FMO Sinter Test Grinder
HVAC Exhaust Modification

ISNATT – International Society of Nuclear Air Treatment Technologies, Inc.

32nd International Nuclear Air Cleaning Conference

Michael Sulva, P.E.
GEH – New Units Engineering ESBWR
Wilmington, NC
GNF – Fuel Manufacturing

- Global Nuclear Fuel – Americas, LLC (GNF-A) is a Fuel Fabrication Facility which fabricates pellets enriched to less than or equal to 5 weight percent U-235
- Location: Wilmington, NC
- USNRC License: SNM-1097
- Docket No. 70-1113
- 10CFR70 – Domestic Licensing of Special Nuc Material
- Integrated Safety Analysis (ISA) identifies process hazards associated with Fuel Manufacturing
- Items Relied On for Safety (IROFS) are identified for each accident sequence that could fail to meet the requirements of 10CFR 70.61
FMO Sinter Test Grinder
HVAC Exhaust Modification

Develop a modification of the system and establish the design bases for the new exhaust system design.

Additionally, the hood design needs minor changes to ensure proper airflows are channeled to the grinder wheel head. This will ensure grinder particles generated are predominantly removed via the grinder wheel (swarf) exhaust. i.e Copy the Production Hood

Update all applicable procedures and design documentation.
Design Parameters

Nuclear Criticality Safety –
Geometry, Mass, Moderator

Grinder Details – 3 connections
Hood Exhaust, Swarf/Grinder Exhaust,
Enclosure

Air Flow Requirements –
Grinder / Swarf Flow
Hood Flow
Design Parameters

Particulate Parameters (Swarf)–
Concentration
Particle Size
Particle Weight

Collection Canister
Capture device max. 25kg

Radiological Monitoring

Accountability Monitoring

HEPA Filter Monitoring
Conclusion Discussion from Early Design Meetings, Vendor recommendation and Best Practices

1. The Cyclone or High Efficiency Centrifugal collector are often used for this application.

2. The Fabric Filter or Self-cleaning Fabric Media Collector is often employed in this application.

3. Since moisture would affect “moderator” negatively this system will NOT employ any Wet Scrubber.

4. Electrostatic Precipitators will not be employed with the medium / larger particle size; however the Apitron originally employed this principle in combination with the self-cleaning fabric HEPA filter.
Production Grinder Setup

Particle Size uniform
< 3 microns

Particle Size non-uniform
0.5 – 50 microns
One Vendor

GS-Mini – early design

55-gal Drum Discharge Configuration

Filter Cartridge

Optional Automatic Timer Cleaning System
Dust Collector in System

GS-1 (GS-Mini)
Preliminary Design
NOT USED
Camfil-Farr GSC1 Dust Collector

Gold Series® offers modular design for optimum flexibility—delivered fast!

We are very happy with the Farr Dust Collector. The dust collection solution was purchased for our CNC plasma cutter to replace a horizontal cartridge dust collector due to short filter life. The current filters have been in for over a year and still look great and are operating on less than 3" pressure drop. Also, the Farr people have been a pleasure to do business with.

— Dan Schuler, Schuler Manufacturing

Gold Series® Features
- Modular design for optimum flexibility—have it your own way fast!
- Each module accommodates airflows up to 5,000 cfm
- Module constructed of 7 gauge carbon steel
- Door, hopper, inlet and panels are all 10 gauge steel
- Powder painted for unsurpassed corrosion resistance
- Component configurations are virtually unlimited
- Vertical design of cartridges enables efficient pulse cleaning of dust

Looks Like a Safe Because It's Built Like a Safe

Optional Quick Open Fire Port in Hopper

Easy Filter Change-out

Powerful Cleaning System to Ensure Long Filter Life

Pulse Discharge of Gold Canister Filter

Individually Powder Coated Gold Series components are individually powder-coated prior to assembly for superior corrosion resistance.

TDC Controller

Automatic Filter Cleaning

The Farr Dust Collector (FDC) Controller's flexible design allows it to be adapted to many dust collector configurations.
Camfil Farr GS-1

Camtrain contained dust collection system

Bag In / Bag Out for dust at collection drum and Cartridge Filter
Camfil Farr GS-1

Camtrain contained dust collection system

Bag In / Bag Out for dust at collection drum and Cartridge Filter
Camfil-Farr GS-1 Dust Collector GNF
New System Discussions

1. Dust Collector Equipment
2. Exhaust Duct (new equipt to grinder / HEPA)
3. HEPA – The existing setup
4. Operation, Maintenance and Startup, CRIT
5. Hood Modification
# Dust Collector Design Criteria

## NEW DUST COLLECTOR UNIT

**Key Design Criteria**

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<thead>
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<th>Criteria</th>
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<tbody>
<tr>
<td><strong>Swarf Collection System Design is Inadequate - Causal Factor #2</strong></td>
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<td>Unit equipped with or can be configured with measurements, alarms, grinder shutdown capability and control panel with:</td>
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<tr>
<td>1. Differential Pressure (for pulse cleaning blowback, alarm, and s/d)</td>
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<td>2. Weight of 3 gallon can (scale or load cell)</td>
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<td>3. Timer for blowback (set for xx mins operation)</td>
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<td>4. Downtime clean (goes thru pulse cleaning cycle when it is s/d)</td>
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<td>5. Can “In-place Switch”</td>
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<td>6. Filter locked “In-place Switch”</td>
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**NOTES**

- Unit will be specified with these requirements to ensure they are met. Testing will ensure design meets those specified. Do NOT want Backflushing without an in-place CTR. Don’t want to operate grinder if filter is not locked in place. See Operational Logic Sheet

- GNF's old 3 gallon can will be the repository of the swarf in an attempt by Apitol nearly identical configuration however, without exposing the collector to air pressure since use of 2 valves will operate when dumping swarf to waste in the can

- The Camfil-FARR design was the most favorable footprint. The addition of the valves and moving the HEPA stop the collector increased overall height and inventory modeling of the unit was needed.

- The unit is test rated to 6.5 psig. QA Program is ISO 9001 ????

- CRIT early analysis indicates that any of the proposed units will meet an analysis. It will just be what controls are required by the Analysis - D. Eghbali

- Preliminary look by RP indicates design of B1BO for filter and 3 gallon can removal identical to Apitol can removal system. Desirable reasonable - Tony Dietrich. The use of a collector fan was aborted Post Peer Review 2-12

- Post Peer Review Design established enclosure around 3-gallon can

- Dell Core FILTER - efficiencies up to 99.99%, MERV 15/16. This will ensure that the downstream HEPA is exposed to an extremely small particle spectrum. The quantity exposed over time will be only 0.01% of the total particle mass sent to the collector. The cartridge has a filter failure alarm which would detect any blowby.

- While all Collectors come with fans to keep flow constant, this
Dust Collector Operation

Clean Air Out

Existing HEPA

Dust in

1. Grinder Swarf
2. 3-gallon can enclosure
3. Grinder Hood

Cartridge Filter
System Operation

a. The dust laden air comes into the unit at a high velocity ensuring there is no settling out within the ductwork (swarf tube, grinder table, or enclosure).
b. The collector is designed to drop the velocity of the air to allow settling out to occur with the direction changes and inlet baffles.
c. The dust which settles out of the dirty air drops down to a 60 degree slope, polished surface, hopper, polished to preclude bridging from occurring.
d. The dust entrained within the air passes onto the outer surface of the cartridge filter where 99.99% (MERV 16) of particles >0.5 micron by weight are captured.
e. The cleaned air (CA) is then free to pass up the inside of the cartridge filter and out of the unit via the clean air plenum of the dust collector.
f. This CA with 0.01% residual particles passes up and is captured onto the downstream HEPA filter.
g. The cartridge filter is periodically pulsed back to remove captured dust and allow it to settle down the hopper.
h. The bottom of the hopper are 6” butterfly valves in series. These valves periodically cycle (open-closed but never both open at once) to allow the dust to fall down first into the space between the valves then into the 3-gallon can. There are 2 vibrators to facilitate dust falling when valves cycle open. As a backup, there are 2 level sensor in this area for measurement of potential excess dust.
Dust Collector in System
Conclusion Discussion

The dust collector will meet:

a. Nuclear Criticality Safety
   - Backup level / vibration and dP sensors
   - Favorable geometry for assumed max dust collected

b. Air Flow Requirements (600 cfm at 6” w.g.) for the:
   - Grinder Exhaust Flow Requirements
   - Grinder Hood & Enclosure

c. Ductwork Air Flow velocity / max sizing (6”)

d. Low Differential Pressure with alarm and grinder s/d

e. Collection requirements
   - 3 gallon can w/ enclosure on scale
   - Automatic Pulse Cleaning w/N2
   - Solid housing w/support leg structure
   - Door, hopper (polished 60º slope), inlet and panels 10 gauge steel
   - Bag In / Bag Out for filter change out