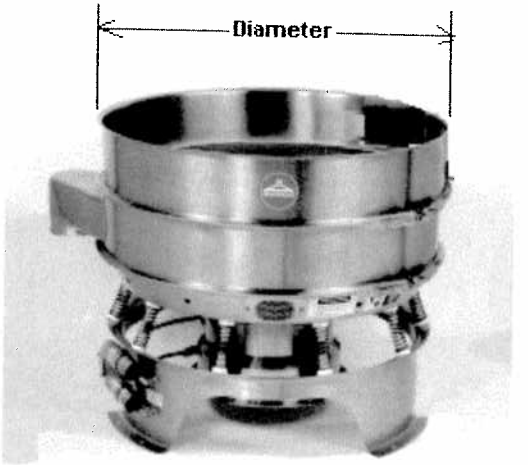
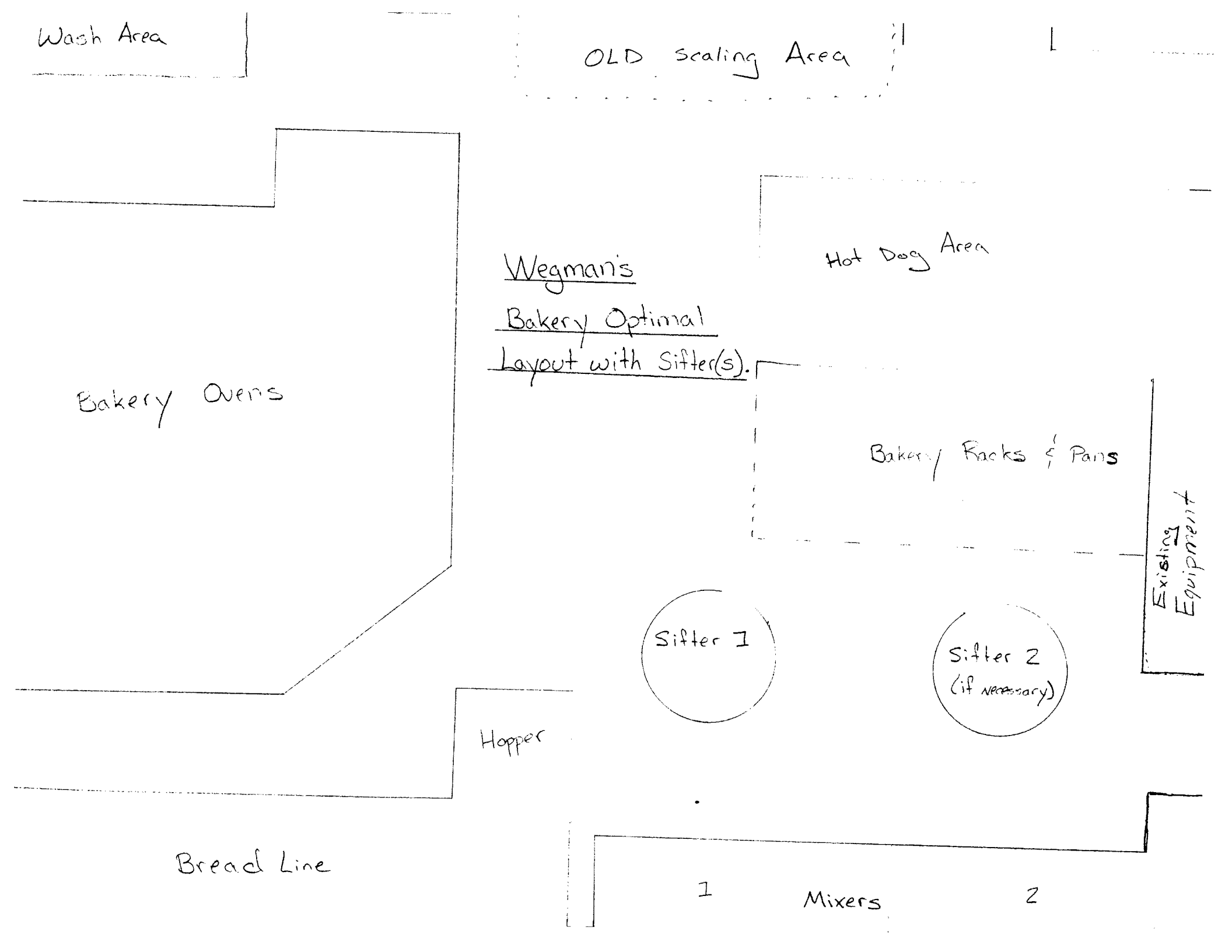
	SWECO Separators family of machine sizes						
Machine Diameter	Spout diameter	Square feet of screen surface area*	Motion Generator Horse Power	Maximum Discharge Spout Capacity** in Cubic Feet per Minute (CFM)	Theoretical spout discharge capacity for a free flowing material weighing 45 lbs per cu ft in lbs/min(ppm)	Actual discharge capacity for stone ground wheat based on the 2-6-09 tested rate of 13.5 lbs per minute through 4 mesh (4.75 mm opening)	
18"	3"	1	0.25			13.5 ppm(=0.3 cfm)	
24"		2	0.33				
30"	6"	4	0.5	2.1 cfm	95 ppm	54 ppm (=1.2 cfm)	
40"	8"	6	0.5	2.9 cfm	131 ppm	81 ppm (=1.8 cfm)	
48"	8"	10	2.5	3.2 cfm	144 ppm	135 ppm (= 3 cfm)	
60"		15	2.5				
72"		23	5				

*NOTE: screen capacity is a linier function of screen surface area:
for example; if 30" can do 4 lbs per minute, a 40" will do 6 lbs, and a 48" 10 lbs

**NOTE: this spout discharge capacity rating is for bulk solids that are dry and very free flowing and where the coarsest particle in the feed distribution is at least 4x smaller than the screen opening

***NOTE: these are maximum theoretical capacity ratings.
Other ingredients, especially those that are cohesive (ex., brown sugar) will flow through the screen much more slowly. Except for the most free flowing materials the screen is usually more of a bottleneck than the discharge spout.


Wash Area
OLD Scaling Area
Wegman's
Bakery Optimal
Layout with Sifter(s).
Hot Dog Area
Bakery Ovens
Bakery Racks & Pans
Existing Equipment
Sifter 1
Sifter 2
(if necessary)
Hopper
Bread Line
1
Mixers
2

Preliminary Risks Assessment

Date: 3/24/2009

Project: **Bread and Roll Scaling Room**
Submitted by: **Grant Garbach and Andrew Teal**

Risk Level
1 -- Low
2 -- Medium
3 -- High

Risks Action	Potential Problem	Severity	Probability	Likely Causes	Preventive Action	Contingent Action
4	~~Team member availability~~	~~2~~	~~3~~	~~Company interviews, schedule changes, personal emergencies~~	~~Advance notice to the team~~	~~Other team members will pick up the work load~~
2	Turbulent air in facility	1	1	High shear forces (Viscous)	Flow quality improvements (expensive)	The equipment recommended for the task can handle turbulent air at inlet.
3	~~Access to needed resources~~	~~1~~	~~2~~	~~RIT or Wegmans does not have needed resources available~~	~~Determine needed resources and alternatives~~	~~Use one of the alternative resources~~
4	~~Access to necessary data from Wegmans~~	~~2~~	~~3~~	~~Data or statistics are not available or do not exist~~	~~Determine what information is available or needs to be collected~~	~~Make appropriate assumptions based on knowledge learned in classes~~
5	~~Access to Wegmans employees/engineers~~	~~1~~	~~1~~	~~Employee too busy or has schedule conflict~~	~~Establish a standard schedule~~	~~Find other employees within Wegmans who possess the same skills~~
6	~~Improper assumptions for calculations~~	~~2~~	~~2~~	~~Assumption was made with current best practices~~	~~Check assumption during reviews~~	~~Make changes to the assumptions and re-perform the analysis~~
7	~~Customer doesn't like/approve initial design~~	~~3~~	~~2~~	~~Wegmans cannot accommodate equipment~~	~~Check with customer for major design decisions that impact facility~~	~~Make adjustments to design as necessary~~
8	~~Not enough time for equipment designing and analysis~~	~~3~~	~~2~~	~~Analysis becomes more in depth, algorithms are too long~~	~~Calculate estimate equipment lead times on best assumption practices~~	~~Faulty intervention~~
9	Facility does not accommodate machine needs	3	1	Wegmans' growth projection is too aggressive	Reconfirm Wegmans' growth projection	Recommend smaller unit as an addition to accomendate the growth
10	Equipment solutions cannot meet ergonomic needs	2	1	Far reaching, or bending is required	Adjust control location	Set up procedure to outline ways for better work flow and ergonomics
~~11~~	~~Safety of machinery~~	~~3~~	~~1~~	~~Did not consider safety during equipment / concept selection~~	~~Add in safety as one of the criteria for selections~~	~~Talk with sales rep regarding safety concerns~~
~~12~~	~~Supplier product don't work and not responding to questions~~	~~3~~	~~2~~	~~Did not consider supplier service during selection~~	~~Add in supplier service during selection~~	~~Wegmans prefer to deal with existing supplier, which reduces the chances of supplier service issue.~~
~~13~~	~~Machinery not performing up to spec~~	3	~~1~~	~~Did not perform tooling before ordering machinery. Supplier send a different machinery~~	~~Perform tooling before ordering machinery. Fill out order form correctly.~~	~~Work closely with sales rep.~~

Statement of Design Objectives

The purpose of this design study is to create an air handling system to reduce dust and airborne particulate density. The result of the design study will be utilized for picking out an existing machine system that can be purchased off the shelf for Wegmans. The design will be completed while meeting all OSHA safety regulations and Wegmans company regulations.

Performance Goals and Specifications

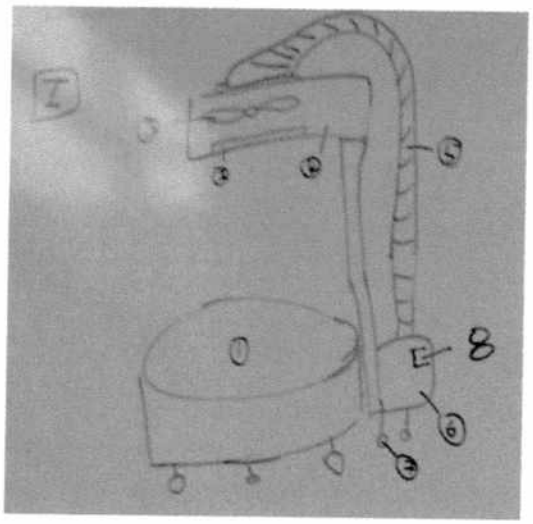
The performance goals are: Increasing the air quality in a given space. Reducing the air particulate density levels below an appropriate threshold of .5mg/m^3. Increasing the time between cleanings to 480 minutes due to the reduction of airborne particulate. A major design goal is to minimize the room the proposed design to occupy. The design should meet all OSHA standards. The unit should be compatible with the current manufacturing facilities power systems. The proposed design will meet all safety requirements of the Wegmans Corporation. The unit should not interfere with current processes at the facility. The unit should be able to be cleaned and maintained easily while meeting all Wegmans and OSHA regulations and guidelines.

Key List

1. Material must be food grade compatible
    a. No Painted Surfaces
    b. Stainless Steel 304 (Food)
    c. Stainless Steel 316 (Food/Medical)
        i. 316 is very stable and has longevity.
        ii. Can be cleaned with most chemicals
        iii. Does not rust
2. Size cannot exceed plants physical layout
    a. Must not interfere with current process
    b. Must not interfere with current workflow
    c. Cannot exceed physical building limitations
3. Safety
    a. Must minimize any safety risks with the associated design
    b. Must meet OSHA standards
    c. Grounded system
    d. Minimize Dust "explosions"
    e. Fire-retardant
    f. Closed system before filter
        i. Exhausts after filter into plant atmosphere with clean air
4. Power
    a. Must be able to use current facility power requirements
    b. Power enclosures must be NEMA 4X.
    c. Efficient design to minimize wasted energy
    d. Grounded Plug outlets required
5. Amount of work
    a. Must minimize additional work from operators
    b. Must minimize unnecessary training to be able to use
        i. Ideally just on/off needed
6. Cost
    a. Must be economically beneficial
    b. Parts must be COTS for filter

Concept Documentations:

I. MOBILE UNIT



Descriptions:
This will be a stand-alone unit that is on wheels. The fan will be located on top of the sifter to ventilate the mushroom cloud created by dumping the ingredients into the sifter. The dust will travel through the pipe and be collected at the bottom where the vacuum bag is located. The exhaust will exit through the bottom as well. The number on the picture is corresponded as follow.

1. Sifter
2. Screen
3. Fan
4. Stand (backbone of the structure)
5. Piping
6. Motor and vacuum bag
7. Wheels
8. On and off switch
9.

Good:

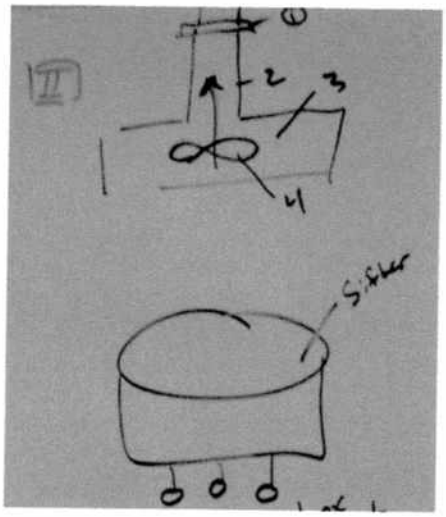
- Small
- Mobile
- Easy to use

Bad:

- Concept includes stagnation points
- Creates turbulence
- Noise concern
- Tip corners (unstable?)
- Weight?

- Exhaust on the ground could kick up dust into the air contaminating the ingredient batch

II. STRAIGHT UP



Descriptions:
This machine is similar to the ventilation system used in the kitchen. The dust will be collected at a central location and the exhaust will exit out of the factory. The number in the picture is corresponded as follow.

1. Filter
2. Fluid transport (piping)
3. Intake
4. Fan

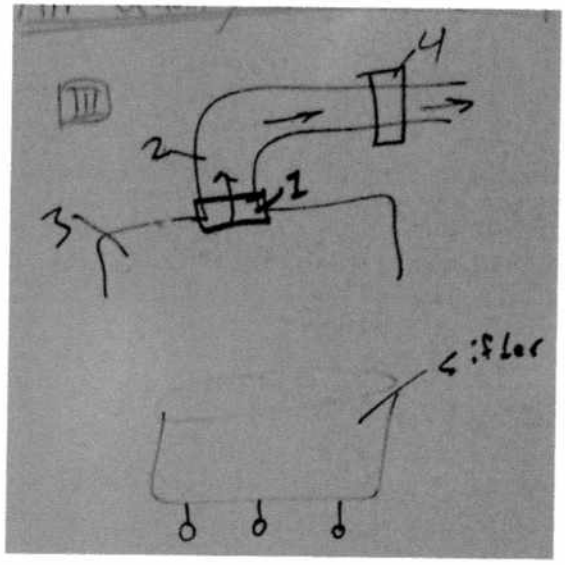
Good:

- Centralized system will save space
- Could utilize more power
- Wider area of intake

Bad:

- Not mobile
- Hanging vacuum could be a safety concern
- Will need more power to operate

III. RIGHT TURN



Descriptions:
Similar concept as the previous one, but this one has a turn at the top. The number in the picture is corresponded as follow.

1. Filter
2. Fluid transport (piping)
3. Intake
4. Fan

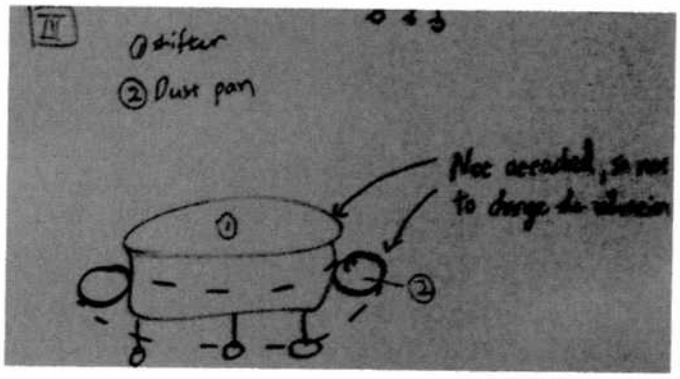
Good:

- Centralized system will save space
- Could utilize more power
- Wider area of intake

Bad:

- Not mobile
- Hanging vacuum could be a safety concern
- Will need more power to operate

VI. DUSTPAN



Descriptions:
This is just a dustpan that surrounds the sifter. It will wait until the dust cloud settles and collects the dusts. The number in the picture is corresponded as follow.

1. Sifter
2. Dustpan

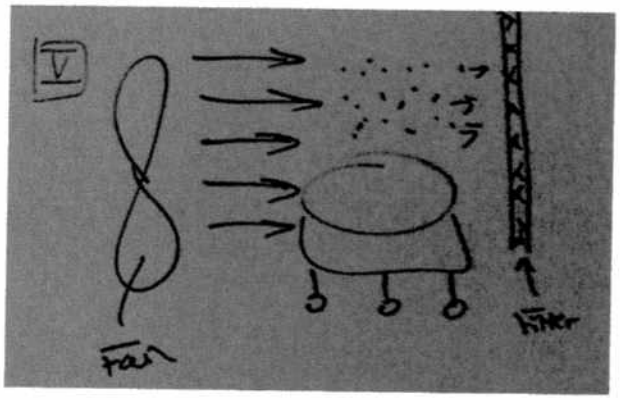
Good:

- Cheap
- Easy to use
- Simple design
- Mobile

Bad:

- How to attach to sifter?
- Weight (Vibrates with the machine? Change the vibration of the machine?)
- Does not actively collects the dust cloud
- Obstruct worker's movement

V. BIG FAN



Descriptions:
This design uses a fan to blow the dust clouds past the sifter through the filter.

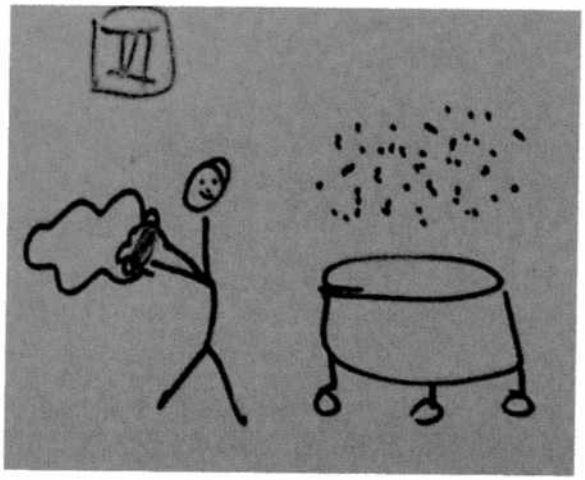
Good:

- Outside the box design
- Simple

Bad:

- Not practical to have that large of a fan blowing during process
- Obstruct worker's movement
- No filter that large
- Creates turbulent in the air flow creates safety issue
- Will end up blowing dust everywhere

VI. BAG



Descriptions:
Basically this is where one worker will wave a butterfly net through the dust cloud to collect the dust.

Good:

- No design required
- Will be reliable (no machinery down time)
- Parts are cheap

Bad:

- Extra labor cost
- Slow down the process
- Safety issue

VII. WATER

Descriptions:
The water will spray from fire hose like system. The water will cling to the dust particulates and be pulled down. The cone shaped part on top of the sifter will keep the water out and there will be a slow blowing fan to blow the dust upward. The fan will not disturb the water particles outside the cone.

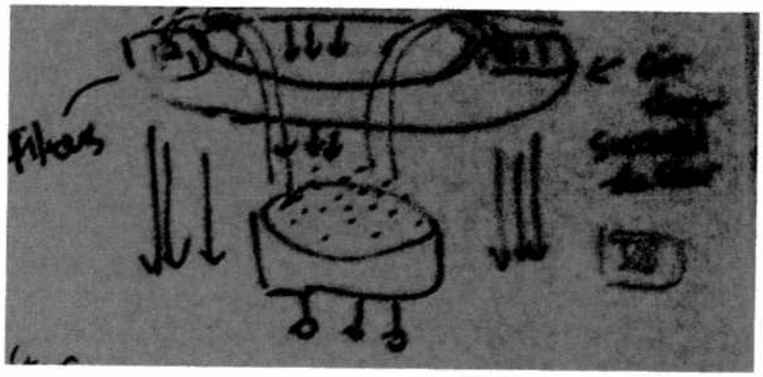
Good:

- Will definitely clean the air
- Easy to design
- Keep itself clean

Bad:

- Water everywhere causing safety issue
- Disrupt workers in the area
- Waste water

VIII. WAL-MART



Descriptions:
This is similar to the air door design at the store that keeps the outside air from entering. This design will collect the dust cloud through air intake and filter up top and sends the clean exhaust downward to create the air door.

Good:

- Innovative
- Isolates the area (create a clean room like environment inside)

Bad:

- The design will not work base on simple engineering analysis
- Cost
- Disturb more particles in the air
- Increase contamination

		Concepts											
		IQ Air			Honeywell			Shick			Kason		
	Segment	1			2			3			4		
Selection Criteria	Weight	Rating	Notes	Wtd	Rating	Notes	Wtd	Rating	Notes	Wtd	Rating	Notes	Wtd
Size	9%	9		0.81	9		0.81	1		0.09	3		0.27
Cost	40%	3		1.20	9		3.60	1		0.40	3		1.20
Serviceability	9%	3		0.27	1		0.09	9		0.81	1		0.09
Change Filters	9%	3		0.27	9		0.81	9		0.81	3		0.27
Steel Grade	3%	1		0.03	1		0.03	9		0.27	9		0.27
Geometric Discontinuities	9%	3		0.27	1		0.09	3		0.27	3		0.27
Ability to stay Laminer	9%	9		0.81	1		0.09	9		0.81	3		0.27
Reduce Particulate size	9%	9		0.81	3		0.27	9		0.81	9		0.81
Increase time between Cleanings	9%	3		0.27	3		0.27	9		0.81	3		0.27
Mobile	3%	9		0.27	1		0.03	1		0.03	9		0.27
Meets OSHA noise standards	9%	9		0.81	9		0.81	9		0.81	9		0.81
Washable	9%	1		0.09	1		0.09	9		0.81	3		0.27
Safety	9%	9		0.81	9		0.81	9		0.81	9		0.81
Engineers Rating of de feasibility	9%	1		0.09	1		0.09	9		0.81	3		0.27
	Total Score	6.81			7.89			8.35			6.15		
	Rank	2			4			1			3		
	Continue?	N			N			Y			N		

Scale

1	Worst
3	
9	Best

Concepts

		Mobile			Straight up		
	Segment	1			2		
Selection Criteria	Weight	Rating	Notes	Wtd	Rating	Notes	Wtd
Size	7%	10		0.70	10		0.70
Stagnation Points	5%	5		0.25	10		0.50
Serviceability	9%	10		0.90	7		0.63
Change Filters	10%	9		0.90	7		0.70
Steel Grade	6%	10		0.60	10		0.60
Painted Surfaces	10%	10		1.00	10		1.00
Geometric Discontinuities	7%	5		0.35	10		0.70
Ability to stay Laminar	10%	6		0.60	10		1.00
Reduce Particulate size	10%	10		1.00	10		1.00
Increase time between Cleaning	20%	7		1.40	10		2.00
Mobile	5%	10		0.50	1		0.05
OSHA 85dB	7%	5		0.35	8		0.56
Washable	8%	7		0.56	7		0.56
Engineers Rating of de feasibility	10%	9		0.90	9		0.90
Safety	13%	9		1.17	9		1.17
Total Score		11.18			12.07		
Rank		2			1		
Continue?		No			Yes		

Scale

1 not important

10 extremely important

Addison Precision Mfg.
500 Avis Street
Rochester NY
14615

Phone: 585.254.1386
Fax: 585.254.5342

Quote Number: 42773

QUOTE

Please refer to this quote number when placing an order.

Quote To:
Grant Garbach
Rochester Institute of Technology
1 Lomb Memorial Drive
Rochester NY 14623

Phone: 585-269-8988

Date: 04/16/09
Expires: 05/16/09
Reference:
Sales Person: House Account
Quoted By:

Refer Technical Questions To:

Line	Part Number	Description	Revision	Drawing
1	W689000	Wegmand Squarehood1	None	

Lead Time: 8 weeks

Quoted using 316SS

Quantity	UM	Unit Price	Extended Price
1.00	EA	2,295.00000	$2,295.00

Line	Part Number	Description	Revision	Drawing
2	W689000-001	Wegmand Squarehood1, Fan Box	None	

Lead Time: 6 weeks

Quoted using 316SS

Quantity	UM	Unit Price	Extended Price
1.00	EA	495.00000	$495.00

Line	Part Number	Description	Revision	Drawing
3	W689000-002	Wegmand Squarehood1, Filter Box	None	

Lead Time: 6 weeks

Quoted using 316SS

Quantity	UM	Unit Price	Extended Price
1.00	EA	495.00000	$495.00

Line	Part Number	Description	Revision	Drawing
4	W690000	Wegmans SS Round 1, Nozzle Intake	None	

Lead Time: 10 weeks

Quoted using 316SS Round

Quantity	UM	Unit Price	Extended Price
1.00	EA	4,925.00000	$4,925.00

APM reserves the right to revise order pricing as a result of inflation and/or fluctuations in the materials market.

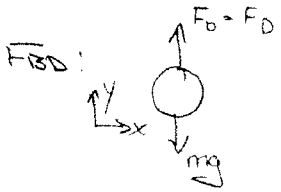
Grand Total: **$8,210.00**

System Level Design Review For Air Handling Equipment

The Wegman's Bakery Facility poses a safety and allergen hazard in the work place. The dust that is generated by the scaling operation and the movement of product contaminates product and is everywhere. Wegmans must constantly clean the room floor to make it safe for employees to walk. Also many employees choose to wear a dust mask to prevent "bakers lung" which is commonly caused by the breathable dust found in the facilities air. Poor circulation allows the air to hold a visible dust cloud, which is a safety concern for both employees and their working conditions. Individuals can reduce their risk of "bakers lung" by wearing the dust masks, but the contamination of product still remain an issue as well as the cleanliness of the floor. As the floor has more products deposited on its surface it becomes increasingly easier to slip and have an accident. The implementation of a dust collection and air handling system would greatly reduce the risks of "bakers lung," contamination and dirty floors. The optimal solution of the Shick air handling system with filter would reduce the amount of the airborne particulates. The air handling system would allow workers to work without the use of a dust mask and reducing the issue with product on the floor. While dust masks are a great solution to the "bakers lung" problem it does not address or solve other safety, allergen and contamination issues. The Shick air handling system will address safety, allergen and contamination issues resulting in an improved quality in the work area. The Shick system is expandable, so when Wegmans grows another unit can be added.

Wegman's Creeping Flow Problem

$\rho_{air} = 1.2\ kg/m^3$ $\rho_{Foam} = 700\ kg/m^3 \approx Akn\ (48\ lb/ft^3)$



$C_D \frac{1}{2} \rho V^2 A + \rho \forall g$ ← Derived From FBD

$\Sigma F_y = F_D + F_B - mg$

$V = \sqrt{\frac{2(\rho_p - \rho_{air}) g \forall}{C_D \rho_{air} A}}$ $A = \frac{\pi D^2}{4}$ $\forall = \frac{\pi D^3}{6}$

height = 2.5 m = 8.2 ft

$$V = \sqrt{\frac{2(700\ kg/m^3 - 1.2\ kg/m^3)(9.81\ m/s^2)(\frac{\forall}{A})}{(24)(1.81\times10^{-5})(1.2)(\frac{(2)(0.0001)}{3})}}$$

$$V = \frac{(\rho_p - \rho_{Air}) g D^2}{18\mu} = \frac{(700-1.2)(9.81)(0.01\times10^{-3})}{(18)(1.81\times10^{-5})} = 0.0001\ m/s$$

$V = DT$ $\quad 0.0001\ m/s = 2.5m(t)$

$$t = \frac{0.0001}{2.5\ (sec)}\left(\frac{60sec}{1min}\right)\left(\frac{60min}{1hr}\right) = \boxed{1.44hrs}$$

Fluids Analysis Results Table

q=4.587	kg/m^3
rho=1.27	

Option	A1	A2	V1	V2	K	Hlm	% difference	
1	1.4864	0.1652	3.0859	27.7730	0.9	107.131		
2	1.4864	0.1652	3.0859	27.7730	0.4	47.614	125.00	
4	1.1675	0.1297	3.9289	35.3610	0.04	7.7187	516.87	1287.941

IQ Air:
Company Name – IQ Air
Product Model – GCX AM
Price – $2239.00

Technical Information

Specifications	GC Series	GCX Series	Dental Series
Maximum air delivery *	260 cfm	300 cfm	260 cfm
Air delivery for all six fan speeds (in cfm) *	35 70 110 140 170 260	45 85 130 170 210 300	35 70 110 140 170 260
Dimensions (W x D x H)	15" x 16" x 28"	15" x 16" x 40"	15" x 16" x 28"
Weight (incl. filters & cartridges)	from 39 to 46 lbs.	from 59 to 74 lbs.	from 41 to 42 lbs.
Power requirements	120 Volt / 60 Hz		
Maximum energy consumption	215 w		
Fan motor	700 cfm, 2750 rpm, centrifugal, backward curved, UL/CSA registered		
Control panel	4-key touch-pad with 32 character LCD display		
Air intake	dual arches at base of unit		
Air outlet	320° EvenFlow™ diffuser		
Color of main housing / locking arms	light grey / blue	light grey / blue	light grey / white
Housing material	non-offgasing, impact-resistant, UV-stabilized ABS		

Performance	
Performance certification	every system is factory certified and issued with individual Certificate of Performance
Certified filtration efficiency	greater than 99% for particles ≥ 0.3 microns (µm)
Certified air delivery	+/- 10% (+ 10 cfm) of specified air delivery
Leak tested	yes

Filter / Cartridge Configuration				
Pre-filter	Type: Purpose: Media type: Surface area:	high efficiency HEPA fine dust pre-filter control of coarse and fine dust particles, protection of subsequent filters HEPA class H11, mini-pleat with solvent-free separators 59 sq.ft.	59 sq.ft.	30 sq.ft.
Gas & odor filter (Set of 4 cartridges) (weights are approx.)	Type: Purpose: Media type:	gas and odor control cartridges control of specific of gaseous and chemical contaminants **Multifilter:** 12 lbs granular activated carbon & impregnated alumina **VOC:** 10 lbs granular activated carbon **Chemisorber:** 17 lbs granular impregnated alumina (with $KMnO_4$ impregnated) **AM:** 11 lbs granular impregnated carbon	**Multifilter:** 22 lbs granular activated carbon & impregnated alumina **VOC:** 17 lbs granular activated carbon **Chemisorber:** 31 lbs granular impregnated alumina (with $KMnO_4$ impregnated) **AM:** 21 lbs granular impregnated carbon	**Pre:** 12 lbs granular impregnated activated alumina, activated carbon & impregnated activated carbon **Hg:** 11 lbs granular impregnated activated carbon
	Chemical and odor control:	**Multifilter:** wide range of gaseous organic and inorganic chemicals **VOC:** volatile organic compounds, solvents, etc. **Chemisorber:** formaldehyde, hydrogen sulfide, sulfur dioxide, etc. **AM:** ammonia and ammonia compounds		airborne viruses and bacteria, mercury vapors, formaldehyde, alcohol solvents, combustion particles, plasticizing agents, aerosolized fluids, tissue, viruses and bacteria, powder particles etc.
Post-filter sleeves (Set of 4)	Type: Purpose: Media type: Surface area:	post-filter sleeves fine dust post-filtration electrostatically charged fiber 6.5 sq.ft.	15.2 sq.ft	6.5 sq.ft.
Average Filter Life Based on 10 hours usage per day on speed setting 3.		Pre-filter: 6 - 18 months Gas & odor filter: 1 - 3 years Post-filter sleeves: 1 - 3 years	Pre-filter: 6 - 18 months Gas & odor filter: 2 - 4 years Post-filter sleeves: 2 - 4 years	Pre-filter: 6 - 18 months Gas & odor filter: 1 - 3 years Post-filter sleeves: 1 - 3 years

Control Panel Features	
Display languages	English (default), French, German, Spanish
Features	intelligent filter life monitor, filter life status LED, programmable timer (hourly/daily), 2 speeds, timer status LED

Accessories			
Standard	remote control (battery included) set of casters	remote control (battery included) set of casters	remote control (battery included) set of casters FlexVac™ source capture kit
Optional	wall mount bracket, positive/negative pressure ducting, coarse dust pre-filter		

Warranty	
Warranty period	1 year on parts and labor (excluding filters)

All technical specifications are subject to change without prior notice. * tolerance +/- 10% (+ 10 cfm)

Figure 1 – Model Information from the Company

Honeywell:
Company Name – Honeywell
Product Model – 50250-N
Price – $199.99

Figure 2 – Model Information from the Company

Shick:
Company Name – Shick
Product Model – 9SF009A
Price – $15,000

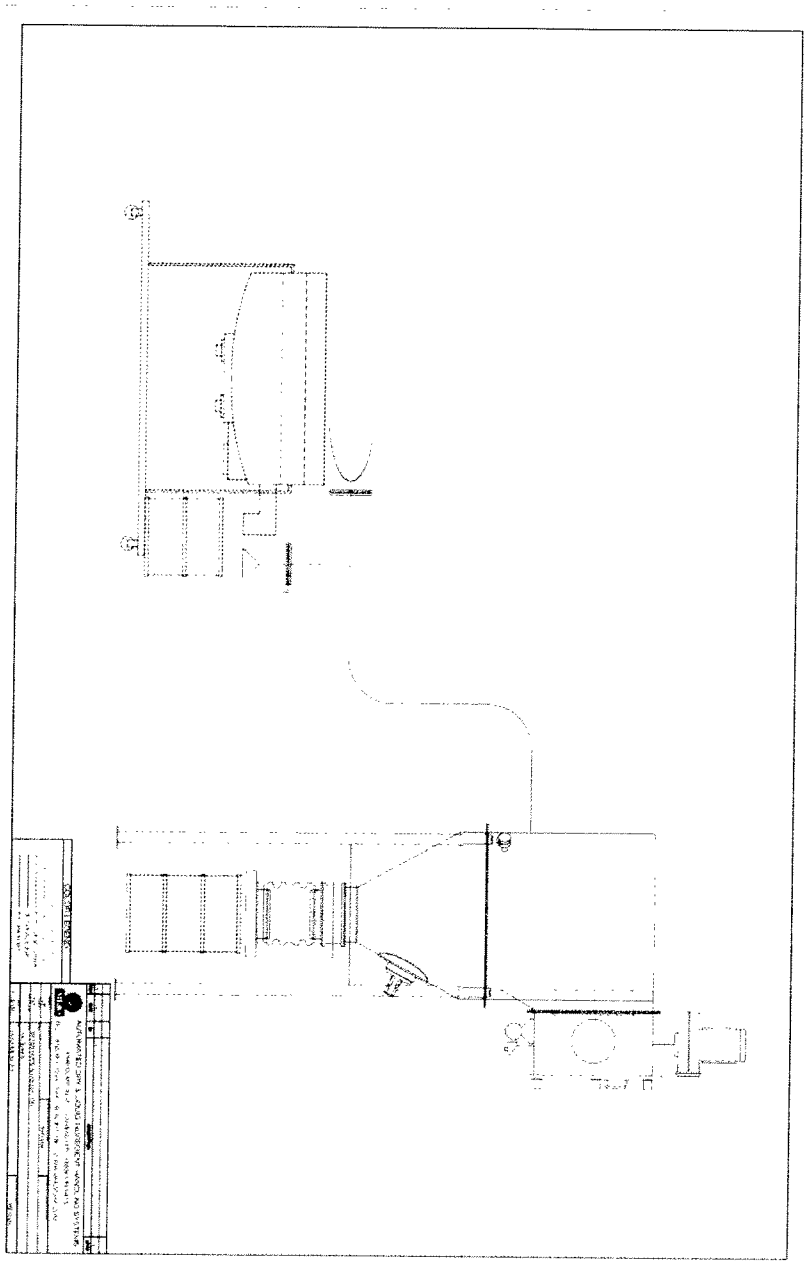


Figure 3– Model Drawing from the Company

Kason:
Company Name – Kason
Price – $7277.00
Product Description – To provide the dust hood with an integral dust collector, including two□filter cartridges, exhaust fan, and reverse pulse cleaning for the□filters with Nema 4X control box.

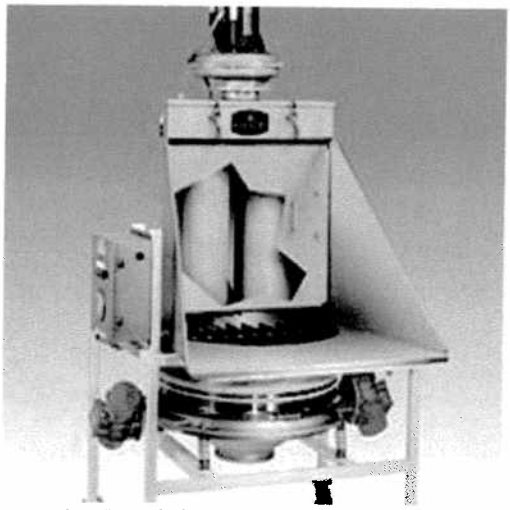
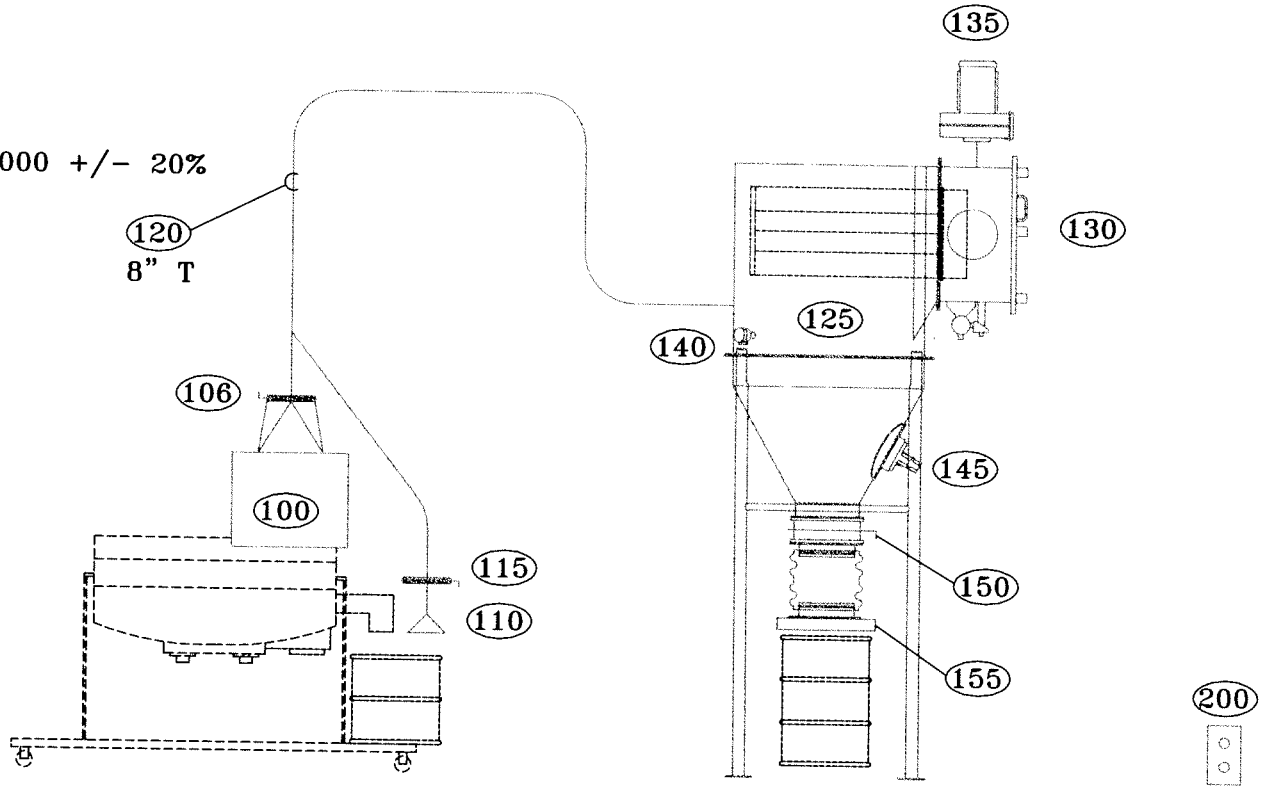


Figure 4 – Model Picture from the Company

TOTAL ACFM = 1375
PICK UP VELOCITY = 150FT./MIN.
TOTAL PRESSURE DROP = 9" W.G.
FAN HP = 7.5
FAN NOISE = 89 DBA @ 5FT.
ESTIMATED PRODUCT LOSS = 1%

TOTAL BUDGETARY PRICE
EQUIPMENT & CONTROLS = $35,000 +/- 20%



COLOR LEGEND
NEW DRY EQUIP.
NEW LIQUID EQUIP.
EXIST. OR BY OTHERS
OPTIONAL EQUIP.
FUTURE EQUIP.

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DESCRIPTION: SIFTER HOOD & COLLECTOR
CUSTOMER: WEGMANS
LOCATION: ROCHESTER, NY
DRAWING NO.: 95F009A