)(2/3)^{0.7} = 0.8\ \text{lb/veh-mile}$$

$$\text{LDGV TSP} - \frac{0.8\ \text{lb}}{\text{veh-mile}} \times \frac{132.5\ \text{miles}}{\text{day}} \times \frac{230\ \text{dry days}}{\text{yr}} \times \frac{\text{st}}{2000\ \text{lbs}} = 12.2\ \text{st/yr}$$

$$\text{HDGV TSP-EF} = 0.08 \times 7.0 \times 2 \times 2 \times 1 \times (5/3)^{0.7} = 3.2\ \text{lb/veh-mile}$$
$$\text{HDGV TSP} - 3.2 \times 26.5 \times 230 \div 2000 = 9.8\ \text{st/yr}$$

$$\text{HDDV TSP-EF} = 0.08 \times 7.0 \times 2 \times 2 \times 1 \times (15/3)^{0.7} = 6.9\ \text{veh-mile}$$
$$\text{HDDV TSP} - 6.9 \times 27 \times 230 \div 2000 = 21.4\ \text{st/yr}$$

Total estimated TSP emissions = 43.4 st/yr

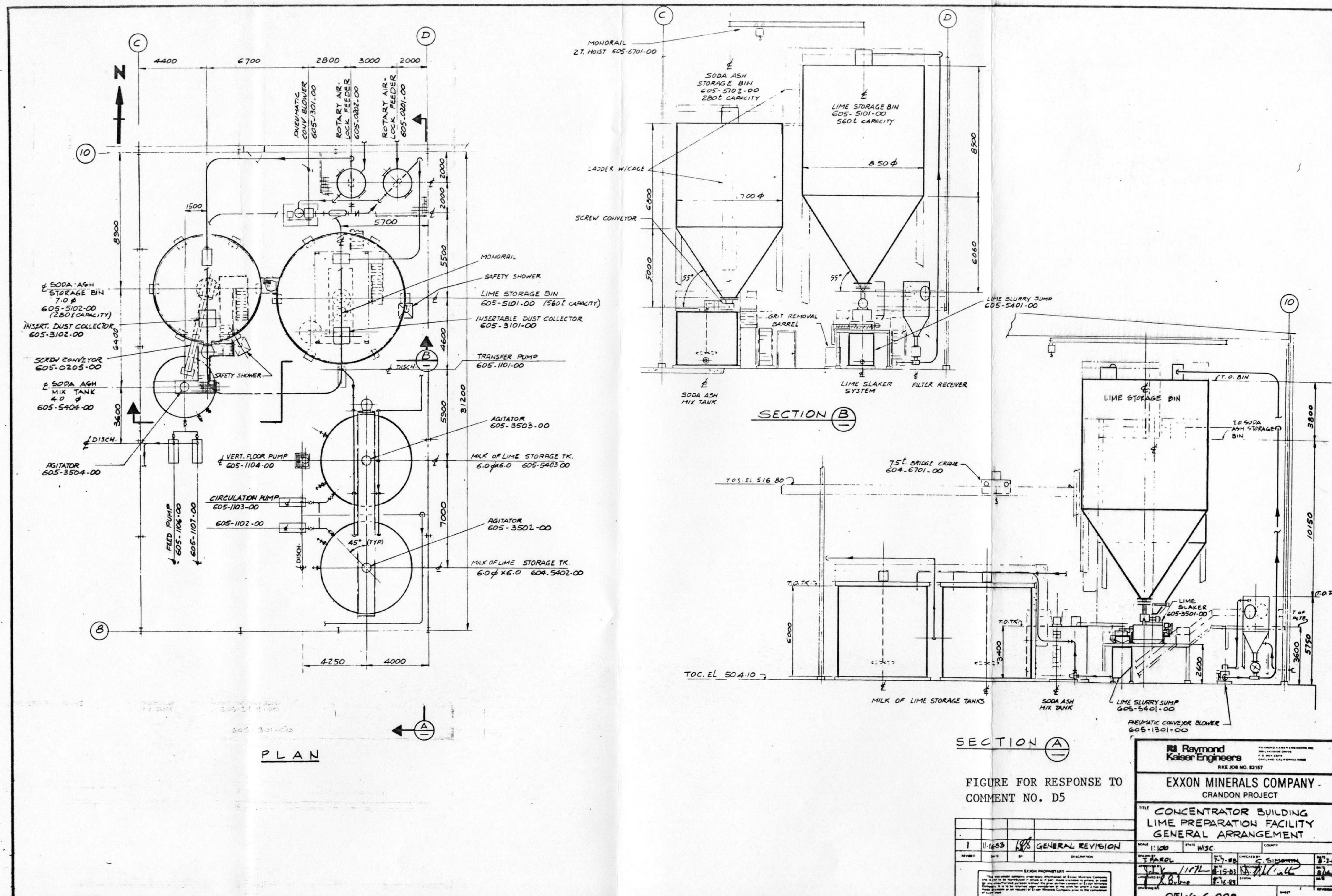

FIGURE FOR RESPONSE TO COMMENT NO. D5

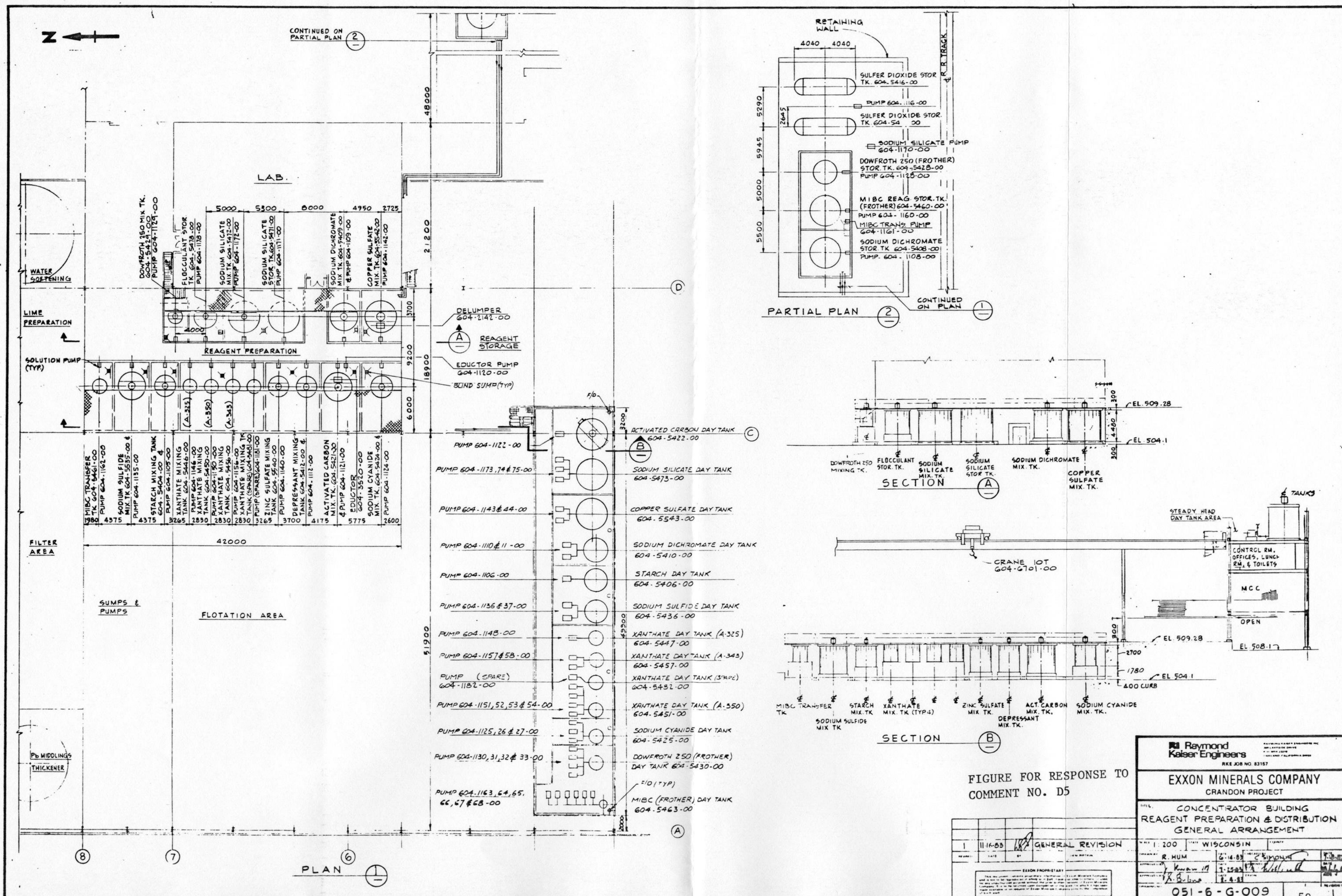

FIGURE FOR RESPONSE TO COMMENT NO. D5

Gravel Roads

Emission Factors and Source: AP-42, Section 11.2.1.3

$$\text{TSP-EF} = k\ 5.9\ (s/12)(S/30)^2(W/3)^{0.7}(w/4)^{0.5}(d/365) = \text{lb/veh-mile}$$

k = 0.8	LDGV =	132.5 miles/day
s = silt content, %	HDGV =	26.5 miles/day
S = vehicle speed, mph	HDDV =	27.0 miles/day
W = vehicle weight, st	s =	6%
w = number of tires	Duration:	230 dry days/yr
d = number of dry days		

Control Method and Efficiency: Watering as necessary.

Example Calculation:

$$\text{LDGV TSP-EF} = k\ 5.9\ (s/12)(S/30)^2(W/3)^{0.7}(w/4)^{0.5}(d/365) = \text{lb/veh-mile}$$
$$= (0.8)\ 5.9\ (6/12)(20/30)^2(2/3)^{0.7}(1)^{0.5}(230/365) = 0.5\ \text{lb/veh-mile}$$

LDGV TSP - 0.5 lb/veh-mile x 132.5 mi/day x 230 day/yr x st/2000 lbs = 7.6 st/yr

$$\text{HDGV TSP-EF} = 0.8\ (5.9)(6/12)(15/30)^2(5/3)^{0.7}(6/4)^{0.5}(0.6) = 0.6\ \text{lb/veh-mile}$$

HDGV TSP - 0.6 x 26.5 x 230 ÷ 2000 = 1.8 st/yr

$$\text{HDDV TSP-EF}\ 0.8\ (5.9)(6/12)(10/30)^2(15/3)^{0.7}(6/4)^{0.5}(0.6) = 0.5\ \text{lb/veh-mile}$$

HDDV TSP - 0.5 x 27.0 x 230 ÷ 2000 = 1.6 st/yr

Total estimated TSP emissions (uncontrolled) = 11.0 st/yr

Total estimated TSP emissions (controlled) = 11.0 st/yr x 0.5* = 5.5 st/yr

Total estimated TSP emissions for employee and plant operation traffic = 48.9 st/yr

---

* 50% control with watering

Comment No. D6

Table 1.4-5 of the EIR lists the methods by which reagent spills and emissions within the confines of the preparation and handling facilities will be controlled. Describe the ventilation and emission control systems for these facilities. Include a diagram which identifies the approximate mixing area for each reagent, the ventilation or hooding equipment for the operation and the control equipment for the operation.

Response:

The facilities for storage and mixing of reagents are presented in Drawings No. 051-6-G-008 and No. 051-6-G-009. Reagent facilities consist of 3 separate areas: (1) bulk reagent storage, (2) reagent preparation (i.e. includes lime and soda ash storage and mixing), and (3) steady-head day tanks.

(1) Reagents in the bulk reagent storage area will be stored in bulk tanks outside the concentrator building. Filling of these tanks will be conducted by directly connected flex hoses or piping, thus minimizing the remote possibility of spillage. In the event a spill does occur, liquid reagents and/or immediate water washdown of the affected area will be collected in a sump. Ventilation systems with hoods, ductwork,

and fans is therefore impractical and unnecessary. Rapid air dispersion of any residual odors will occur in the immediate area and render any emissions undetectable outside the plant property.

(2) Reagent tanks in the reagent preparation area are individually or collectively diked (i.e. when similar type reagent tanks are clustered) and any spillage within the dikes will be collected in "blind" sumps. From these sumps, any spills will be reclaimed with portable sump pumps and saved for use. Again immediate water washdown will reduce any residual emissions. Ventilation systems with hoods, ductwork, and fans are not required or necessary. The general mill facility ventilation system will disperse any generated odors and render them unnoticeable off plant property.

(3) The steady-head day tanks will receive reagent solutions from the reagent preparation area via directly connected piping, thus reducing the possibility of spillage. In the remote circumstance that a spill does occur, each tank or group of tanks is diked and gravity piped to blind sumps for reclamation. Day tanks will be constructed such that any overflow of solution will flow directly back to the mixing tank. Again a special ventilation system to exhaust or capture air emissions is not necessary. As before, the general ventilation system of the mill building will rapidly disperse any air emissions and render them unnoticeable off plant property.

Comment No. D7

The emissions from employee vehicular travel were estimated using 2,000 total miles traveled per day (page B-22 of the air permit application appendix). There will be 623 employee vehicles (p. 1.4-35 of the EIR) traveling the facilities access road which is approximately 3 miles long each day. At this rate, 3,738 miles (2 x 3 x 623) would be traveled each day. Based on these assumptions, the estimated emissions from employee vehicular should be revised.

Response:

Current estimates indicate that approximately 703 operation phase personnel will be employed by the Crandon Project. It is also assumed that there will be 1.6 employees/vehicle traveling 2.5 miles (one-way) of access road to the mine/mill site. Therefore, at this rate (2 trips/day x 2.5 miles/trip x 703/1.6 employees per vehicle), approximately 2,200 vehicle miles would be traveled per day. Therefore, the estimates on p. B-22 of the air permit application, Appendix B, will be revised as follows:

Emission Factor and Source: AP-42, Appendix D, Table D.1-19 (1987)
Process Rate: Employee vehicles - 2200 mi/day (LDV)
Duration: 350 days/yr
Control Method and Efficiency: As per EPA vehicle emission controls.

Example Calculation: Process Rate x Emission Factor = Emission Rate
TSP: 2200 mi/day x 0.05 g/mi x 0.002 lbs/g x 350 days/yr x st/2000 lbs = 0.04 st/yr
SO_x: 2200 x 0.13 (Table D.1-21) x 0.002 x 350 ÷ 2000 = 0.1 st/yr
NO_x: 2200 x 0.40 x 0.002 x 350 ÷ 2000 = 0.3 st/yr
CO : 2200 x 3.6 x 0.002 x 350 ÷ 2000 = 2.8 st/yr
HC : 2200 x 0.43 x 0.002 x 350 ÷ 2000 = 0.3 st/yr
Emitting Device: Tailpipes of vehicles.

E. (D) Mine Waste Disposal Facility Construction

Comment No. E1

Please recalculate the fugitive dust emissions from vehicle travel on unpaved roads using the attached emission factor as requested for the surface facilities paved roads. The number of dry days per year should be 230 days. Silt content of the gravel road in northern Wisconsin should run 6-7% unless some soil is mixed with the gravel. The silt content of 12% used in the permit calculations is acceptable if some soil is mixed with the gravel.

Response:

Recalculation of emissions from vehicle travel on unpaved roads using the emission factor specified by WDNR in the September 12, 1983 letter are:

Emission Factor and Source: AP-42 (i.e. May, 1983), Section 11.2.1 - Unpaved Roads

$$TSP\text{-}EF = k\ 5.9\ (s/12)(S/30)^{2*}(W/3)^{0.7}(w/4)^{0.5}\ (d/365) = \text{lb/veh-mile}$$

where:
EF = Suspended particulate emissions - lb/veh-mile
k = Particle size multiplier - 0.8
s = Silt content of gravel road surface material in % - 6%**
S = Average vehicle speed - 15 mi/hr
W = Average vehicle weight - tons
w = Average number of wheels per vehicle
d = dry days per year - 230 days

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* The factor (S/30) is valid for a speed range of 30 to 50 mph. Below 30 mph the square of the factor is recommended (WDEQ 1979. Fugitive dust emission factors. Cheyenne, WY: Wyoming Department of Environmental Quality, Division of Air Quality. January 24 Memorandum from Charles Collins).

** In accordance with WDNR recommendations.

Example Calculations:

Hauling of Excavated Till from Pond T2

S = 15 mi/hr
Assume loose wet density of till at 110 lb/ft^3 = 2,970 lbs/yd^3
Vehicle weight empty = 88,900 lb* (25 yd^3 scraper)
Vehicle weight loaded = 25 yd^3 x 2,970 lbs/yd^3 + 88,900 lb = 163,150 lb
= 81.58 st loaded

$$\text{Average } W = \frac{(163{,}150 + 88{,}900)}{2} \div 2000 = 63 \text{ st}$$

w = 4
d = 230
s = 15% for till
TSP-EF = $(0.8)5.9(15/12)(15/30)^2(63/3)^{0.7}(4/4)^{0.5}(230/365)$ = lb/veh-mile
= 7.8 lb/veh-mile

Total annual TSP emissions (uncontrolled) =
35,162** mi/yr x 7.8 lb/veh-mi x st/2000 lb = 135.4 st/yr

Total annual TSP emissions (controlled) = 135.4 st/yr x 0.5*** = 67.7 st/yr

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* Empty weight of CAT 631D.
** See assumptions submitted in air permit application (p. B-26).
*** Watering.

Hauling of Waste Rock

Assume 35 st truck such as CAT 773B
Vehicle weight empty = 33 st
Vehicle weight loaded = 68 st
s = 6%
S = 15 mi/hr
W = 51 st avg.
w = 6
d = 230 days

TSP-EF = $(0.8)5.9(6/12)(15/30)^2(51/3)^{0.7}(6/4)^{0.5}(230/365)$ = lb/veh-mile
= 3.1 lb/veh-mile

Total annual TSP emissions (uncontrolled) =
7,915**** mi/yr x 3.1 lb/veh-mi x st/2000 lbs = 12.3 st/yr

Total annual TSP emissions (controlled) = 12.3 x 0.15***** = 1.9 st/yr

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**** See assumptions submitted in air permit application (p. B-26).
***** 85% control with chemical stabilization of haul road.

Hauling of Bentonite From Mill To Batch Plant Area

Assume 12 st tractor/trailer
Vehicle weight empty = 10 st
Vehicle weight loaded = 22 st
s = 6%
S = 15 mi/hr
W = 16 st avg.
w = 18
d = 230 days

TSP - $(0.8)(5.9)(6/12)(15/30)^2(16/3)^{0.7}(18/4)^{0.5}(0.6)$ = 2.4 lb/veh-mile

Total annual TSP emissions (uncontrolled) = 4,995* miles/yr x 2.4 lb/veh-mile x st/2000 = 6.0 st/yr

Total annual (TSP) emissions (controlled) = 6.0 st/yr x 0.15** = 0.9 st/yr

* See assumptions submitted in air permit application (p. B-26).
** 85% control with chemical stabilization of haul road.

Hauling of Bentonite/Soil Mix to Tailing Pond

Assume 12 st rear dump truck
Vehicle weight empty = 24 st
Vehicle weight loaded = 36 st
W = 30 st avg.
w = 6
S = 15 mi/hr
s = 6%
d = 230 days

TSP - $(0.8)(5.9)(6/12)(15/30)^2(30/3)^{0.7}(6/4)^{0.5}(230/365)$ = 2.3 lb/veh-mile

Total annual TSP emissions (uncontrolled) = 7,575*** mi/yr x 2.3 lb/veh-mile x st/2000 lbs = 8.7 st/yr

Total annual TSP emissions (controlled) = 8.7 st/yr x 0.15**** = 1.3 st/yr

*** See assumptions submitted in air permit application (p. B-26).
**** 85% control with chemical stabilization of haul road.

Total fugitive dust (TSP) emissions from vehicle traffic on unpaved roads during the year of maximum MWDF construction is 71.8 st/yr.

Comment No. E2

An emission factor (EF) of 0.0275 pounds per short ton was used for material dumping (page B-27 of the air permit application appendix) based on the equation in Section 11.2.3 of U.S. EPA publication AP-42. Please show how this EF was derived.

Response:

Section 11.2.3 of U.S. EPA publication AP-42 addresses fugitive particulate (TSP) emissions from aggregate storage piles and is expressed in the form:

$$TSP\text{-}EF = \frac{0.33}{(PE/100)^2}$$

where:
PE = Thornwaite's precipitation/evaporation index - (120 for site area)

This equation estimates total emissions from aggregate storage piles obtained by <u>combining</u> emissions from:

	Activity	Fraction of Total Emissions
1)	Loading of aggregate	0.12
2)	Equipment traffic in storage area	0.40
3)	Wind erosion	0.33
4)	Loadout of aggregate for shipment	0.15
	Total	1.00

The relative percentage of aggregate emissions from loading onto piles is estimated to be 12% of the total. Therefore, the contribution from loading (i.e. material dumping) alone would be:

$$TSP\text{-}EF = \frac{(0.12)(0.33)}{(120/100)^2} = 0.0275 \text{ lb/st}$$

Comment No. E3

For the windblown emissions (page B-29 of the air permit application appendix) show how the parameters used to obtain the emission factor of 0.0275 lb/st were derived. The wind erosion losses (0.010 and 0.025) seem very low and should be supported with data from a soil analysis, as should the soil erodibility factor. Show how the unsheltered field wi(d)th of 0.7 was calculated and how the climate factor was determined.

Response:

The emission factor 0.0275 lb/st is not shown on page B-29 of the air permit application, Appendix B, nor is it used in these calculations. Emission factors for wind-blown emissions on page B-29 of the air permit application were determined as indicated using the formula E = aIKCLV.

The specific factors (a, I, K, C, L and V) used in the calculation were from guidelines in the referenced document (PEDCo, 1976) which specifies these factors as follows:

a" and "I"

Surface Soil Type	a	I (st/acre/yr)
Rocky, gravelly	0.025	38
Sandy	0.010	134
Fine	0.041	52
Clay loam	0.025	47

"K"

"K" is a surface roughness factor which accounts for wind resistance. It is a function of the height and spacing of ridges and varies from 1.0 (no reduction) for a field with a smooth surface to a minimum of 0.5 for a field with an optimum ratio of ridge height to ridge spacing. "K" was conservatively assumed to be 1.0 for the site area.

"C"

"C" is a dimensionless climatic factor which can be calculated or taken directly from prepared charts. The climatic factor of 0.05 for the site area was taken from the chart of climatic factors provided in the referenced report.

"L"

"L" is the unsheltered field width which is the distance across an open field between shelters. It depends on shelter height, if there is any, but is usually given a value of 0.7 for exposed areas approximately 1000 ft across, and 1.0 for areas greater than 2,000 ft in width. As the Crandon Project mine/mill site and MWDF exposed areas would be wider than 1,000 ft the factor for these areas should be assigned a value of 1.0. (This results in an increase in total wind-blown TSP emissions from the MWDF of 43% or 9.3 st/yr). Emission factors shown below were developed using a factor of 0.7. The revised air permit application will have TSP emissions calculated using "L" as 1.0.*

"V"

"V" is a factor to account for vegetative cover. It was conservatively assumed that the disturbed areas were unvegetated and a value of 1.0 was used.

The calculated emission factors are as st/acre/yr (short ton per acre per year) by area and were calculated to be:

Area	Emission Factor
1 - Haul Road	0.0333 st/acre/yr
2 - Storage Area	0.0469 st/acre/yr
3 - Ponds	0.0469 st/acre/yr (0.067*)

*Value calculated using "L" value of 1.0.

Comment No. E4

It appears the screening plant used to process materials for the liner and underdrain system, and the series of conveyors and radial stackers which distribute the processed materials to the appropriate stockpile in the construction support area could be significant emission sources (p. 1.3-15 of the EIR). Please address this concern by justifying that these are not significant sources (e.g. due to the use of wetted materials, etc.) or provide the throughput and calculate the emissions for these processes.

Response:

The emissions from the screening plant during construction for the year of maximum soil material processing are represented by estimates of screening (i.e. soil processing) plant emissions during MWDF operation (see air permit application, Table 4.7). For estimates of maximum emissions during construction, the emissions identified on Table 4.7 should be used (i.e. 1.02 + 0.028 = 1.04 st/yr).

Comment No. E5

Please provide a copy of the reference used to estimate mobile source emissions (p. B-24 of the air permit application appendix).

Response:

A copy of the reference is attached as part of response D4 (see source categories 31 and 44).

F. Mine Waste Disposal Facility Operation

Comment No. F1

Exposed areas of the tailings ponds such as waste rock between ponds or beach areas where the tailings slurry has dried could be sources of significant fugitive dust. Please address this concern justifying that these will not be significant sources by calculating the fugitive dust emissions from them.

Response:

Wind-blown emissions from the waste rock between ponds or beach areas where the tailings slurry has dried are assumed to be less than the wind-blown emissions estimated for MWDF construction. Wind-blown emissions calculated for MWDF construction represent emissions from the total Pond T2 and waste rock storage areas assuming both areas are disturbed and exposed. These wind-blown emissions for the entire area (Pond T2 plus waste rock storage area) are only 6.5 st/yr (see Table 2.6 of the Air Permit Application). A conservative estimate of 25% of the pond as open area was used for the dried beach and exposed waste rock; therefore, the estimated TSP emissions are less than 2 st/yr. Therefore, this does not consititute an important (i.e. "significant") source of fugitive dust (TSP).

Comment No. F2

The emissions from the bentonite liner batch plant should be considered a MWDF construction source and not an operation source if its use is primarily for construction.

Response:

Comment acknowledged.

Comment No. F3

Describe the purpose of the soil processing plant (Table 1.4-9, p. 7 of 7 of the EIR.

Response:

The purpose of the soil processing plant is to partition by screening the various particle sizes required for construction of the leachate (i.e. seepage) control system of the MWDF. These particle size distributions are necessary to produce the three soil size classifications required for the liner, drainage and filter layers of the leachate control system. The smallest particle size soil fraction will be used to mix with bentonite in the liner batch plant. The drainage and filter sized soil particles will be used directly in construction of the leachate control system.

Comment No. F4

Sufficient concern has been raised by the general public regarding the possibility of the tailings ponds being a significant source of odors due to the high sulfur content of the tailings. Please address this matter by contacting the operators of a similar facility to determine if such concerns are valid.

Response:

The tailing ponds will not be an important source of odors. Contained sulfur in the ponds is estimated to be 25 weight percent as determined by mineralogical examinations. This contained sulfur is present in a bonded form with iron (mineral pyrite). The potential to generate H_2S or SO_2 from this mineral is not likely with the planned overall tailings liquid pH of 10. Addition of lime at the tailings thickner will assure maintenance of an average tailings liquid pH of 10. The attached equilibrium diagram (i.e. Figure 5.5) for pyrite in aqueous solution shows no region of stability for H_2S or SO_2 in the tailing ponds range of pH's. (H_2S and SO_2 are generally the two gases associated with sulfur which have an odor) Contacts with experienced mine personnel, as well as EMC staff who have worked or visited at other plants, have indicated that odors are not a problem or concern at operating facilities.

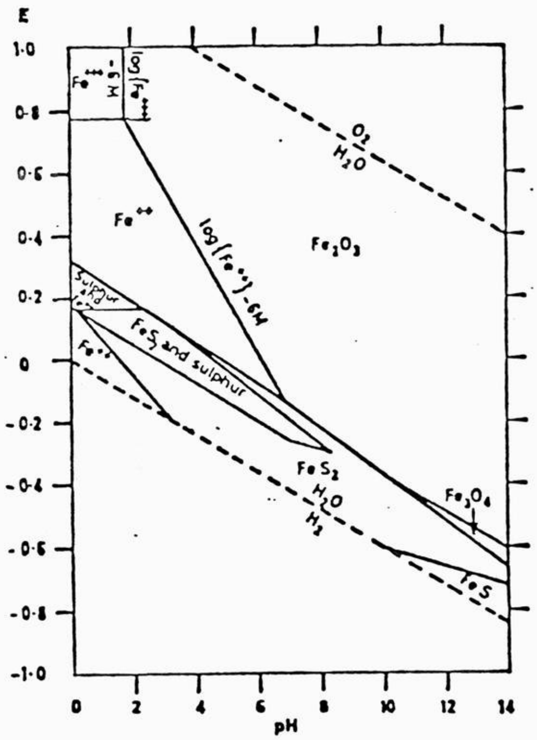

Figure 5,5 Iron oxides and sulphides in water. Equilibrium diagram for 25°C, 1 atm. pressure. Activities of ferrous and ferric ions: 10^{-6} M; activities of sulphur-containing ions in solution: 0·1M.

FIGURE FOR RESPONSE TO COMMENT NO. F4

G. General

Comment No. G1

Questions have been raised by the general public regarding the emission of trace elements from the Crandon Project. Elements of concern are aluminum, mercury, cadmium, copper, lead, arsenic and zinc. Potential public concerns should be addressed in the contents of the permit application. Please amend the permit application to include a section on the emission of trace elements. I suggest that for the worst case year during the life of the mine when particulate emissions are greatest, trace element emissions and impact be estimated. This could be done by assuming conservatively that emissions of aluminum, mercury, cadmium, copper and arsenic are proportional to their concentrations in the mine tailings fines provided in Table 3.9 of the Mine Waste Disposal Facility Feasibility Report. Similarly, the downwind concentration of these elements can be estimated by assuming conservatively that their contribution to the maximum 24-hour average particulate impact from the dispersion modeling is proportional to their concentration in the mine tailings fines. Lead and its impact are already being addressed as it is a criteria pollutant.

Response:

The amended air permit application will include a section on the estimated air emissions of the trace metal elements mentioned in the September 12, 1983 letter from the DNR. This section will utilize the "worst case" year during the operation phase for highest estimated particulate (TSP) emissions to evaluate any potential effects of aluminum, arsenic, cadmium, copper, mercury, and zinc. Further, the conservative assumptions indicated by the DNR will be incorporated in the evaluation. An example set of calculations are provided below. However, these estimates could change depending upon the results of the additional air quality dispersion modeling. As mentioned in the DNR's letter, particulate associated lead air emissions have already been addressed in the air permit application.

Estimation of Trace Metal Contributions in Particulates:

Assume: 36 $\mu g/m^3$ is the highest 24-hour average TSP concentration at the property boundary for all sources (see air permit application); also assume that suspended particulates have same trace metal analysis as impounded tailings.

Constituent	Concentration(*) in Tailings as ppm	Concentration(*) in Tailings as percent	Concentration in TSP $\mu g/m^3$
Al	45,000	4.5	1.62
Hg	2.2	.00022	0.00008
Cd	16	.0016	0.0006
Cu	1,690	.169	0.061
As	900	.09	0.032
Zn	5,410	.541	0.20

*From MWDF - Feasibility Report p. 3-22 (Table 3.9).

Example calculation:

$$\text{Al} - 36\ \mu g/m^3 \times \frac{4.5}{100} = 1.62\ \mu g/m^3$$

Comment No. G2

Dispersion modeling for the Crandon Project will be conducted for the year when particulate emissions are highest. In order to clearly demonstrate which year represents the worst case, please provide a figure similar to Figure 1 - 1 of the air permit application which includes the total yearly particulate emissions for each stage of construction, operation and reclamation. These emissions should be totaled for each year so it is evident which year should be modeled.

Response:

Comment acknowledged. See also response to Comment No. 17.

Comment No. G3

It is expected that after emissions are recalculated based on comments raised during our discussions, Tables 2.1, 2.2, 2.3, 2.4, 2.5, 2.6 and 2.7 of the air permit application will be revised to include the new sources and emissions.

Response:

Comment acknowledged and the appropriate Tables will be revised as needed in the amended air permit application.