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G-000-101.29

APPLICATION FOR DETERMINATION OF A MODIFICATION UNDER 40 CFR 61, NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - PLANT 8 ROTARY KILN (FMPC

06/04/90

DOE-1164-90
DOE-FSO/USEPA
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LETTER

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Department of Energy
FMPC Site Office
P.O. Box 398705
Cincinnati, Ohio 45239-8705
(513) 738-6319

June 4, 1990
DOE-1164-90

Valdas V. Adamkus
Regional Administrator
U. S. Environmental Protection Agency
Region V - 5A-14
230 South Dearborn Street
Chicago, IL 60604

Dear Mr. Adamkus:

APPLICATION FOR DETERMINATION OF A MODIFICATION UNDER 40 CFR 61, NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - PLANT 8 ROTARY KILN (FMPC NO. 8-029) - FEED MATERIALS PRODUCTION CENTER (FMPC)

Enclosed is an application for determination of a modification under 40 Code of Federal Regulations (CFR) 61, NESHAP, for the Plant 8 Rotary Kiln (FMPC ID No. 8-029). Please be advised that this document is the first application for determination for the FMPC, and will serve as the model application. All subsequent applications for determination will be of similar format.

If your staff has any questions or requires additional information concerning this application, please ask them to contact Behram Shroff, of my staff, at (513) 738-6003 or FTS 774-6003.

Sincerely,

Gerald W. Westerbeck
FMPC Site Manager

DP-84:Shroff

Enclosure: As stated

cc w/enclosure:

W. H. Britton, WMCO
W. Dillow, SE-31,ORO
R. Shank, OEPA-Columbus

cc w/o enclosure:

D. A. Kee, USEPA
T. Tucker, OEPA-Columbus
C. E. Schumann, SWOAPCA

REQUEST FOR DETERMINATION OF A MODIFICATION UNDER 40 CFR 61 U. S. DEPARTMENT OF ENERGY FEED MATERIALS PRODUCTION CENTER

ROTARY KILN - PLANT 8

FMPC ID NO. 8-029

PLANT ADDRESS: FEED MATERIALS PRODUCTION CENTER
7400 WILLEY ROAD
FERNALD, OHIO 45030

OWNER ADDRESS: U. S. DEPARTMENT OF ENERGY
P. O. BOX 398705
CINCINNATI, OHIO 45239-8705

April 24, 1990

[redacted]

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[redacted]

Request for Determination of a Modification Under 40 CFR 61
U.S. Department of Energy - Feed Materials Production Center
Rotary Kiln - Plant 8 (FMPC I.D. No. 8-029)

I. INTRODUCTION

The Feed Materials Production Center (FMPC) is a federal facility for the production of highly pure uranium metal. The FMPC is owned by the U.S. Department of Energy (DOE) with program direction administered through the Oak Ridge Operations office of the DOE.

The FMPC is located in southwestern Ohio near the unincorporated village of Fernald in the Great Miami River Valley. The FMPC is located about twenty miles, (32.2 km), northwest of the City of Cincinnati, Ohio and about two miles (3.2 km) southwest of Ross, Ohio. The address of the FMPC is 7400 Willey Road, Fernald, Ohio 45030. The center of the site is located at Latitude 39°-17′-58" and Longitude 84°-41′-19".

This application is submitted as a Request for Determination of Modification under 40 CFR 61.06. The New Rotary Kiln (FMPC I.D. No. 8-029) is a replacement of an existing rotary kiln (FMPC I.D. No. 8-001) in Plant 8. The New Rotary Kiln will employ the best available technology and result in a net decrease of emissions from the facility. This application describes both the existing and new kilns, and will also compare the emissions of the existing rotary kiln with the expected emissions from the new kiln. The Rotary Kiln System is located in Building 8, in the southwest corner of the FMPC Production area. The location of Building 8 within the FMPC complex is indicated in Figure 1. Figure 4 indicates the location of the existing kiln and the new kiln in Plant 8.

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II. DESCRIPTIONS

A. Existing Rotary Kiln

The existing rotary kiln (Bartlett and Snow Company) is a natural gas fired furnace located in the southeast corner of Plant 8 at the Feed Materials Production Center in Fernald, Ohio. It consists of a steel cylinder 66" I.D. x 50′ long, lined with 6" refractory bricks which are backed by 3" insulating blocks. It is slightly inclined from the horizontal and fitted with riding rings which rest on trunnion rolls. Thrust rolls are provided at one trunnion base to hold the cylinder in the proper longitudinal position. The main structural steel base is designed so that the pitch of the kiln may be varied. The cylinder is rotated by means of a girt gear which meshes with a drive gear that is mounted on the slow speed shaft of a reduction unit. The high speed shaft of the reduction unit is coupled directly to a four speed motor that will provide rotational speeds of 0.45, 0.60, 0.90, and 1.23 RPM.

The discharge end of the kiln is provided with a firing hood mounted on track wheels. Two excess air type natural gas burners are mounted on a firing hood. The burners are equipped with flame detector rectifiers which shut off the gas supply whenever a flame fails. The burners are also equipped with gas pressure limit switches which shut off the gas supply whenever pressure limits are exceeded. Combustion air for the burners are supplied by an auxiliary blower.

Combustion gases containing entrained dust, water vapor, and volatiles are passed through a cyclone separator to remove the dust and then through a venturi type fume scrubber to neutralize acidic constituents with a 10% caustic (NaOH) solution. The scrubbed gases exit to an exhaust blower on the roof above and

[redacted] 7

are channeled through a 30′ long, 12" ID stack equipped with a single point, modified EPA Method 5 long duration sampler which removes isokinetic samples into a filter that is analyzed for particulate and Uranium. The stack extends 5 feet above the roof of Plant 8 and 45 feet above ground level. Dust Collector G43-27 ventilates the drum dumper, feed tray, breach chamber packaging station, and product packaging station. Dust Collector G43-27 is a baghouse fabric filtration system. The blower exhausting the collector exi ts through the roof via a 28" diameter stack that extends 5′ above the roof and 45 feet above ground level. The stack is equipped with a fixed single point, continuous sampler with filter attached to a Ludlum detector. Dust from the cyclone and dust collector are discharged into the dry feed dumping station for recycle. Table 1 lists the control equipment and their estimated efficiencies.

Uranium bearing wet residues are fed to the kiln from a feed tray into a chute equipped with a valve operated by a foot lever at the rate of 1000 lbs/hr (1200 lbs/hr maximum), whereas dry materials are fed by means of a drum dumper and feed screw. The rotation and incline of the kiln causes the material to move to the kiln's other end where it is discharged into a water cooled screw conveyor which conveys the material to a packaging station. Materials passing through the kiln are dried, roasted, or oxidized depending upon the characteristics of the feed materials and the desired product. A flow diagram of the existing Rotary Kiln is included as Figure 2.

8. <u>New Rotary Kiln System</u>

The new rotary kiln is part of the Scrap Recovery Plant, Plant 8, and will be used to process residues for recycle or discard. Materials containing uranium are fed into the kiln to oxidize the uranium and to eliminate other

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impurities such as water, oil, etc. The kiln will handle a maximum feed of 1200 lb/hr. The maximum residence time will be two (2) hours depending on the slope and the rotational speed. The solids, exiting the kiln at a maximum temperature of 1200°F, will be cooled using a water heat exchanger to 200°F and drummed into 48/55 gallon containers.

The new Rotary Kiln System is similar to the existing Rotary Kiln System in nature, size, design, method of operation, operating design capacity, and physical plant location with the following exceptions.

The new Rotary Kiln equipment includes:

1. Sintered metal filter
2. Packed bed scrubber in the flue gas system
3. Enclosed feed station
4. Enclosed drumming station
5. HEPA filter after the new cartridge filter dust collector
6. Collector control equipment
7. Sampling equipment and monitors.

The new Rotary Kiln is a natural gas fired rotating cylinder consisting of a steel shell approximately 6 feet I.D. x 45 feet long lined with a 9-inch layer of refractory brick to limit the loss of inputted heat. The kiln is slightly inclined from the horizontal and is fitted with riding rings which rest on trunion rolls. Thrust rolls are provided to hold the kiln in the proper longitudinal position. The cylinder is rotated through on girt gear meshing with a drive gear that is mounted on the output shaft of a reduction unit drive, controlled from the main control panel. The trunion rolls are supported on concrete piers.

The kiln is direct fired by an excess air type natural gas burner mounted in a retractable firing hood. A UV type flame detector monitors the flame in the kiln. This control shuts off the fuel gas supply whenever a flame failure occurs. Other limits controlling burner operation are fuel gas pressures, combustion air fan, dust collector fan, high temperature limit for kiln, and stack monitor operating mode. The kiln has countercurrent flow of feed material to the flue gas. This means the firing end is the discharge end for the product stream.

Combustion gases containing entrained dust, water vapor, and volatiles are passed through an afterburner which completes the oxidation of any combustibles. This afterburner also has a UV flame detector, fuel gas pressure limits, a separate combustion air fan, and stack monitor interlock. The combustion gases are then filtered through a sintered metal filter which removes particulates down to 1 micron. These particulates are added to the discharging product stream. The filtered combustion gases are cooled with water in a Venturi scrubber which also removes more residual particulates, and finally scrubbed countercurrently with water in a packed bed scrubber in which residual particulates are further removed. This latter scrubber is packed with a highly efficient plastic packing. The recirculating scrub waters are cooled and neutralized, as required, with KOH solution, followed by discharge of the cooled cleaned combustion gases through a stack to the atmosphere. The 29.8 inch stack extends 30 feet above the roof of Plant 8 and 84 feet from ground level.

The rotary kiln is fed either granular or pasty (wet) feeds from an enclosed robot device vented to a dust collector. The feed is introduced into the kiln feed end using a sequence of a multi-screw feeder discharging to a vibratory feeder, which actually charges the feed into the kiln. The product discharged from the kiln is cooled in a water jacketed conveyor, then elevated to an upper floor. Here the kiln product is processed, as required, by milling or size screening.

The final product is sampled and drummed out on an enclosed product drumming station vented to the dust collector. Oversize product is drummed out in its own enclosed drumming station. Material from the kiln breaching is discharged in an enclosed drumming station, as is the discharge by the vacuum drumming station. All solids handling equipment and the drumming station are vented to a dust collector equipped with bag-in bag-out cartridge filters. The dust collector is in turn vented to a HEPA filter equipped with a prefilter. The final filtered air is discharged via an induced draft fan to the atmosphere through a stack shared with the previously described cleaned and cooled combustion gas stream.

All equipment is interlocked for safe sequential startup and shutdown using a programmable logic controller. This controller sends signals to a main control panel with a graphic display of data and operating states of the system. An annunciator in this control panel alarms and alerts an operator to upsetting conditions.

A custom designed stack monitor guards against discharge of radionuclides to the atmosphere. This is a dual channel device which automatically filters two air streams, collecting particulates on filter papers (for further analysis, as required). An alpha-beta detector monitors the radiation of the particulates collected on these filter papers, sending appropriate signals as described. One air stream sample is taken from before the HEPA filter. This is an "early warning sample" that will alert an operator to an impending increase in radioactivity of the polluting particulates. The set point is set independently to signal that excess radionuclide concentrations are present. This initiates an alarm on the main control panel. The other air stream sample is taken (and controlled isokinetically) from the final stack. This will generate an alarm when radionuclide concentration of filter particulates reaches an unacceptable level. This set point is set independently of the early alert alarm. The monitor also contains a microprocessor for storing and processing data on the particulates and air flow out the stack. This data can be retrieved for permanent records.

The individual process units which comprise the new rotary kiln system are listed below. Each of these units are physically interconnected, causing them to function as one individual source of air pollution. The process units described below denote the number of each type installed in the rotary kiln, and whether such unit is a new process unit or a replacement for an existing unit. Table 1 compares the existing system to the new system for all major features, including control equipment efficiencies. Figure 3 is a flow diagram of the new Rotary Kiln System.

Component of the Rotary Kiln System	Number Used	New/Replacement
Rotary Kiln	One (1)	Replacement
Drum Dumping	One (1)	Replacement
Drumming Station	Four (4)	2 New, 1 Replacement, and 1 New associated with control equipment
Product Cooler	One (1)	Replacement
Product Elevator	One (1)	New
Screening	One (1)	New
Conveyor	Three (3)	1 Replacement, 2 New

C. Credible Abnormal Circumstance - New Rotary Kiln

Several abnormal circumstances were considered for evaluation for the new Rotary Kiln.

Failure of any cartridge filters in the Dust Collector would generate increased flow of radionuclides to the HEPA filter. The HEPA filter would capture most of the escaping radionuclides so little would be released to the environment. The stack monitor, with its early warning feature, would sound an alarm and its recorder would show the abnormal increase in radioactivity due to this release which would alert the operators to take corrective action and shut down the system. This scenario would result in minimal radionuclide releases to the environment from the abnormal circumstance. Also, turning off the dust collector will shutdown the entire processing operation using electrical interlocks, except the stack monitor which will be operational at all times.

The most credible abnormal circumstance would be an emergency shutdown which would shut down the entire processing operation and cause the flapper valve on the emergency stack to open. This would release the offgas from the kiln and afterburner to the atmosphere. Since the emergency stack is upstream of the sintered metal filter, the released offgas would contain radioactive particulates from the kiln.

This credible abnormal circumstance of an emergency shutdown can occur unexpectedly and unpredictably. The following shall be cause for emergency shutdown.

a. Loss of negative kiln pressure

b. Loss of venturi scrubber spray water

c. Loss of scrubber tower spray water

d. High water temperature at heat exchanger discharge

e. High temperature at HEPA filter inlet

f. High material temperature at discharge from product cooler

g. High temperature of kiln offgas

h. Loss of power

i. Unacceptable rate of radionuclide emissions from the stack.

Under emergency shut down conditions, except for loss of power, the Jet Scrubber Pumps and Scrubber Tower Pumps shall remain in operation until manually shut down.

[redacted]

From PTI calculations:

3.0 lbs Particulate/hr (during operation)

/. 60 min/hr

= 0.05 lbs Particulate/min (during operation)

/. 2392 ft/min (air velocity during operation)

= 2.09E-05 lbs Particulate/cu ft (during operation

x 1052 cu ft (air volume of equipment and stack)

= 2.20E-02 lbs Particulate/Occurrence

x 0.75 (maximum lbs Uranium/lbs Particulate)

= 1.65E-02 lbs Uranium/Occurrence

= 0.75E-02 Kg Uranium Occurrence

Calculations indicate that air displacement would take a maximum of one minute. In reality, complete replacement of the process air in the stack and equipment would be unlikely because in most cases they would be in a negative pressure environment when the shutdown occurred.

These calculations differ from the OEPA PTI emergency shutdown, because the previous calculations assumed the air velocity would be maintained when exiting the emergency stack. Table 2 lists all emission rates including the credible abnormal circumstances.

D. <u>Credible Abnormal Circumstance - Existing Rotary Kiln</u>

For comparison the same scenario (i.e., an emergency shut down) for the existing kiln area is examined. The existing kiln has the same geometry (diameter and length) as the new kiln but has only a cyclone and a venturi scrubber to remove particulates. In an emergency shut down the water flow to

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[redacted]

the venturi scrubber would stop and the gas contained in the kiln system with its dust content would be released to the atmosphere through its only stack. The maximum yearly emissions for the old kiln would be:

From PTI calculations:

3.0 lbs Particulate/hr (during operation)

/. 60 min/hr

= 0.05 lbs Particulate/min (during operation)

/. 3300 ft/min (air velocity during operation)

= 1.52E-05 lbs Particulate/cu ft (during operation

x 1941 cu ft (air volume of equipment and stack)

= 2.94E-02 lbs Particulate/Occurrence

x 0.75 (maximum lbs Uranium/lbs Particulate)

= 2.21E-02 lbs Uranium/Occurrence

The release should last for an estimated maximum of one minute and then stop naturally from displacement by air free of particulates.

III. EMISSION COMPARISONS

A. General Emission Information

The uranium emissions used in this submittal for the new rotary kiln are taken from the approved OEPA Permit to Install (PTI No. 14-1565). The existing rotary kiln emissions are actual averaged emissions from 1984 and 1985 divided by the average hours of operation. The resulting existing uranium emissions per hour of operation are compared to estimates for the new Rotary Kiln System. The new Rotary Kiln estimates are based on stack sampling performed on the old kiln and worst case assumptions, which should represent a conservative estimate of

[redacted]

true facility emissions. The uranium emission comparison is considered an effective method for evaluating whether the new facility decreases emissions. The following sections show methods of calculation, uranium emission rates for the old and new facilities, and radionuclide emission data. Table 2 lists all existing and new emission rates for the Rotary Kiln.

B. Radionuclide Emission Data

The radionuclide concentration factors per Kilogram of Uranium, which are used for the Rotary Kiln, are the average values of the Chemical Plants dust collectors. The values are an average of samples taken from the Chemical Plant dust collectors because the rotary kiln processes mostly chemical plant residue. Since the values are higher than the results of stack sampling in 1988 on the existing Rotary Kiln, and are also higher than the average of all of the Plant 8 dust collector and scrubber samples obtained in 1985, the concentration factors should be a conservative estimate of true facility emissions. The activity of the uranium isotopes is based on an average enrichment of 0.71% (normal) uranium. The radionculide factors will be the same for old and new systems because the feed material will be the same. The individual radionuclide factors and their solubilities are listed in Table 3. Although the uranium emission estimates are sufficient for determining whether the emissions are increased or decreased, the complete estimated radionuclide emissions are included for informational purposes in Table 4. The radionuclide factors were multiplied by the uranium emissions to determine the total emissions from the facilities.

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IV. STARTUP OF NEW ROTARY KILN

A. General Requirements

The new kiln is planned as a replacement for the existing rotary kiln. The new kiln has sufficient capacity that the old kiln will not be needed once the new rotary kiln is in production. Therefore, the existing Plant 8 Rotary Kiln and the new Rotary Kiln will not be operated simultaneously. The existing Plant 8 Rotary Kiln will continue to operate until initiation of operation of the new Rotary Kiln for production purposes. Prior to initiation of operation of the new Rotary Kiln for production, the existing Plant 8 Rotary Kiln shall be permanently shut down. This will result in a net decrease in radionuclide emissions from Plant 8 Rotary Kiln System. Startup, operational testing, and compliance testing of the new facility with radionuclide bearing material will only be performed with the old kiln temporarily shut down. Before the new facility is operated for production (processing radionuclide bearing material), the existing rotary kiln will be rendered inoperative as described in the next section. Production will not start until the results of compliance testing are known and an Ohio PTO is approved.

B. Shutdown of Existing Rotary Kiln

The existing rotary kiln will be rendered inoperative by physically removing utility connections including, at the minimum, all natural gas supplies and all electrical connections. The project plans include initiating the complete removal of the existing rotary kiln after the new system is turned over to production. The removal action is required to take place expeditiously because the area of the old rotary kiln is to be used for other projects.

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C. <u>Projected Schedule</u>

Construction Complete - January 1990

Systems Testing - August 1990

Operation Safety Analysis - December 1990

Performance Testing - January 1991

Compliance Testing New Kiln - January 1991
(Existing Temp. Shutdown)

Shutdown Existing Kiln - April 1991

Start Production - New Kiln - April 1991

Conditional acceptance from the contractor was received in January 1990. Funding restrictions and site priorities indicate that the Operation Safety Analysis will not be final until December 1990, at which time testing can be initiated. After testing, several months will be required to obtain the Ohio PTO approval.

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APPENDIX A

FIGURES

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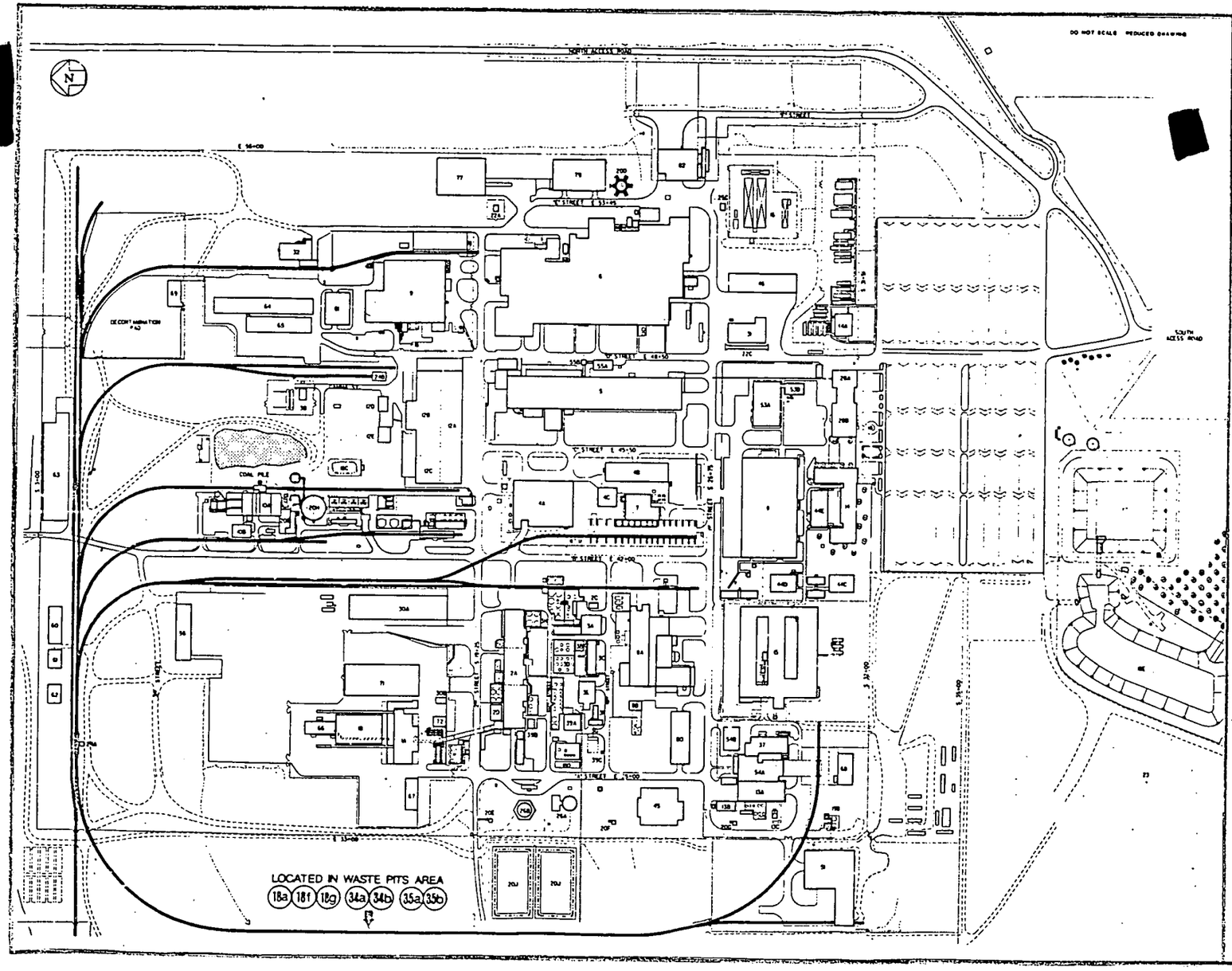

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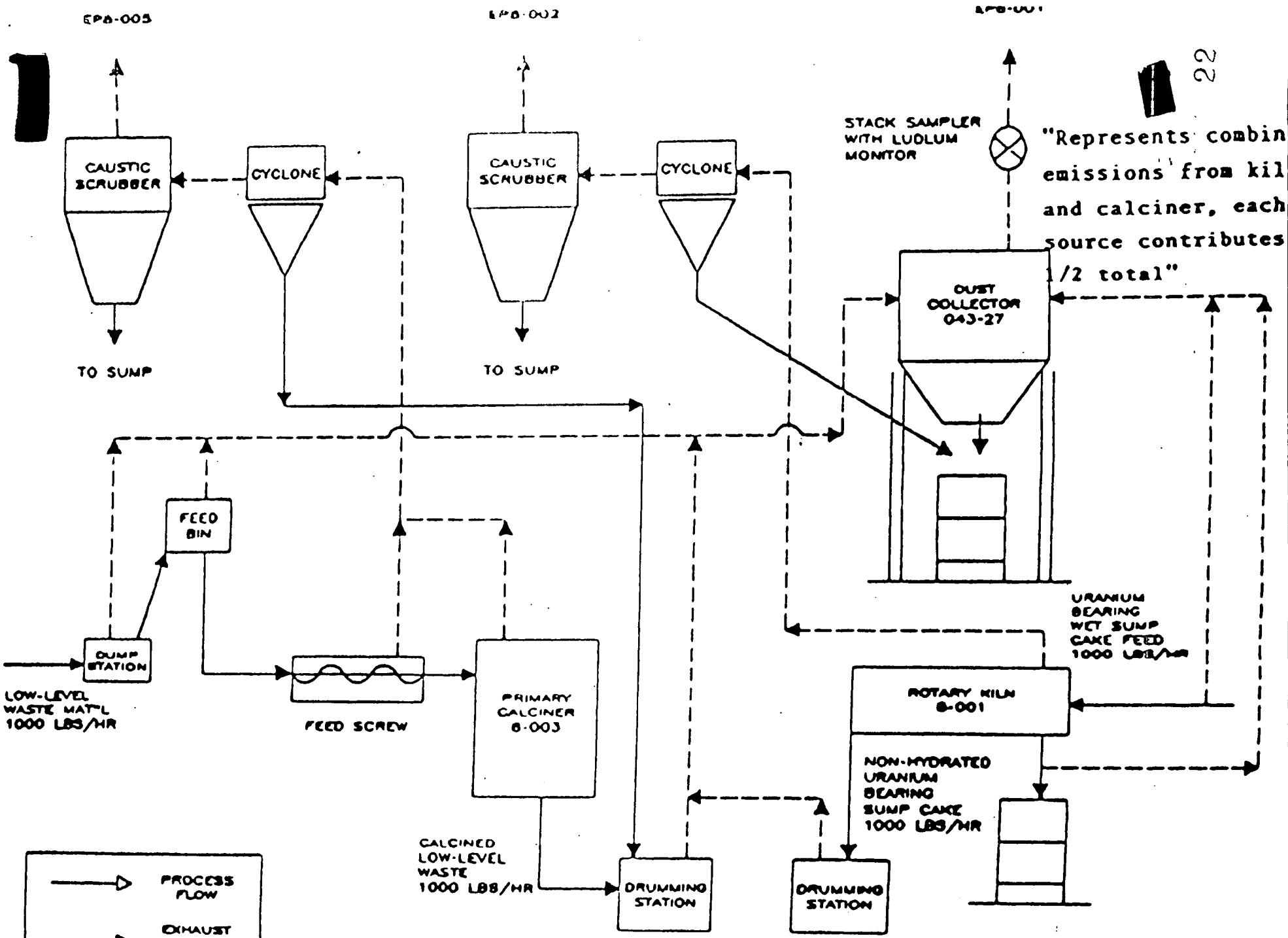
BUILDING IDENTIFICATION

1A	Preparation Plant
1B	Plant 1 Storage Building
2A	Ore Refinery Plant
2B	Lime Handling Building
2C	Bulk Lime Handling Building
2D	Metal Dissolver Building
2E	NFS Storage and Pump House
3A	Maintenance Building
3B	Ozone Building
3C	Control House
3D	NAR Towers
3E	Hot Raffinate Building
3F	Digestion Fume Recovery
3G	Refrigeration Building
3H	Refinery Sump
4A	Green Salt Plant
4B	Plant 4 Warehouse
4C	Plant 4 Maintenance Building
5	Metals Production Plant
6	Metals Fabricating Plant
7	Plant 7
8A	Recovery Plant
8B	Maintenance Building
9	Special Products Plant
10A	Boiler Plant
10B	Boiler House Maintenance Building
11	Service Building
12A	Maintenance Building (Main)
12B	Cylinder Storage Building
12C	Lumber Storage Building
13A	Pilot Plant Wet Side
13B	Pilot Plant Maintenance Building
13C	Sump Pump House
14	Administration Building
15	Laboratories
16	Main Electrical Substation
19A	Surge Lagoon
18B	General Sump
18C	Coal Pile Runoff Basin
18D	Biodenitrification Towers
18E	Storm Water Retention Basin
18F	Pit 5 Sluice Gate
18G	Clearwell Pump House
19A	Metal Tank Farm
19B	Pilot Plant Ammonia Tank Farm
20A	Valve/Control Building
20B	Filter/Chemical Building
20C	Cooling Towers
20D	Elevated Storage Tank (Potable-L.P.)
20E	Well House
20F	Well House
20G	Well House
20H	Process Water Storage Tank
20J	Lime Slurry Pits
22A	Gas Meter Building
22B	Sewer Lift Station
22C	Truck Scale
23	Meteorological Tower
24A	Railroad Scale House
24B	Railroad Engine Building
25A	Chlorination House
25B	MH #175
25C	Sewage Lift Station Building
25D	U.V. Disinfection Building
25E	Digester Control House
26A	Pump House-H.P. Fire Protection
26B	Elevated Storage Tank for H.P. Fire Protection
28A	Security Building
28B	Human Resources Building
30A	Chemical Warehouse
30B	Drum Storage Warehouse
31	Engine House - Garage
32	Magnesium Storage
34A	E-65 Storage Tank-N
34B	E-65 Storage Tank-S
35A	Metal Oxide Storage Storage Tank-N
35B	Metal Oxide Storage Tank-S

37	Pilot Plant Annex
38	Propane Storage
39A	Incinerator Building
39B	Warehouse
39C	Incinerator Building Sprinkler Riser House
44A	Trailer Complex-6 Plex-E
44B	Trailer Complex-3 Plex
44C	Trailer Complex-7 Plex-S
44D	Trailer Complex-7 Plex-N
44E	Trailer Complex-10 Plex
45	Building 45
46	Heavy Equipment Garage
51	UF6 to UF4 Reduction Facility II
53A	OSHA Building
53B	In-Vivo Building
54A	UF6 to UF4 Reduction Facility I
54B	P.P. Warehouse
55A	Slag Recycling Plant
55B	Slag Recycling Pit/Elevator
56	CP Storage Warehouse
60	Quonset Number 1
61	Quonset Number 2
62	Quonset Number 3
63	KC-2 Warehouse
64	Plant 9 Warehouse (Old)
65	Plant 5 Warehouse
66	Drum Reconditioning Building
67	Plant 1 Thorium Storage Building
68	Pilot Plant Warehouse
69	Decontamination Building
71	General In-Process Storage Warehouse
72	Drum Storage Building
73	Fire Brigade Training Center Building
77	Finished Products Warehouse
78	D & D Building
79	Plant 6 Warehouse
80	Plant 8 Warehouse
81	Plant 9 Warehouse
82	Receiving/Incoming Materials Inspection Building

Figure 1
FMPC Site Map



"Represents combin emissions from kil and calciner, each source contributes 1/2 total"

FIGURE 2 EXISTING ROTARY KILN

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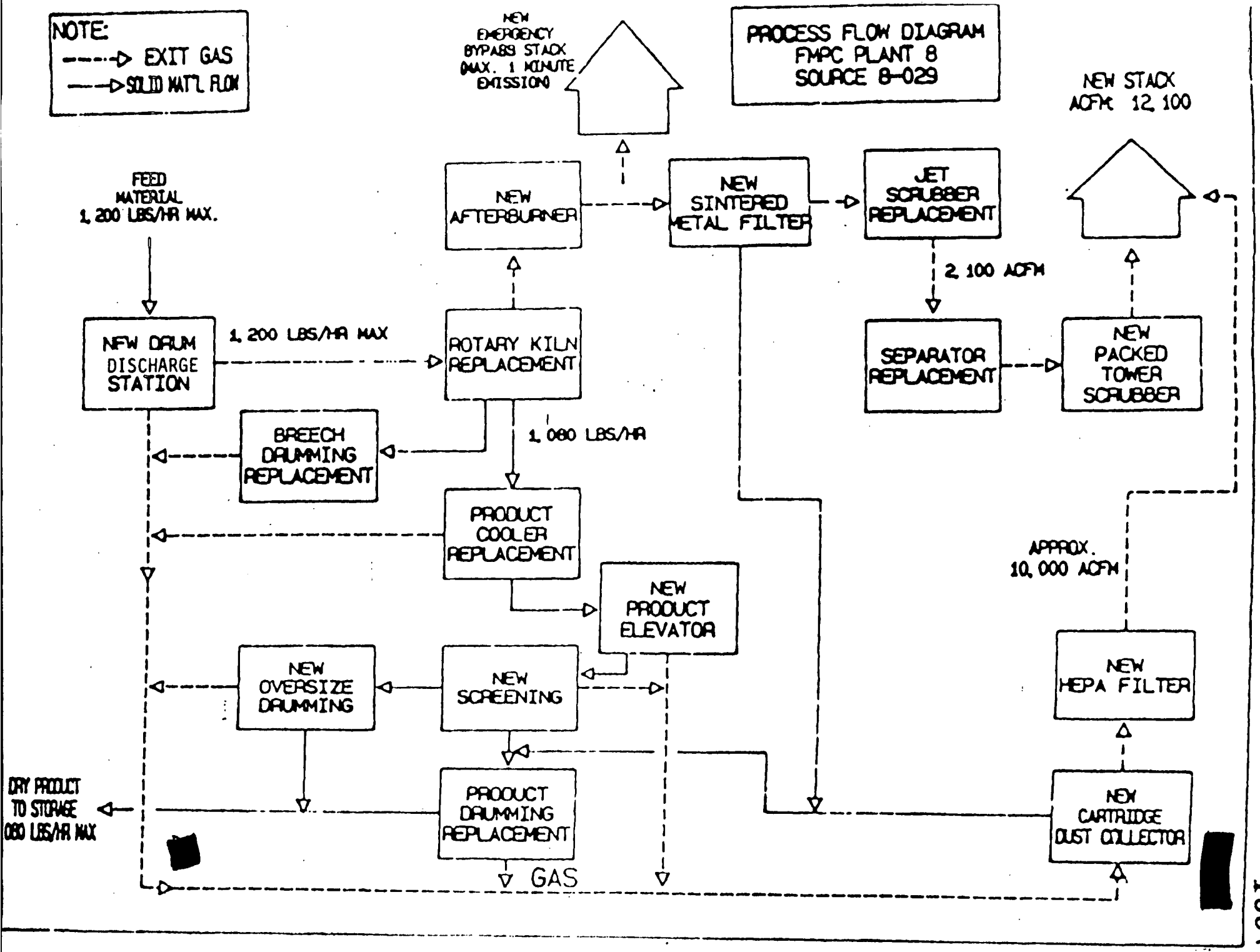

FIGURE 3 NEW ROTARY KILN

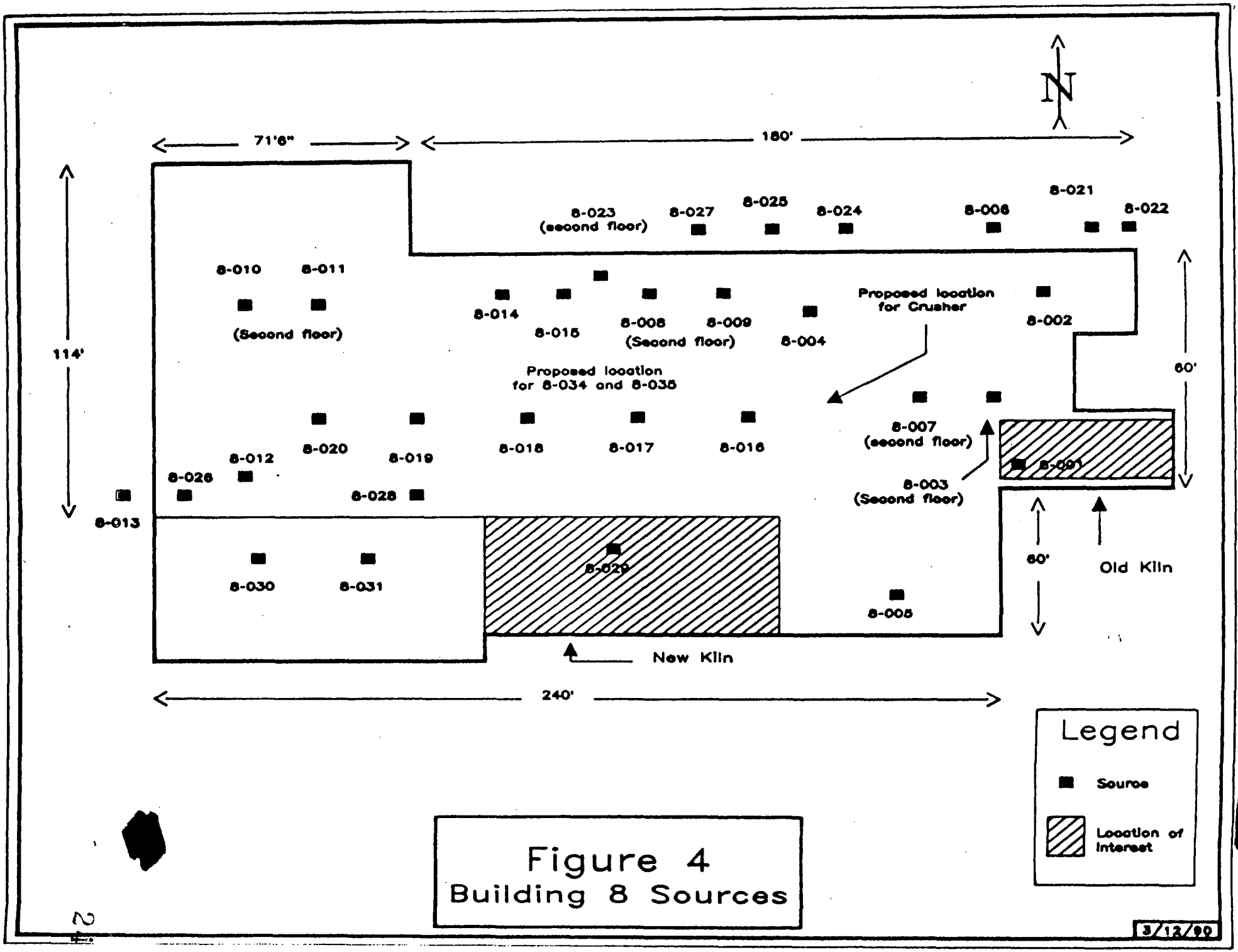

Figure 4
Building 8 Sources

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APPENDIX B

TABLES

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TABLE 1

SYSTEM COMPARISONS

	OLD ROTARY KILN (FMPC I.D. No. 8-001)	NEW ROTARY KILN (FMPC I.D. No. 8-029)
Location	Plant 8	Plant 8
Capacity	1200 lbs/hr maximum	1200 lbs/hr maximum
Combustion	Natural Gas	Natural Gas
Material Handling	Ventilated	Ventilated and Enclosed
Particulate	Dust Collector (99.5+% Eff.)	Dust Collector (99%) and HEPA (99.9%)
Kiln Gases	Cyclone and Caustic Scrubber (>90%)	Jet Scrubber (70%) and Packed Tower (99%)
Kiln Organic Material	-	Thermal Afterburner (99%) and Sintered Metal Filter (99.5%)
Kiln Particulate	Cyclone and Caustic Scrubber (>90%)	Sintered Metal Filter, Jet Scrubber, and Packed Tower (99.5%)
Stack Monitoring-Scrubber	Single Point Isokinetic	Isokinetic Multipoint
Stack Monitoring-Dust Collector	Fixed Single Point Isokinetic	Isokinetic Multipoint
Pollutants Controlled	Acids, Particulates	Organics, Gases, Particulate, and Acids

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TABLE 2

URANIUM EMISSION DATA FOR NEW AND EXISTING ROTARY KILNS

	Existing Kiln	New Kiln	Decrease	% of Decrease
Average Hourly	0.00704 Kg/hr	0.0023 Kg/hr	0.0047 Kg/hr	67%
Maximum Hourly	0.00704 Kg/hr	0.0051 Kg/hr	0.0019 Kg/hr	28%
Average Annual	42.2 Kg/yr*	13.8 Kg/yr*	28.4 Kg/yr	67%
Maximum Annual	59.1 Kg/yr**	21.6 Kg/yr***	37.5 Kg/yr	63%
Abnormal	0.0100 Kg/occ.	0.0075 Kg/occ.	0.0025 Kg/yr occ.	25%

* Average based on 6000 hrs/yr @ average hourly rate

** Maximum based on 8400 hrs/yr @ average hourly rate

*** Maximum based on approved OEPA Permit to Install Limit which is lower than estimated emissions using 8400 hours.

Existing Kiln data is based on actual hourly emissions in 1984 and 1985.

New Kiln data is based on stack sampling of old kiln and worst case engineering estimates of emissions.

[redacted]

TABLE 3

RADIONUCLIDE VALUES

Radionuclides	Quantity (Ci/Kg U)	Solubility
U-234	3.42E-04	Y
U-235	1.53E-05	Y
U-236	3.18E-05	Y
U-238	3.32E-04	Y
Pu-239+240	1.35E-05	Y
Pu-238	7.14E-07	Y
Np-237	7.69E-07	Y
Th-234	4.89E-04	Y
Pa-234m	3.21E-04	Y
Th-232	1.90E-05	Y
Th-230	1.73E-04	Y
Th-228	1.09E-05	Y
Ra-228	3.00E-07	Y
Ra-226	4.12E-07	Y
Cs-137	4.98E-06	D
Ru-106	2.56E-07	W
Tc-99	3.86E-05	Y
Sr-90	2.89E-06	D
Ba-137m	4.98E-06	Y

[redacted]

[redacted]

TABLE 4

MAXIMUM ANNUAL RADIONUCLIDE EMISSIONS

RADIONUCLIDE	EXISTING KILN Ci/yr	NEW KILN Ci/yr	DECREASE
U-234	2.02E-02	7.39E-03	1.28E-02
U-235	9.04E-04	3.30E-04	5.74E-04
U-236	1.88E-03	6.87E-04	1.19E-03
U-238	1.96E-02	7.17E-03	1.24E-02
Pu-239+240	7.98E-04	2.92E-04	5.06E-04
Pu-238	4.22E-05	1.54E-05	2.68E-05
Np-237	4.54E-05	1.66E-05	2.88E-05
Th-234	2.89E-02	1.06E-02	1.83E-02
Pa-234m	1.90E-02	6.93E-03	1.21E-02
Th-232	1.12E-03	4.10E-04	7.10E-04
Th-230	1.02E-02	3.74E-03	6.46E-03
Th-228	6.44E-04	2.35E-04	4.09E-04
Ra-228	1.77E-05	6.48E-06	1.12E-05
Ra-226	2.49E-05	8.90E-06	1.60E-05
Cs-137	2.94E-04	1.08E-04	1.86E-04
Ru-106	1.51E-05	5.53E-06	9.57E-06
Tc-99	2.28E-03	8.34E-04	1.45E-03
Sr-90	1.71E-04	6.24E-05	1.09E-04
Ba-137m	2.94E-04	1.08E-04	1.86E-04

Ci/Kg U (from Table 3) x Kg U (Emissions) = Ci/yr (Total Emissions)

[redacted]

[redacted]

APPENDIX C

ATTACHMENTS

[redacted]

[redacted]

ATTACHMENT 1

PROCESS AND STACK DATA

EXISTING AND NEW KILN

[redacted]

[redacted]

PROCESS AND STACK DATA

EXISTING KILN

ilance

[redacted]

Control Equipment Code

(A) Settling chamber
(B) Cyclone
(C) Multiple cyclone
(D) Electrostatic precipitator
(E) Fabric filter
(F) Spray chamber
(G) Cyclonic scrubber
(H) Impingement scrubber
(I) Orifice scrubber
(J) Venturi scrubber
(K) Plate or tray tower
(L) Packed tower
(M) Adsorber [redacted]
(N) Condenser
(O) Afterburner - catalyt
(P) Afterburner - thermal
(Q) Other, describe Dust Collector Q2 Roughing Filter

Control Equipment data: (Material Handling)

Item	Primary Collector	Secondary Collector
(a) Type (See above code)	Q1	Q2
(b) Manufacturer	Donaldson Industrial Corp.	(Part of HEPA filter
(c) Model No.	Torit 3DF36	See pg. 2.5
(d) Year installed	1989	
(e) Your identification	C-08F-4000	
(f) Pollutant Controlled	particulates, Uranium	
(g) Controlled pollutant emission rate (if known)	Particulates 0.03 lbs/hr Max Uranium 0.023 lbs/hr Max	
(h) Pressure drop	Est'd. 5" H_2O Approx.	
(i) Design efficiency	99.5% at 0.5 microns	
(j) Operating efficiency	99 %	

STACK DATA

1. Your stack identification Rotary Kiln process stack C-08F-6800

2. Are other sources vented to this stack: [] Yes [X] No
   If yes, identify sources _____

3. Type: [X] Round, top inside diameter dimension 29.8 inches
   [] Rectangular, top inside dimensions (L) _____ x (W) _____

4. Height: Above roof 30 ft., above ground 84 ft.

5. Exit gas: Temp. ambient °F, Volume 11,689 ACFM, Velocity 2,392 ft./min.

6. Continuous monitoring equipment: [X] Yes [] No
   If yes, indicate: Type Single Point Sampler Manufacturer Sorrento Electronics
   Make or Model Custom, Pollutant(s) monitored radioactive particulate

7. Emission data: Emissions from this source have been determined and such data is included with this appendix: [X] Yes [] No

   If yes, check method: [] Stack Test [] Emission factor [X] Material balanc

[redacted] 33

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Control Equipment Code:

(A) Settling chamber
(B) Cyclone
(C) Multiple cyclone
(D) Electrostatic precipitator
(E) Fabric filter
(F) Spray chamber
(G) Cyclonic scrubber
(H) Impingement scrubber
(I) Orifice scrubber
(J) Venturi scrubber
(K) Plate or tray tower
(L) Packed tower
(M) Adsorber
(N) Condenser
(O) Afterburner - catalyti
(P) Afterburner - thermal
(Q) Other, describe HEPA Filter

Control Equipment data: (Material Handling)

Item	Primary Collector	Secondary Collector
(a) Type (See above code)	Q3	
(b) Manufacturer	American Air Filter	
(c) Model No.	Bag. in/Bag out. Size 52	
(d) Year installed	1989	
(e) Your identification	C-08F-4100	
(f) Pollutant Controlled	Particulates, Uranium	
(g) Controlled pollutant emission rate (if known)	Particulates 3.1×10^{-5} lbs/hr Max Uranium 2.3×10^{-5} lbs/hr Max	
(h) Pressure drop	Est'd. 3" H_2O	
(i) Design efficiency	99.97%	
(j) Operating efficiency	99.9%	

STACK DATA

Your stack identification Rotary Kiln Process Stack C-08F-6800

Are other sources vented to this stack: [ ] Yes [X] No
If yes, identify sources

Type: [X] Round, top inside diameter dimension 29.8 inches
[ ] Rectangular, top inside dimensions (L) ____ x (W) ____

Height: Above roof 30 ft., above ground 84 ft.

Exit gas: Temp. Ambient °F, Volume 11,689 ACFM, Velocity 2,392 ft./min.

Continuous monitoring equipment: [X] Yes [ ] No
If yes, indicate: Type Isokinetic Sampler, Manufacturer Sorrento Electronics
Make or Model Custom, Pollutant(s) monitored Radioactive Particulates

Emission data: Emissions from this source have been determined and such data is included with this appendix: [X] Yes [ ] No

If yes, check method: [X] Stack Test [X] Emission factor [X] Material balance

[redacted] 34

Completed by D. B. Katz, Date 7/17/89

[redacted]

ATTACHMENT 2

EMISSION CALCULATIONS

[redacted]

I. EMISSION ESTIMATES FOR EXISTING PLANT 8 ROTARY KILN (8-001)

A. Assumptions and Emission Factors

1) Rotary Kiln 8-001 was under repair during 1986 and 1987 making the through-put during that period non-representative. Therefore, actual emissions are based on 1984 and 1985 data.

2) It is assumed that half of measured rotary kiln emissions are derived from the Material Handling Subsystem since Plant 8 Primary Calciner (8-005) and Plant 8 Rotary Kiln Material Handling (8-001) both vent to the same Dust Collector (G43-27).

3) Emissions from the existing rotary kiln scrubber stack are 20.4 grams of uranium per 3 hours of operation from in house sampling data performed in 1985 - 1987.

B. Uranium Emissions

1) The Stack Discharge Reports from 1984 and 1985 provide the following emission data:

Year	Rotary Kiln Scrubber	Dust Collector GA3-27	Emissions* From Rotary Kiln Mat'l Handling
1984	63.6 lbs/yr	3.1 lbs/yr	1.6 lbs/yr
1985	28.6 lbs/yr	2.9 lbs/yr	1.4 lbs/yr
TOTAL	92.2 lbs	6.0 lbs	3.0 lbs

* One-half of the emissions from G43-27 Dust Collector

2) Average Actual Emissions of Uranium

a) (Scrubber) Actual Emissions of Uranium =
(92.2 lbs/2 yrs)(1 ton/2000 lbs) = 0.0230 tons/yr

b) (Dust Collector) Actual Emissions of Uranium =
(3.0 lbs/2 yrs)(1 ton/2000 lbs) = 7.5×10^{-4} tons/yr

c) Total Actual Emissions of Uranium =
(0.0230 tons/yr) + (7.5×10^{-4} tons/yr) = 0.0238 tons/yr
(21.6kg/yr)

3) Average Actual Hours of Operation

a) (0.0230 tons/yr uranium)(2000 lbs/ton)(454 gm/lb)
(3 hrs/20.4 gm) = 3,071 hrs/yr

[redacted]

4) Hourly Emissions of Uranium

a) (.0238 tons/yr)(2000 lbs/ton) / 3071 hrs =
(0.0155 lbs/hr (0.00704 kg/hr)

5) Average Annual Uranium Emissions

a) (0.00704 kg/hr)(6000 hrs/yr) =
42.2 kg/yr

6) Maximum Annual Uranium Emissions

a) (0.00704 kg/hr)(8400 hrs/yr) =
59.1 kg/yr

[redacted]

I. EMISSIONS ESTIMATES FOR THE NEW ROTARY KILN (8-029)

A. Assumptions and Emission Factors

1) Cartridge filter bank particulate removal - estimated overall efficiency for cartridge filter bank: 99%

2) HEPA filter particulate removal - estimated overall efficiency for HEPA: 99.9%

3) Sintered metal filter, wet scrubber system particulate removal - estimated overall efficiency for sintered metal filter, wet scrubber system: 99.5%

4) Particulate emission rate from rotary kiln: 5 lbs per ton of feed (This emission rate is based on engineering testing by Martin-Marietta during November, 1985)

5) Particulate emission rate from material handling - 25 lbs per 8 hour shift and feed rate of 1200 lbs/hr:
(25 lbs emissions/8 hrs)(1 hr/1200 lbs feed)(2000 lbs/ton)
= 5.2 lbs emissions/ton feed material
(This emission rate is based on best engineering judgement)

6) It is assumed that the percentage of uranium in the particulate emissions equals the percentage of uranium in the feed material (a worst case assumption.) The maximum uranium percentage in the feed is assumed to be 75% by weight and the average uranium is assumed to be 40% by weight.

B. New Source Emission Estimates for Particulate

1) Particulate

a) Hourly, Average, and Maximum

i. AVERAGE HOURLY PARTICULATE EMISSIONS (Rotary Kiln):
(5 lbs particulate/ton charge)(1000 lbs/hr)(1 ton/2000 lbs)=
2.5 lbs/hr
(2.5 lbs/hr)(.005) = 0.0125 lbs/hr

ii. MAXIMUM HOURLY PARTICULATE EMISSIONS (Rotary Kiln):
(5 lbs particulate/ton charge)(1200 lbs/hr)(1 ton/2000 lbs)=
3.0 lbs/hr
(3.0 lbs/hr)(.005) = 0.015 lbs/hr

[redacted]

iii. AVERAGE HOURLY PARTICULATE EMISSIONS (Material Handling):
(5.2 lbs particulate/ton charge)(1000 lbs/hr)(1 ton/2000 lbs) [redacted]
= 2.6 lbs/hr
(2.6 lbs/hr)(.01)(.001) = 2.6×10^{-5} lbs/hr

iv. MAXIMUM HOURLY PARTICULATE EMISSIONS (Material Handling):
(5.2 lbs particulate/ton charge)(1200 lbs/hr)(1 ton/2000 lbs)
= 3.1 lbs/hr
(3.1 lbs/hr)(.01)(.001) = 3.1×10^{-5} lbs/hr

b) Total Particulate Emissions Average, and Maximum

i. AVERAGE HOURLY PARTICULATE EMISSIONS (TOTAL):
(0.0125 lbs/hr from Rotary Kiln) + (0.000026 lbs/hr from Mat'l Handling) = 0.0125 lbs/hr Average Total Particulate Emissions

ii. MAXIMUM HOURLY PARTICULATE EMISSIONS (Total):
(0.0150 lbs/hr from Rotary Kiln) + (0.000031 lbs/hr from Mat'l Handling) = 0.0150 lbs/hr Maximum Total Particulate Emissions

2. New Source Emission Estimates for Uranium

a) Hourly, Average, and Maximum

i. AVERAGE HOURLY URANIUM EMISSIONS:
(0.0125 lbs particulate/hr)(0.40 lbs U/lb particulate) =
0.005 lbs U/hr (0.0023 kg/hr)

ii. MAXIMUM HOURLY URANIUM EMISSIONS:
(0.0150 lbs particulate/hr)(0.75 lb U/lb particulate) =
0.0112 lbs U/hr (0.0051 kg/hr)

iii. AVERAGE YEARLY URANIUM EMISSIONS:
(0.0023 kg/hr)(6000 hr/yr) =
13.8 kg/yr

iv. MAXIMUM YEARLY URANIUM EMISSIONS:
(Assume 40% uranium at maximum particulate emission rate)
(.0150 lbs particulate/yr)(.40)(8400 hr/yr) / (2.2 lbs/kg) =
22.9 kg/yr

v. MAXIMUM ALLOWABLE YEARLY URANIUM EMISSIONS:
(Ohio EPA Approved Permit to Install limits
this facility to 0.0238 tons/yr Uranium emissions)
0.0238 tons/yr (2000 lbs/ton) / 2.2 lbs/kg =
21.6 kg/yr