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14 November 2014

U.S. Nuclear Regulatory Commission, Region III
2443 Warrenville Road, Suite 210
Lisle, IL 60532-4351
ATTN: Kevin Null

LICENSE No: 24-21362-01

SUBJECT: Response to Conv. Record dated 9-Sep-14 regarding SOP-44

NRC,

In this letter you will find,

(1) The response to conversation dated 9-Sep-14. Each paragraph has been written in its entirety and is followed by a paragraph titled Response; (2) The requested changes to SOP-44 "Repair or Replace Hood Exhaust System" have been tracked using red type for easy following; (3) Summary of survey results for the External ductwork and internal filter housings; (4) proposed map of before and after ductwork layout.

If you have any questions or require clarification on any of the attached information, you may contact our RSO directly at (314) 991-4545.

Sincerely

AMERICAN RADIOLABELED CHEMICALS, INC

A handwritten signature in black ink, appearing to read 'Surendra K Gupta'.

Surendra K Gupta, Ph.D.
President
American Radiolabeled Chemicals, Inc.

RECEIVED NOV 18 2014

Response to conversation record between ARC and NRC dated 9-Sep-14

- 1. Improper handling of radiologically contaminated items, e.g., exhaust ductwork, can create cross contamination problems. In particular, cutting of contaminated ductwork can create an airborne hazard and increase the possibility of worker intake of radionuclides. Therefore, describe the bioassay program that will be in place to evaluate the internal dose for any worker who handles and/or cuts contaminated duct work.**

Response: Item 3.1 in SOP-44 has been amended to reference SOP-21 for training and dose estimates of non-laboratory personnel. The most likely time when any intake may occur will be during the initial removal of the ductwork. ARC personnel will handle the moving of contaminated ductwork while contract workers will only be doing the cutting. All of this work will take place outside on the roof. Cutting shears will be used instead of saws in order to reduce any dust contaminants. Dust masks and PPE will be worn, while cutting the ductwork. The stack sends out ~12,000 cubic feet of air per minute, the main trunk line of the exhaust is circular with a 2 foot diameter; $A = \text{Pi } (r)^2$ therefore Area ~ 3.14 ft² ; 12,000 CFM divided by 3.14 ft² gives a linear velocity 3,822 linear feet per minute. Because of this high velocity in the ductwork and 24 hour run time, we believe we will find very little removable contamination on the long cylindrical ductwork.

If a permanent ARC employee working alongside the contract employees shows an elevated bioassay the following week, additional samples will be obtained from the contract workers. The individuals will be direct scanned each time they leave the roof and again at the end of the day to check for external contamination.

- 2. Submit a current diagram of the exhaust system and identify the areas within the system where the work will be performed. Include a diagram of the proposed revision to the system and identify components that will be replaced, including filtration.**

Response: A diagram of the ductwork before and after the proposed changes has been included in this letter. The filtration boxes are not required and will not be replaced. ARC's most recent dose to the public calculation showed 0.286 mrem in a year.

Components removed: three (3) filter houses, rusted ductwork.

Components added: Four (4) forty-five degree taps that connect the main line with the first four lateral lines. Possibly two (2) more taps at the terminal lines, depending on if they need to be replaced or not.

- 3. In addition to SOP-44, please provide a more detailed description of the work that needs to be performed, the expected length of time to complete the work, and the expected number of contractor employees that will be required to complete the job.**

Response: According to the company we're working with, it will most likely take three (3) days to complete the job and will require two (2) contract employees. In addition we will most likely have three to four ARC employees to remove the contaminated ductwork including the RSO.

First the contract employees will cut the ductwork into manageable sizes. A member of radiation safety will perform direct scan surveys with a third party calibrated GM. Wipe surveys will be performed on the first few sections to determine if it is mostly removable or fixed. This will only be done on the first few sections because wipe surveys take several minutes to put in assay vials and count. The ratio of

removable to fixed will be applied to all subsequent ductwork. After the removable to fixed ratio is measured only direct scan surveys will be performed. Because these items will be considered SCO and moved to Building 200 an inventory tag number will be assigned to each section of ductwork and a plastic bag will be taped over each end to reduce cross contamination while it is being transported to Building 200. After each lateral duct line is removed a new duct line will be put in its place, starting at the main trunk line and connecting to the ductwork above the hoods. The space above the hoods is in the attic and is a non-contaminated area. If work inside the lab needs to be performed, then permanent ARC employees will be utilized first, before any contract employees are used in the lab. If a contract employee needs to enter the lab, then training will be given in accordance with SOP-21. Most likely one lateral line of ductwork will be removed and replaced at a time.

- 4. Please submit an evaluation of the impact that the repair/replacement project will have on routine licensed operations. We are assuming that in order to protect the contract workers during this project, licensed operations and including fume hoods which remove radioactive air effluent through building 300 ductwork will be suspended temporarily until the project is completed. Please confirm our understanding.**

Response: On each of the six (6) lateral lines is a damper valve proximal to the main trunk line and distal to the hoods. When a lateral line is replaced its respective damper valve will be closed allowing the other hoods to continue flowing. Based on hood flow measurements the damper valves work very well and will stop all airflow to that line. When this occurs each hood connected to the duct will have all the hood face panels closed and a sign will be posted notifying all individuals that the hood is not flowing. For the majority of the replacement this will work, however when the last few feet between the damper valve and the main trunk line need to be replaced to install the forty-five degree taps can be connected, the exhaust may need to be completely shut off. The exhaust and make-up air will then be restarted in the manner described in SOP-43 of this license.

- 5. Confirm that workers on the project will be issued protective clothing. Describe the protective clothing that workers will be required to wear.**

Response: When removing the contaminated ductwork, required PPE will be gloves, lab coat, eye protection and dust mask. All of this is standard PPE for our laboratory and will be available during construction. After the contaminated ductwork is removed, the PPE required will be whatever is standard for the contract company, most likely eye protection and leather gloves.

- 6. Please conduct and submit for our review an evaluation to determine whether or not workers will be assigned respirators, especially for those who will be cutting ductwork.**

Response: A survey of the external surface of the ductwork has been performed and included with this response. The survey showed that the external surface area meets the release levels required for disposal as non-radioactive waste. The internal surface cannot be surveyed until construction has begun; however the inside of the filtration units can be accessed and has been surveyed. The survey inside the filter boxes showed contamination levels from less than the action level in the restricted area up to 34 times the action level. The wipes that showed the highest results also picked up some grease that was not easily removed from the exhaust system and would therefore not easily become airborne and thus be inhaled by any worker. The filter boxes have many ridges and corners for contamination to be caught. The smooth circular ductwork is likely to have less removable.

7. Please describe an air sampling program that will be conducted to evaluate for the presence of airborne radionuclides, or submit justification why one is not needed.

Response: Air concentrations are measured every week in the contaminated areas where production occurs and consistently show levels much lower than the DAC limits for Hydrogen-3 and Carbon-14. ARC employees, including production chemists, consistently have measured annual doses of less than 1250mrem. These doses are measured from employees who spend 40+ hours every week in the contaminated area working with curie amounts of activity. We don't expect to find curie levels of removable contamination inside of the ductwork. We expect it to be fixed contamination due to the high air velocities. That coupled with the dust masks being utilized and contamination control procedures described in the response to item 3 above, ARC does not need an air sampling program set up on the roof of Building 300.

8. The objective of SOP-44 should also include a provision to assure the radiological and occupational safety of the contract workers who will be handling the ductwork.

Response: The 'objective' section of SOP-44 has been amended to reflect this.

9. For item 1 of SOP-44, describe the purpose and content of the scoping survey, and include a description of thresholds and associated actions levels.

Response: A scoping survey of the external surface of the ductwork as well as the inside of the filter houses has been performed and is included in this report. The purpose of the scoping survey is to determine if there is removable and/or fixed contamination on the internal and external surfaces. The action level for the ductwork will be the same action level described in item 2.2 of SOP-16 "Contamination Control Program"; item 3.0 of SOP-30 "Equipment Release"; as well as item 4.2.2.6 (b) of the Radiation Protection Program. Item 1.3 has been added to SOP-44. The action level is also written in item 5.1 of SOP-44 "Repair or Replace of Exhaust System".

10. For item 2.1 of SOP-44, confirm that all contactors who are involved with the repair/replacement project, will receive training. Confirm that all contractor employees will conduct work under direct supervision of ARC staff.

Response: According to SOP-21 "Training and Dose Estimates for Non-Lab Personnel" item 2.4 "Training Exception" direct supervision may be used as a replacement for formal training. Because the work takes place outside in a non-contaminated area, and the contractors will only be cutting the ductwork and not handling it directly, direct supervision by radiation safety staff will be sufficient. Direct supervision will include verbal training and is commensurate with the work being performed.

11. For item 3.1 of SOP-44, what do you mean by the statement that "contract workers under direct supervision receive verbal training?" Is this training different from the training described in item 2.2? From item 2.0, it appears that individuals who cut ductwork are the ones who receive direct supervision. Does this group of individuals then, only receive verbal training?

Response: Item 3.1 has been amended to reference item 2.4 of SOP-21 "Training and Dose Estimates of Non-Lab Personnel". See response above. The training described in item 2.2 of SOP-44 is formal training

required if the contractor were to work directly with radioactive material or need to enter the lab. Neither of these situations applies to contractors cutting the ductwork. In the event that contract workers need to enter the lab for any reason, they will be given formal training in accordance with item 2.2 of SOP-44 as well as item 2.2 of SOP-21.

12. For Item 5.0 of SOP-44, describe your protocol for conducting smears of ductwork to determine if the material may be released for unrestricted use.

Response: Item 5.2 has been added to SOP-44. It is similar to the methods described in SOP-16 item 6.0 as well as SOP-30 item 2.0. Because surveying each individual item with wipes would take an excessive amount of time, wipe surveys will be performed only on the first few sections of ductwork removed to determine the ratio of fixed to removable contamination. After the ratio is estimated only a direct scan survey will be performed to allow for immediate radiation detection.

Supersedes: new
Reviewed by RSC: 1-Aug-14
Approved by NRC: TBD

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SUBJECT: Repair or Replace Hood Exhaust System

OBJECTIVE:

To ensure that no contaminated, or potentially contaminated, ductwork is removed from the ARC site due to repair and/or replacement of the hood exhaust system.

To provide the contract workers with radiation safety training commensurate with the hazard involved.

To ensure the radiological and occupational safety of all personnel, contract employee and permanent alike, during construction.

RESPONSIBILITY: Radiation Safety Officer

REFERENCE:

SOP-16 “Contamination Control Program”
SOP-21 “Training and Dose Estimates for Non-Lab Personnel”
SOP-29 “Storage of SCO”
SOP-41 “Inventory of SCO”

PROCEDURE:

1.0 Scoping Survey

- 1.1 A direct scan survey using a calibrated survey meter with a G-M pancake probe will be performed covering an area of ductwork.
- 1.2 The results of the area surveyed should be indicative of the overall contamination of that segment of ductwork. All results will be documented
- 1.3 The ductwork must be less than the action level in order to release it is non-contaminated. The action level can be found in item 2.2 of SOP-16 “Contamination Control Program”; item 3.0 of SOP-30 “Equipment Release”; as well as item 4.2.2.6 (b) of the Radiation Protection Program. The action level is also listed in item 5.1 of this SOP.

2.0 Radiation Safety Training

- 2.1 Requirement

Supersedes: new
Reviewed by RSC: 1-Aug-14
Approved by NRC: TBD

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SUBJECT: Repair or Replace Hood Exhaust System

- 2.1.1 Training is required for individuals who perform work functions such as (but not limited to) the removal of contaminated (or potentially contaminated) roofing material.
- 2.1.2 Contract employees who only cut the ductwork and do not handle the contaminated ductwork will only need direct supervision by a member of the radiation safety staff. Provided the work takes place in a non-contaminated area. The direct supervision will replace formal training in accordance with item 2.4 of SOP-21 "Training and Dose Estimates for Non-Laboratory Personnel".
- 2.1.3 When handling contaminated ductwork gloves, safety glasses, and a lab coat are required.
- 2.1.4 All work done will be under the supervision of the RSO.
- 2.2 Training subjects.
 - 2.2.1 Nature of radioactive material
 - 2.2.2 Difference between radiation and contamination
 - 2.2.3 Beta emitters vs other emissions
 - 2.2.4 Effect of beta energy
 - 2.2.5 Beta shielding from clothing, etc
 - 2.2.6 Dose, internal vs external, internal only
 - 2.2.7 Protective clothing and equipment (PCE)
 - 2.2.8 Donning and wear of PCE
 - 2.2.9 Removal of protective clothing when exiting a contaminated area.
 - 2.2.10 Surveys and survey meters.
- 3.0 **Certification of Training and Dose**
 - 3.1 A record of each contract worker trained will be kept on file along with all bioassay records. Contract workers under direct supervision receive verbal

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SUBJECT: Repair or Replace Hood Exhaust System

training. See item 2.4 of SOP-21 “Training and Dose Estimates of Non-Laboratory Personnel”

3.1.1 Bioassay requirements; An entry sample will be given prior to the start of all work. Contract workers will be working alongside permanent employees of ARC, it is therefore assumed that contract and permanent workers will receive the same dose from inhalation during this renovation. Follow up samples from contract workers will only be needed in the event one of the ARC employees gives an elevated bioassay the following Monday.

4.0 Location and Description of Repair Site

4.1 The majority of the ductwork is on the roof of building 300, a non-contaminated area. The ductwork goes down into the attic, also a non-contaminated area. All work should take place in a non-contaminated area.

4.1.1 All cutting tools will be operated by contract workers trained to do so. ARC employees will handle the dismantling, removal and transportation to the waste processing area in Building 200.

4.2 If any work need be done in a contaminated area, an experienced ARC employee should be used if possible.

5.0 Disposal

5.1 Any ductwork that exceeds the release levels will be disposed of as radioactive waste. The release levels are,

Total – 5000 dpm/100 cm² average, not to exceed 15,000 for a single point

Removable – 1000 dpm/100 cm²

5.2 Direct scan surveys shall be performed on the inside of all cut out sections of ductwork. Wipe surveys shall be performed on the first few sections in order to determine if the contamination is removable or fixed. The ratio of fixed to removable will be applied to all sections of ductwork thereafter.

5.2.1 If the direct scans are greater than the total listed in 5.1 above, then the section will be sent to the waste processing area of building 200. The ends of the ductwork should be covered to prevent removable contamination from falling out.

Supersedes: new
Reviewed by RSC: 1-Aug-14
Approved by NRC: TBD

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SUBJECT: Repair or Replace Hood Exhaust System

- 5.2.2 If the direct scans are less than the total listed in 5.1 above, then wipes will be performed to check compliance with the removable limit.
- 5.2.3 If both wipes and direct scans are less than the limits listed in 5.1 above then the item may be released as non-radioactive.
- 5.2.4 If either wipe or direct scan is greater than the action, then the item is considered an SCO and will be subject to SOP-29 “Storage of SCO” and SOP-41 “Inventory of SCO”.

6.0 End of Day

- 6.1 All workers handling radioactive material will be surveyed with a calibrated GM as they leave the roof and again at the end of the workday before leaving site.

Internal Surfaces of the Three (3) Filter Boxes on B300

	DPM		µCi	
	H3	C14	H3	C14
1	12835	5074	5.78E-03	2.29E-03
2	6597	4144	2.97E-03	1.87E-03
3	48166	29445	2.17E-02	1.33E-02
4	6047	2173	2.72E-03	9.79E-04
5	5016	1591	2.26E-03	7.17E-04
6	93665	12201	4.22E-02	5.50E-03
7	835176	47739	3.76E-01	2.15E-02
8	586333	42016	2.64E-01	1.89E-02
9	203889	27824	9.18E-02	1.25E-02
10	255666	15500	1.15E-01	6.98E-03
11	1066048	0	4.80E-01	0.00E+00
12	154314	634	6.95E-02	2.86E-04
13	327945	0	1.48E-01	0.00E+00
14	1713896	0	7.72E-01	0.00E+00
15	1398479	0	6.30E-01	0.00E+00

Restricted Contaminated Area
Action Level
2.22E+06 DPM/µCi

Meter 250184
Detector 134087
C14 Eff. 7.30%
Background 140

	Wipes	Direct Scan (CPM)	Direct Scan (DPM)
Filter-1	1 to 5	60000	820000
Filter-2	6 to 10	14000	189863
Filter-3	11 to 15	14000	189863

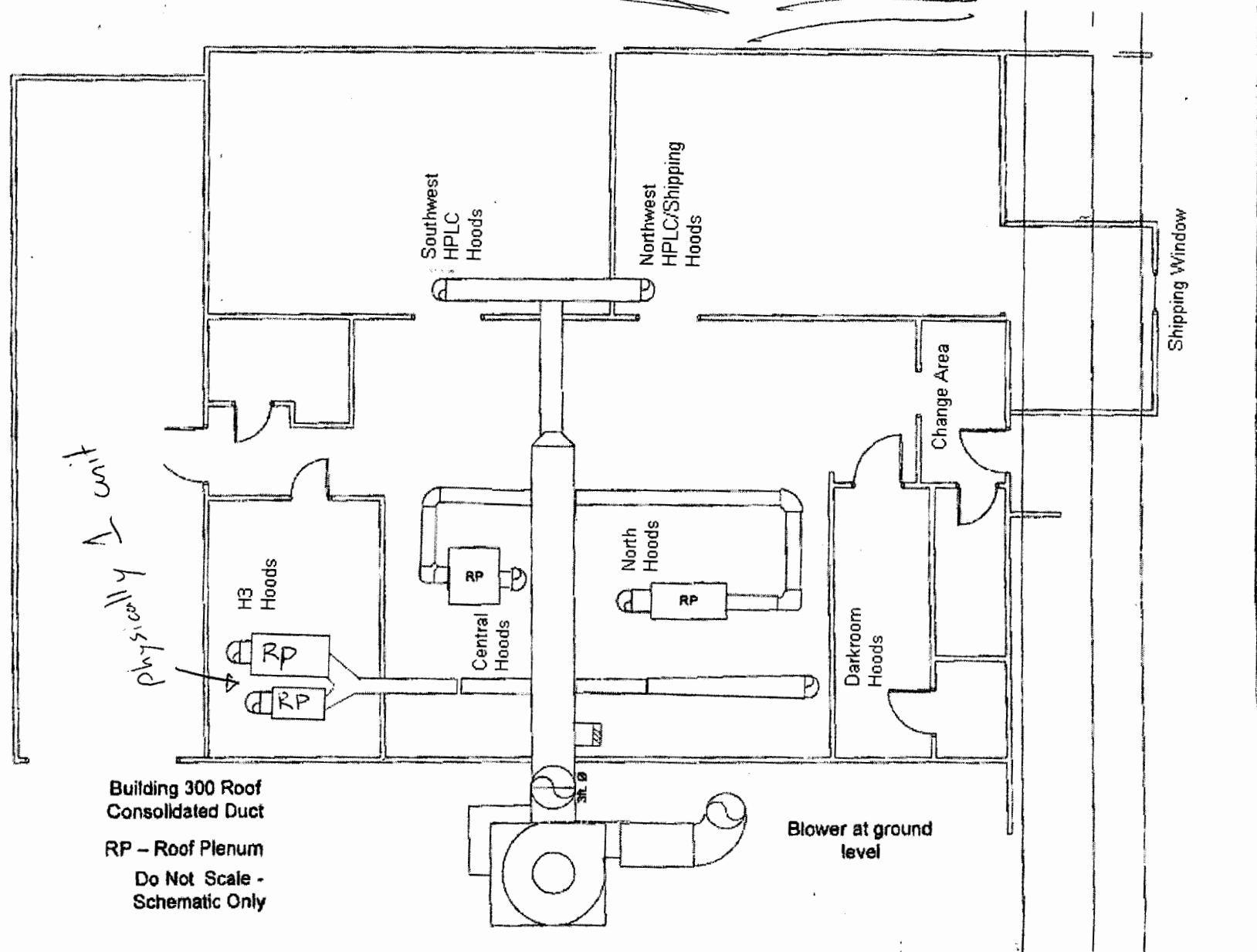
External Surfaces of the Exhaust Ductwork

	Action Level		Scan (CPM)	Scan (DPM)
	H3	C14		
1	0.22	0.02	200	822
2	0.22	0	160	274
3	0.16	0.01	160	274
4	0.17	0.02	160	274
5	0.2	0.01	180	548
6	0.21	0.02	180	548
7	0.18	0.01	180	548
8	0.16	0.04	160	274
9	0.24	0.01	160	274
10	0.15	0	180	548
11	0.2	0.03	160	274
12	0.27	0.02	140	0
13	0.22	0.01	160	274
14	0.23	0.01	160	274
15	0.15	0.02	160	274
16	0.23	0.02	180	548
17	0.21	0.03	160	274
18	0.27	0.03	200	822

Uncontaminated Action Level
H3 1000 DPM
C14 1000 DPM

Meter 250184
Detector 134087
C14 Eff. 7.30%
Background 140

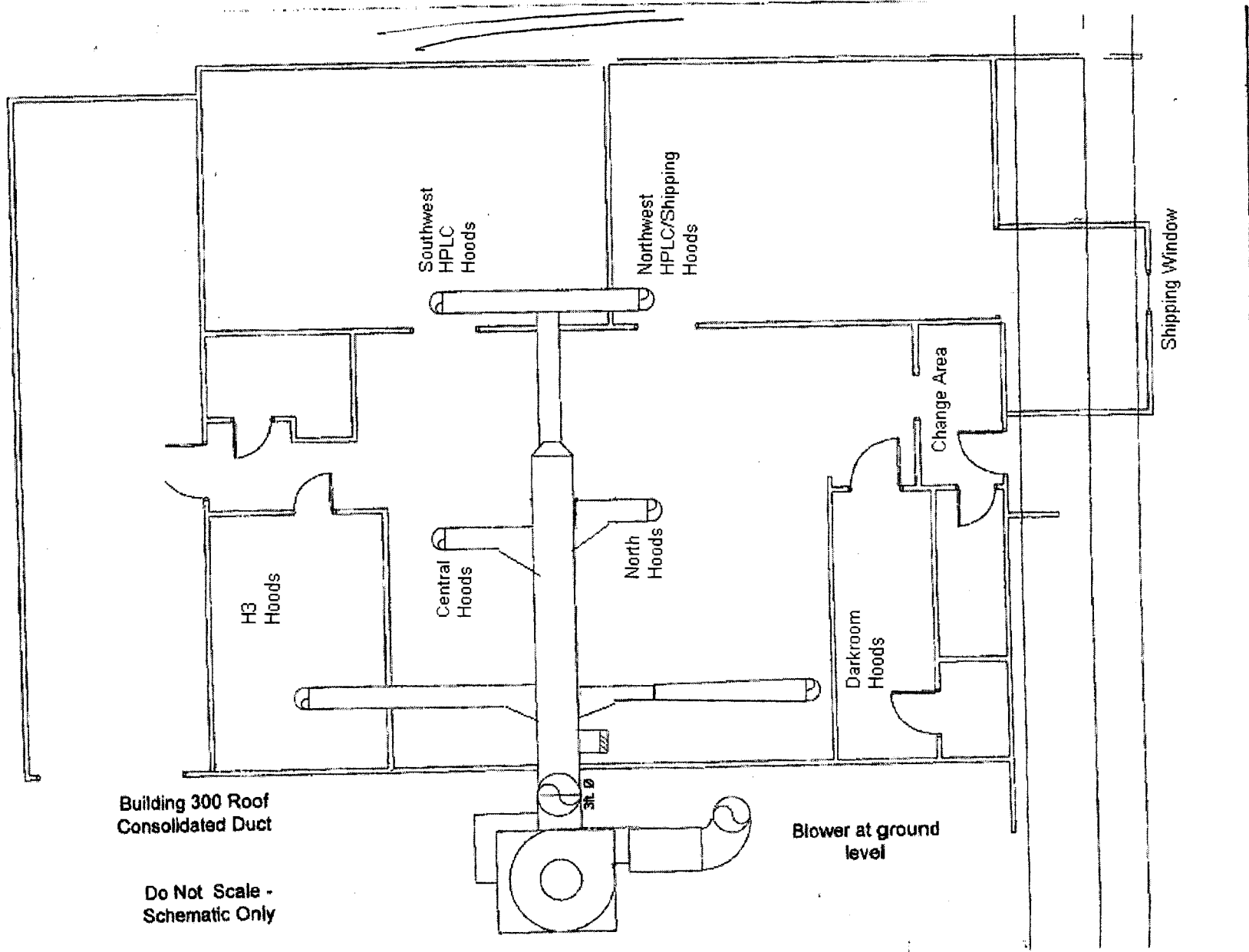
~~Attachment 1~~ Before



Building 300 Roof
Consolidated Duct
RP - Roof Plenum
Do Not Scale -
Schematic Only

Blower at ground
level

After



Building 300 Roof
Consolidated Duct

Do Not Scale -
Schematic Only

Blower at ground
level

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