Operation & Maintenance Work Plan of Structure Ventilation Systems

Ground Water Vapor Project
Endicott, NY

Revision 3

July 2012

O'BRIEN & GERE

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

This revised Work Plan describes activities associated with the ongoing operation and maintenance (O&M) of ventilation systems installed by IBM Corporation (IBM) in the Village of Endicott and the Town of Union, New York (hereinafter the "ventilation system"). The original O&M work plan[1], was effective in January 2005 and a first revision took place in 2007[2] .This current version of the work plan will remain in effect until a modification is requested by IBM, NYSDEC or NYSDOH and as long as the mitigation systems are warranted. Any future modifications to this Work Plan will be submitted to the NYSDEC and NYSDOH for approval.

The modifications in this work plan are being implemented based on the statistical analysis of data collected during the initial 7 years of ventilation system O&M activities. Some of the statistical data analysis is described in more detail in Section 1.1.

1.1 BACKGROUND

IBM's ventilation system design and construction began in February 2003. For a large majority of the affected structures, subslab depressurization/ventilation systems (subslab ventilation systems) constitute the mitigation systems installed. For structures where the subsurface or structure conditions were not conducive to the sub-slab system approach, other means (including sub-membrane and crawlspace ventilation or pressurization systems (HVAC)) constitute the mitigation approach used in conjunction with or in lieu of subslab ventilation. For the remainder of this document subslab depressurization systems will be referred to as "typical" systems, while all other ventilation systems (HVAC, crawlspace and submembrane) while be referred to as "special" systems.

In March 2012, as the effective duration of the then current Work Plan was coming to a close, IBM, NYSDEC and NYSDOH met to review 7 years of ventilation system O&M data and discuss the ongoing requirements of the ventilation system O&M activities. Based on the historical system performance data presented by IBM in that meeting it was agreed that for "typical" systems, annual fan operation and exterior system checks will continue to take place, but full routine maintenance inspections will no longer be required. Full routine maintenance inspections will continue to be performed on typical systems at the request of any property owner. Other minor enhancements to the O&M inspection forms and tracking logs will also be incorporated into the work plan to improve the efficiency of data management and tracking.

At the March 2012 meeting referenced above, IBM presented statistical system performance data from the first 7 years of ventilation system operation (January 2005 through February 2012) which was based on 3,610 routine and non-routine visits. The conclusion of the statistical analysis was that all typical systems were found to be within the acceptable design range of operation, provided there was power to the fan and that it was running. Therefore, one of the primary objectives contained in this Work Plan is to continue to provide annual checks to verify this system critical component of all typical systems.

Consistent with the November 2007 Revised Work Plan and as described herein, IBM will continue to provide in home routine maintenance visits for all special systems.

This document was formatted to comply with IBM's overall site Comprehensive Operations, Maintenance, and Monitoring Program. Like the original Work Plan, this document also will be made available to the public through the Project Information Repository located in the George F. Johnson Library.

[1] "Operation & Maintenance Work Plan of Structure Ventilation Systems," O'Brien & Gere, Revision 1, October 8, 2004.
[2] "Operation & Maintenance Work Plan of Structure Ventilation Systems," O'Brien & Gere, Revision 2, November 29, 2007.

1.2 SCOPE

This Work Plan describes the following activities associated with routine maintenance and requests for maintenance from residents:

- Communicating and scheduling of structure visits with property owners and residents;
- Response to system operational problems and property owner and resident's inquiries;
- Re-commissioning systems, if necessary, after repairs are made;
- Regular review of structures and systems to screen for significant changes in the structure and/or to assess on-going system operation and performance;
- Preventative maintenance requirements; and
- Documentation and recordkeeping of the operations and maintenance activities.

Operational checks are also conducted by property owners or residents. These checks are not part of the scope of this work plan, but are vital to the initiation of resident requested maintenance. Each property owner has been instructed, via a signed access agreement, a ventilation system operational fact sheet, and an annual reminder letter (see Section 5.5), to contact IBM if:

- Major renovations to the structure are planned;
- There is a problem with system operation; or
- The system becomes damaged.

1.3 OBJECTIVES

The objectives of these ventilation system O&M activities are to:

- Ensure ongoing ventilation system operations through appropriate system checks and maintenance;
- Provide responsive repairs to ventilation systems when problems arise;
- Provide timely response to concerns and complaints related to ventilation systems operations (e.g., noisy operation);
- Track and respond to the need for new ventilation system installations at currently vacant properties;
- Track and respond to the need for ventilation system modifications for structures that have new additions;
- Track and annually offer ventilation systems to properties that originally declined systems, had unsafe or other conditions such that design and installations was not practical, or were unresponsive to IBM's repeated attempts at communication; and
- Implement IBM's energy usage reimbursement program.

1.4 ROLES AND RESPONSIBILITIES

Routine and non-routine ventilation system O&M activities will be performed by a maintenance supervisor and a team of technicians. The O&M team will be available during normal business hours with emergency response capability when required. Scheduled system maintenance will be performed at the convenience of the individual property owners and, if necessary, this work will occur outside of normal business hours.

In general, the maintenance supervisor will be responsible for ensuring that the requirements set forth in this work plan are met. Specifically, the supervisor will:

- Coordinate scheduling and assignments for the maintenance technicians;
- Serve as the primary point of contact and response for requests for maintenance from property owners and residents;

- Address maintenance in accordance with the process outlined under Section 2;
- Coordinate scheduled routine maintenance visits (see Section 3);
- Review and approve system modifications recommended by the maintenance technicians;
- Coordinate program management and communication activities (see Section 5); and
- Review and approve documentation of O&M activities.

The maintenance technicians will be responsible for the following:

- Execute the assignments identified by the maintenance supervisor;
- Recommend and execute system repairs as necessary; and
- Monitor system performance so as to meet the requirements set forth in this work plan.

2. MAINTENANCE REQUEST FROM PROPERTY OWNERS OR RESIDENTS – NON-ROUTINE

A program has been developed to manage requests for maintenance from residents. This program documents the process by which IBM investigates and potentially repairs systems when property owners or residents contact IBM about a suspected problem. Figure 1 illustrates the process from contact with residents to completion of the investigation and repair. The following subsections describe the process steps in more detail.

2.1 NON-ROUTINE MAINTENANCE REQUEST

The following describes a process for handling situations involving a request for non-routine maintenance by the property owner or resident. The request can be placed by calling the IBM toll free number, contacting the IBM ventilation system O&M field office, or by directly contacting IBM's Contractor (O'Brien & Gere). Regardless of how the request is made, the following steps will be taken to respond.

1. The maintenance supervisor will be notified of the request (assuming the supervisor does not receive the request directly from the property owner);
2. The supervisor will designate a tracking number for the maintenance request and enters information in the Maintenance Request Table that is used for tracking purposes. An example of the Maintenance Request Table showing the information that is tracked throughout the cycle of each request is provided in Appendix A;
3. The supervisor will then complete the top part of a blank Maintenance Request Form (presented in Appendix B), and assign the request to a maintenance team that is responsible for investigating and resolving the request. The maintenance supervisor may conduct the investigation by him or herself;
4. The maintenance supervisor will contact the property owner or resident that made the request and schedule a date and time for the investigation visit; and
5. Prior to the investigation visit, the maintenance team will receive the Maintenance Request Form and assemble an electronic or hardcopy field maintenance folder containing, at a minimum, the following documentation:
    - Latest version of As-Built drawing;
    - Latest copies of IC/OC, system inspection or re-commissioning forms;
    - Asbestos and Electrical Inspection forms; and
    - Current and previous (if any) Maintenance Request Forms.

The remaining subsections describe the process steps that will be followed until the request is resolved and documentation is complete.

2.2 INVESTIGATIONS

During the investigation visit, the maintenance team will investigate the reported problem, identify any potential cause, and develop an action plan to resolve the problem.

In addition, the team will visually inspect and conduct an owner/resident interview to identify any changes to the structure that may have occurred since the last visit. Structure changes will be brought to the attention of the maintenance supervisor to confirm that the existing ventilation system does not require any modification in response to the changes. A Structure Review form (provided as Appendix C) will be completed for each investigation visit. Note that some of the structure review questions may be asked of the owner during the scheduling of the investigation visit. The following items may affect system performance and must be noted:

- New or modified heating and ventilation systems;
- New ventilation or combustion appliances;

- Additions to the structure (footprint changes);
- Major changes to occupied spaces; and
- Slab and wall cracks in basement.

The maintenance team will implement the necessary repairs during the investigation visit. If the repairs cannot be executed at that time, a construction/modification visit will be arranged and scheduled for a later date (see Section 2.3).

If a non-routine maintenance visit is conducted within six months of a scheduled routine maintenance inspection, then an additional routine maintenance inspection, discussed in Section 3, will be conducted during that non-routine maintenance visit.

The maintenance team will complete the investigation portion (and when applicable, the repairs portion) of the Maintenance Request Form. This information will include the date of the investigation, the time spent for the investigation, any findings, and proposed repairs.

2.3 REPAIRS

The repairs program will be implemented when a reported or identified system problem cannot be corrected during the initial investigation visit.

The maintenance team leader will complete the repairs portion of the Maintenance Request Form (Appendix B). This information will include the date, team designation, actions taken, materials used, and the man hours expended. System and structure modifications will be recorded by redlining the As-Built drawing and preparing an updated As-Built.

Upon completion of the repair, the maintenance team will notify the maintenance supervisor and review the problem resolution and subsequent need for re-commissioning activities, if applicable.

2.4 RE-COMMISSIONING

Re-commissioning will be completed when repair activity involves changing the fan size, changing the ventilation system piping configuration, or when there is an unacceptable difference in the post repair system operation and the recorded initial system operational condition. In such cases, the re-commissioning will consist of one or more tests and checks of the system's performance, depending on the type of repair correction that was performed. Table 1 contains a matrix of maintenance activities and its associated inspection requirements. Appendix C will be used for recording these activities. Only the forms related to the specific maintenance activity performed need to be completed. All spaces on the forms must be completed with information or "N/A" if the information is not applicable or required. The maintenance activities are categorized and the forms are organized as follows:

- Fan and Electrical;
- Piping, Slab and Wall;
- Crawlspace Data; and
- Test Data and Backdraft.

As can be noted in Table 1, the electric meter number will always be recorded and compared to the existing number on file to support the management of electrical cost reimbursements (see Section 5.4). If the system does not pass re-commissioning (*i.e.,* sub-slab communication) tests and checks after repeated attempts to correct the system, or if the structure changed significantly, then the system may need to be modified. Table 1 also identifies the re-commissioning requirements of redesigned systems.

The forms presented in Appendix C will document "as found" conditions. If ventilation system modifications are made, the team will re-perform tests and complete the forms to document "as left" conditions. All test results will be compared to the design and performance criteria outlined in Table 2. If any performance criteria are not

met, then actions will be taken until the system's performance is demonstrated to meet criteria. There are two permissible deviations from the design and performance criteria:

1. Communication tests do not need to be conducted in the quadrant of the structure where a subslab suction point is located; and

2. Communication tests do not have to be performed in a specific quadrant if the test would be destructive to the area (such as carpet or hardwood flooring destruction) and if communication in the quadrant with the lowest vacuum, recorded during the original commissioning or recommissioning (whichever is most recent), is tested and is acceptable. It is IBM's intent, contingent on owner approval, to complete the communication testing at the point with the lowest commissioning/recommissioning vacuum.

Prior to leaving the structure with a completed re-commissioning, the maintenance team will apply a label (or update the existing label) that will identify the date of the re-commissioning. Updated labels will be placed beneath the existing label(s) so as not to obscure the older labels.

2.5 REQUEST CLOSE-OUT AND DOCUMENTATION

Following completion of the required re-commissioning activities, the maintenance team will complete:

- The Maintenance Request Form (Appendix B);
- All relevant Maintenance System Inspection and Re-Commissioning Forms (Appendix C); and
- Modifications of the As-Built drawing, if necessary.

The team will complete both a hardcopy and electronic version of these documents and submit the hardcopy along with the maintenance folder (described in Section 2.1) to the maintenance supervisor for review. The supervisor will review the forms for completeness and accuracy, and make changes as necessary (confirming changes with the field team as appropriate). The maintenance supervisor or designee will update the forms, as necessary, and print a final hard copy to be filed in the dedicated maintenance filing cabinet organized by property address. Marked-up versions of hardcopies will be saved in a draft file separate but attached to the maintenance folder for each respective property.

Each structure will have a hardcopy folder containing the latest and past maintenance files. Each file will be labeled with the structure's address. Electronic versions of all documents will be kept on dedicated space of a computer file server

If system modifications were made and/or structure modifications noted, this information will be entered in the Summary Table electronic database by the maintenance supervisor or designee prior to closing the maintenance request. In addition, a form letter (Maintenance Requests from Residents Completion Letter, presented in Appendix D.1) will be mailed to the property owner. The letter will be maintained electronically on the dedicated space of a computer file server. Hard copies of these letters will be sent to IBM.

3. ROUTINE MAINTENANCE

The routine maintenance program documents the process of conducting regular inspections of the ventilation systems to verify continued performance in accordance with the design and performance criteria identified in the design, IC/OC and data management protocols referenced in Section 1.1 and summarized in Table 2 of this work plan.

As discussed in Section 1.1, ventilation systems are categorized as either typical systems or special design systems for the purpose of performing routine maintenance. Lists of typical and special design systems are provided in Appendix E. The systems are identified by property address and building number and represent the system category as of December 2007. Sections 3.1 and 3.2 discuss routine maintenance of typical systems and special systems, respectively. Sections 3.3 through 3.6 describe scheduling, conducting and reporting the routine maintenance activities.

3.1 TYPICAL SYSTEMS

All typical systems will continue to receive an annual fan operational check.

A fan operational check verifies that the fan is operational. These checks can be performed by a variety of reasonable means including but not limited to auditory confirmation and physically touching the fan. All attempts will be made to perform the fan operational checks without entering the structures. IBM will document the means of each fan operational check. A field form provided in Appendix F will be used to document the fan checks.

Fan operational checks will also include a visual inspection of all exterior components of the system that are visible.

Fan operational checks will be initiated in September and completed no later than the end of November of each calendar year.

3.2 SPECIAL DESIGN SYSTEMS

This subsection describes the system inspections and preventive maintenance to be conducted on special design systems. Appendix G provides the field forms for documentation of the maintenance activities. Special systems include:

- Ventilation systems that incorporate direct ventilation of inaccessible crawlspaces, with or without supplemental heating equipment; and
- Systems that use building pressurization rather than subslab depressurization.

Supplemental heating was installed in some crawlspaces where the amount of outside air brought into the space was significant enough to create an incremental heat loss in the space. Heat recovery ventilators (HRVs) and electric baseboard heaters were used for supplemental heating.

A HRV is a packaged heat recovery unit comprised of an air-to-air heat exchanger, two fans, and filters. HRVs are used in lieu of single fan units to exhaust a predetermined quantity of air from inaccessible crawlspaces while supplying the same quantity of fresh air from outdoors. The HRV transfers heat between the outgoing and incoming air streams, allowing fresh air to be heated in the winter or cooled in the summer by the air exhausted from the crawlspace. An in-line electric booster heater is used to boost the final fresh air temperature when required. As of the date of this work plan, HRVs are installed in only two of the approximately 511 properties.

Table 3 lists the preventive maintenance requirements for HRVs. Field forms used to document these activities are included in Appendix G. In addition to preventive maintenance, the ventilation performance of HRVs will be tested. Air stream velocity measurements will be observed and recorded and compared to the original design target air stream velocity. Flow rate adjustments will be made if necessary and as indicated on the field form.

Electric heaters are used in some inaccessible crawlspaces where supplemental heating is required to substitute the heat loss due to ventilation of the crawlspace. In addition to the heating element, these heaters include an alarm thermostat, which energizes alarm lights and an audible alarm when the crawlspace temperature drops below a set temperature. As of the date of this work plan, electric baseboard heaters are installed at only six of the approximately 511 properties. Table 3 lists the preventive maintenance requirements for electric heaters. Field forms used to document these activities are included in Appendix G.

Building pressurization systems are installed in structures where subslab depressurization or ventilation was not feasible. Pressurization systems induce a slight positive pressure above the slab rather than a slight negative pressure under the slab. Pressurization is achieved by introducing more air into a closed space than is exhausted.

Each of these systems is a heating, ventilating, and air conditioning (HVAC) system. The two key components of the systems are the air handler and the space mounted pressure controller. The air handler is a package heating and cooling unit that delivers conditioned air to the occupied space, while pressurizing the space. The air handler is capable of mixing return air from the space with outside air and heating or cooling it as controlled by the space thermostat. In the mixing process, a greater percentage of outside air versus return air is introduced, creating a positive pressure in the space. The air handler delivers the conditioned air to the space through insulated ductwork above the ceiling and diffusers in the ceiling.

The pressure controller measures the pressure difference between the occupied space and subslab. The controller is interlocked with the air handler, controlling the amount of outside air required to maintain the pressure differential at a minimum of 0.004 inches of water column.

Table 3 lists the preventive maintenance requirements of the HVAC systems. The field form provided in Appendix G will constitute the documentation of these activities. In addition to preventive maintenance, the system's performance to create a slight positive pressure above the slab will be tested. The space pressure above the subslab pressure will be measured at one centrally located test point. The results of this test will also be documented on the same field form. The HVAC's pressure controller reading at the time of the test will be recorded as well.

As of the date of this work plan, building pressurization systems are installed at only two of the approximately 511 properties. Systems with electric heaters, HRVs and HVAC systems are identified in Appendix E

3.3 ROUTINE MAINTENANCE INSPECTION VISIT SCHEDULING

It is IBM's intention to provide the requisite routine maintenance and/or operational inspection to every ventilation system that has been installed, but it is ultimately up to the property owner to allow access to perform that maintenance. Requisite maintenance visits will be scheduled and implemented in an efficient and cost effective manner while accommodating the personal schedules of the property owners as much as possible.

Figure 2 illustrates the process of routine maintenance inspections of special design systems. It starts with scheduling a routine maintenance inspection visit with the property owner or resident, who will be called approximately four weeks in advance. One week prior to the scheduled visit, a telephone call to the owner will be made as a reminder of the date and time of the visit.

For typical systems, the property owner will be notified via the annual communication letter of an approximate time frame for the exterior inspection.

Access agreements on file from the original ventilation system installations constitute the ongoing approval from property owners for IBM to access their property and to conduct maintenance activities. Whenever property ownership changes, a new access agreement will be presented to the new owner for signature at the time of the maintenance visit.

The person performing the scheduling will:

- Maintain a routine maintenance log and mailing and phone log of contacts or attempts to contact residents; and
- Maintain a master schedule that documents the dates of each actual maintenance visit, as well as dates for planned visits.

3.4 FIELD MAINTENANCE FILES

Once the routine maintenance inspection visit is scheduled, a maintenance team will be assigned to complete the work, including an update of the structure field maintenance file. The structure field file will contain:

- Latest version of As-Built drawing;
- Latest copies of IC/OC or re-commissioning forms;
- Latest (if any) Maintenance Request Forms; and
- Copies of blank system inspection re-commissioning forms.

3.5 DOCUMENTATION

Following completion of the required routine maintenance activities at special design systems, the maintenance team will complete all applicable field forms (Appendices C and G). The maintenance team will complete both hardcopy and electronic versions of these documents and submit the hardcopies with the maintenance folder to the maintenance supervisor for review. The supervisor will review the forms for completeness and accuracy, and make changes as necessary (confirming changes with the field team as appropriate). The maintenance supervisor or designee will update the forms, as necessary, and print the final hard copies to be filed in the dedicated filing cabinet by address.

Each structure will have a hardcopy folder containing all maintenance files. Each file will be labeled with the structure's address. Electronic versions of all documents will be kept on a dedicated server.

If system modifications were made and/or structure modifications noted, this information will be entered in the Summary Table electronic database by the field supervisor or designee prior to closing the tracking number. In addition, a form letter (Routine Maintenance Completion Letter, provided in Appendix D.2) will be mailed to the property owners with special design systems. The letter will be maintained electronically on the dedicated server. Hard copies of the letters will be sent to IBM. The Routine Maintenance Log will be updated with a notation indicating a completed maintenance visit for the structure

As previously described, a field form (Appendix F) will be used to document the fan operational checks of the typical systems.

4. REPORTING TO AGENCIES

Within 45 days after the end of the heating season (March 31), an annual report will be submitted to the regulatory agencies (NYSDEC and NYSDOH) summarizing the following:

- Addresses and dates of routine and non-routine maintenance visits;
- Addresses that declined maintenance or were unresponsive.
- Description of repairs made; if any, and
- Dates of receipt and close-out of request.

The annual report(s) will be submitted for ventilation system O&M activities conducted during the previous heating season.

Additionally, non-routine activities conducted at individual properties will be documented in completion letters to the property owner. Hard copies of these letters will also be sent to IBM.

5. PROGRAM MANAGEMENT AND COMMUNICATIONS

In addition to managing the requests for maintenance from residents and routine maintenance of the ventilation systems, other aspects of the program need to be managed. The following subsections describe the activities that will take place to facilitate:

- Identification of pending new construction in the GVP ventilation area and the process for any design and installation effort if the property owner accepts an offered ventilation system;
- Tracking of property ownership changes to allow for continued communication with owners;
- Annual notification of IBM's offer of ventilation for property owners who for a variety of reasons declined previous offers to have a ventilation system installed;
- Reimbursement to property owners for the systems' energy usage; and
- Annual reminder to property owners of the existence of a ventilation system and of IBM's commitment to maintain the system, as required in the Action Plan.

5.1 NEW STRUCTURE CONSTRUCTION

New structures that are constructed within the Limits of Ventilation of the GVP and are qualified to receive a ventilation system will be offered one. The determination of whether a property is qualified to receive a ventilation system will be made in accordance with the Ventilation Decision Matrix approved for the project. New construction could include:

- Construction of structures on properties already containing structures;
- Additions to existing structures; and
- Construction of structures on vacant properties.

The Village of Endicott and the Town of Union will be asked to inform IBM of any building permits they grant for properties within the Limits of Ventilation of the GVP. The maintenance supervisor will contact owners of those properties, on IBM's behalf, to offer ventilation systems that can then be installed as part of the new construction. Other checks for new construction were discussed in Sections 2 and 3 where structure changes are to be discussed with the property owner and observed while conducting maintenance activities at a given property.

5.2 PROPERTY OWNERSHIP CHANGES

Transfer of property within the Limits of Ventilation of the GVP will require that IBM be notified of the change in ownership so that the new property owners can be contacted for maintenance purposes, electrical reimbursements, and general communication. The Town of Union has agreed to inform IBM on a quarterly basis of ownership changes that take place.

Within 30 days after being notified by the Town, the maintenance supervisor will contact the new owners to verify the change and to provide information to the new owners about their system, its operation and the ongoing O&M program. They will be given a FACT sheet and asked to sign an access agreement needed for subsequent inspection visits. The new ownership information will be added to the maintenance folder and program mailing lists.

5.3 PROPERTIES WITHOUT A SYSTEM

As of the date of this work plan, owners of approximately 14 properties have either:

- Declined a ventilation system;
- Have not responded to numerous attempts to contact them about a ventilation system;
- Have unsafe conditions that preclude the installation of a ventilation system; or

- Have other situations such that IBM has been unable to complete installation of a ventilation system at their property.

In the third quarter of each year, the maintenance supervisor will coordinate a communication program to contact the owners of these properties and restate IBM's offer of a system. The communication program will involve telephone calls and an annual communication mailing. A letter will be sent, via registered mail return receipt requested, explaining that the offer to have IBM install or complete the installation of a system is still available and provide contact information. This process will be completed annually. IBM will also attempt to contact these property owners by telephone.

All calls and call attempts will be logged in a telephone log. Copies of each of these letters will be maintained electronically on the dedicated space of a computer file server and filed in the structure's maintenance folder. Hard copies will be sent to IBM.

5.4 ENERGY COST REIMBURSEMENT

IBM reimburses property owners or residents for the operating costs of the ventilation systems. Payments by IBM are made to New York State Electric and Gas Corporation (NYSEG), who in turn credits property accounts based on electric and gas meter numbers and the calculated costs (see below) provided by IBM. At the beginning of each year, IBM's maintenance contractor will submit to NYSEG a list of property addresses, their respective meter numbers, and calculated annual electric and gas operating costs of the systems installed at that property. A preliminary list will be submitted first, and NYSEG will compare meter numbers to addresses and will confirm (or correct) that the data matches with the NYSEG database. After the preliminary list has been corrected and/or approved, NYSEG will credit each property's account for the requested amount.

The following variables affect reimbursement amounts and payees and must therefore be tracked so that information provided to NYSEG can be adjusted accordingly:

- Meter numbers;
- Percentage of year that the system is in operation;
- Percentage of year owner/tenant own/rent the property;
- Energy usage (fan quantity and model, special design system components); and
- Energy rates ($/Kwh or $/therm).

A conservative assumption is made that the energy usage for each system component is the maximum rated power draw according to the manufacturer. The energy rates for the upcoming year are estimated based on the highest for all categories (residential, commercial, etc.) and assuming two rate hikes through the year (March and September). During the preparation of reimbursement amounts for the following year, the assumptions used above for the current year will be reviewed. If the assumptions yielded underestimated energy costs, the difference will be added to the reimbursement amount for the following year.

Based on the above variables, changes in meter numbers, system components, and property owners and/or residents need to be identified so that reimbursement accounts and amounts can be updated on an ongoing basis. The maintenance activities described in Sections 2 and 3 include procedures to identify meter number changes and system component changes. The procedures described above in Section 5.2 will identify property ownership changes. Whenever these changes are identified, the maintenance supervisor is responsible for entering the changes in the energy reimbursement database. If the changes result in an increased reimbursement amount for the current year, the supervisor is responsible for submitting a request to NYSEG for reimbursement of the incremental amount.

As a quality assurance step, the maintenance supervisor will coordinate an annual audit of reimbursement data used to credit property accounts. Results of the audit will be documented in a memorandum.

5.5 ONGOING COMMUNICATIONS

During the third quarter of each year during the ventilation system O&M program, a letter will be sent to each property owner who has a ventilation system that will remind them of the following:

- How to check on the proper operation of the system;
- To keep the systems operating on a continuous basis;
- To contact IBM if there will be any structure changes or new combustion appliances;
- How to contact IBM for non-routine maintenance;
- Upcoming routine maintenance activities;
- The energy reimbursement program; and
- IBM's commitment to maintain their system.

In consideration of the new fan check procedure for routine maintenance of typical systems, as described in Section 3.1, it is expected that there may be some property owners who prefer the fan check take place inside the structure. Therefore, the letter will notify homeowners that a fan check during the heating season will take place outside the structure, and will offer property owners the option to schedule an in-home fan check.

System Inspection and Maintenance Activity Matrix

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Table 1
System Inspection and Maintenance Activity Matrix
Groundwater Vapor Project
Endicott, NY

	Maintenance Activity Requirements														
	FAN AND ELECTRICAL					PIPING, SLAB AND WALLS			CRAWLSPACE DATA		TEST DATA AND BACKDRAFT				
Description	Electric Meter	Equipment Documentation	Fan System	Electrical Check	Labeling Inspection	Piping Check	Slab Check	Wall Check	Inaccess. Crawlspace*	Access. Crawlspace*	Manometer Reading at Fan Inlet*	Manometer Reading at SSPs*	Communi-cation Test*	Backdraft Test	Redline Drawing
Fan change (same model/fan)	X	X	X	X							X				
Fan change (different model)	X	X	X	X	X				X[c]		X	X	X	X	X
Fan/stack relocation and installation	X		X			X					X	X			X
Fan guard installation	X					X[b]					X				
Housing damage	X		X								X				
Piping changes	X					X					X	X			
Piping improperly supported	X					X									
Leaking pipe joints	X					X					X	X			
Pipe size change of inaccessible crawlspace	X				X	X			X		X	X	X[a]	X	X
Pipe size change of accessible crawlspace	X	X			X	X			X[c]	X	X	X	X[a]	X	X
Inaccess. crawlspace penetration not sealed	X								X		X	X			
Access. crawlspace EPDM repair	X									X	X	X			
Replacement of inaccessible crawlspace valve	X					X			X[d]		X	X			
Replacement of accessible crawlspace valve	X					X			X[c]	X[e]	X	X			
Inaccess. crawlspace valve position change	X								X		X	X	X	X	
Accessible crawlspace valve position change	X								X[c]	X	X	X	X	X	
Slab SSP Valve position change, significant change in vacuum reading[g]	X								X[c]		X	X	X	X	
Replacement of slab SSP valve	X					X					X	X[e]			
Slab SSP penetration not sealed	X						X		X[c]		X	X			
Addition of SSP	X				X	X	X	X	X[c]	X[c]	X	X	X	X	X
Sealing floor cracks/expansion joints	X						X				X	X			
Dranjer installation/cleanout	X						X[c]				X	X			
Discovery of additional ventilation and/or combustion appliances	X								X		X	X	X	X	
Switch replacement	X			X	X										
Relocation of electrical service	X			X	X										
Redesign	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Routine Maintenance	X	X	X	X	X	X	X	X	X	X	X	X		X[f]	X

Notes:
[a] Unless the inaccessible crawlspace is on its own dedicated fan system.
[b] To be performed on modification only.
[c] If applicable.
[d] Valve to be set within +/-10% of original target velocity (see As-Built drawing).
[e] Set valve such that manometer reading is the same as last commissioning.
[f] Backdraft tests must be performed during routine maintenance on appliances that are located within spaces treated as inaccessible crawlspaces (spaces ventilated with air exchanges).
[g] Criteria is met if deviation is less than or equal to 0.25"wc (for all fans with the exception of the HS-5000). For an HS-5000 fan, criteria is met if deviation is less than or equal to 10% of the prior commissioned value or less than or equal to 0.25"wc, whichever is greater.
If deviation exceeds criteria (0.25"wc or 10% of prior commissioned value, as applicable), conduct communication testing and document below.
* These tests must be performed on the system before repairs are performed, in order to document "as found" conditions.

Ventilation System Design and Performance Criteria

O'BRIEN & GERE

Table 2
Ventilation System Design and Performance Criteria
Groundwater Vapor Project
Endicott, NY

Parameter	Criteria
Number of communication test points	One in each quadrant (minimum) [a]
Inaccessible crawlspace ventilation	0.6 air exchanges per hour (minimum)
Communication tests	> or = -0.004" w.c. vacuum
Allowable static pressure (without crawlspaces)	<1.6" w.c. vacuum (HP-175) <2.50" w.c. vacuum (HP-220) <4.25" w.c. vacuum (GP-501) <53" w.c. vacuum (HS-5000)
Backdraft	None induced
Open block walls	Tops sealed and smoke tested
Multiple suction points and crawlspaces	Valves and manometers installed on each
Membrane	Sealed and smoke tested
Walls and floors	Sealed and smoke tested
Special design condition	Documented through design memoranda and plans

[a] See exceptions to this criterion in Section 2.4.

Preventive Maintenance Requirements of Special Design Systems

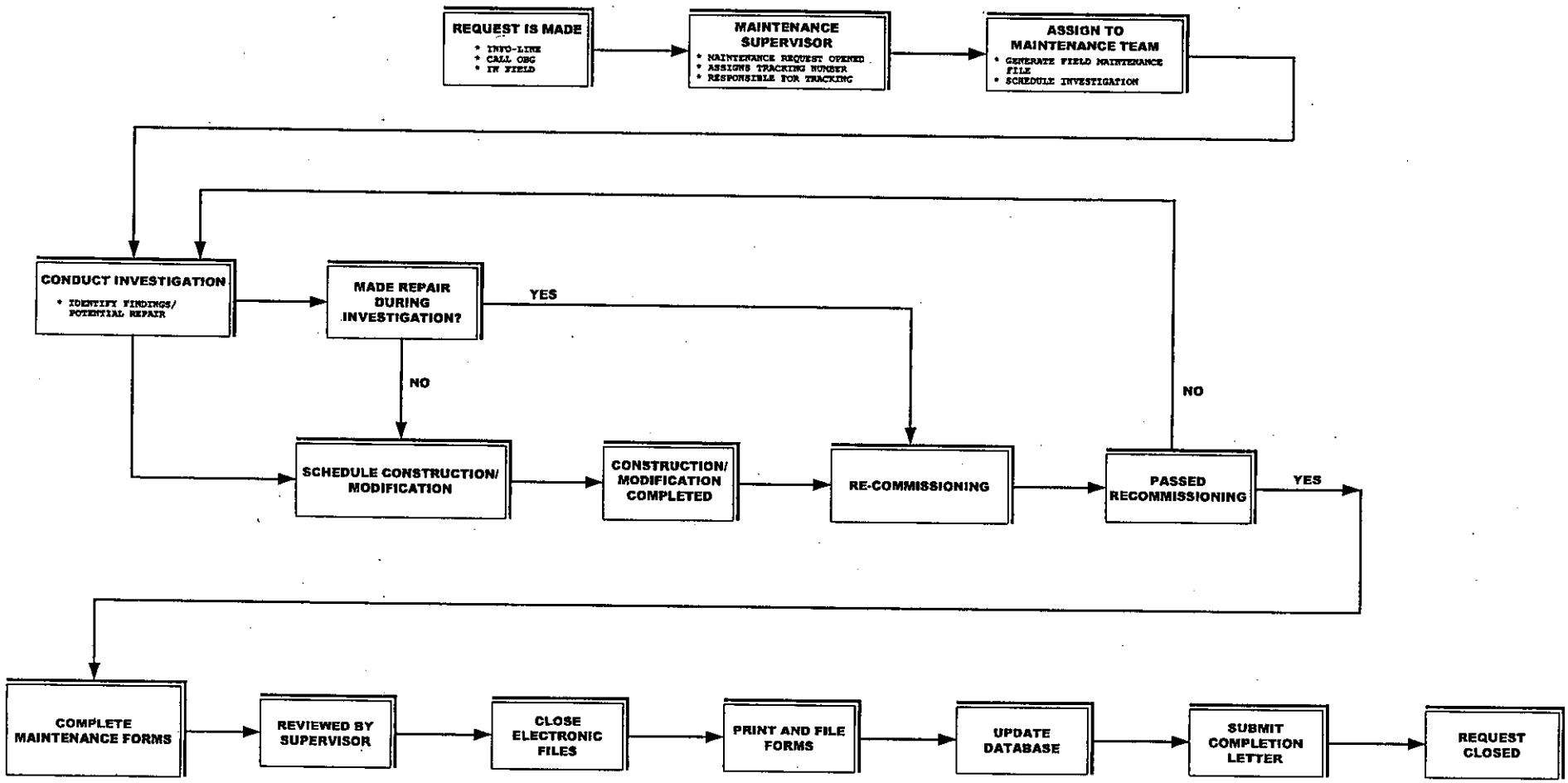
Table 3
Preventive Maintenance Requirements of Special Design Systems
Groundwater Vapor Project
Endicott, NY

Equipment Component	Preventive Maintenance Requirement	Frequency[a]
HRV	Inspect exterior air intake and exhaust hoods for blockages or restrictions	Annually
	Remove and clean filter and core	Semi-annually
	Clean condensate drain line (flush with warm soapy water)	Annually
	Inspect/clean HRV cabinet	Annually
Electric baseboard heaters	Clean heater of dust, dirt and debris	[b]
	Test control thermostat	[b]
	Test operation of alarm	[b]
HVAC	Calibrate pressure controller	Annually
	Change filters	Semi-annually
	Lubricate bearings	Annually
	Inspect fan belt	Annually, replace as necessary
	Clean drain pan and condensate drain	Annually
	Clean air handler cabinet	Semi-annually
	Clean evaporator and condenser coils	Annually

[a] Annual maintenance should be scheduled just prior to the start of the heating season.
[b] Performed in conjunction with regularly scheduled routine maintenance of ventilation systems.

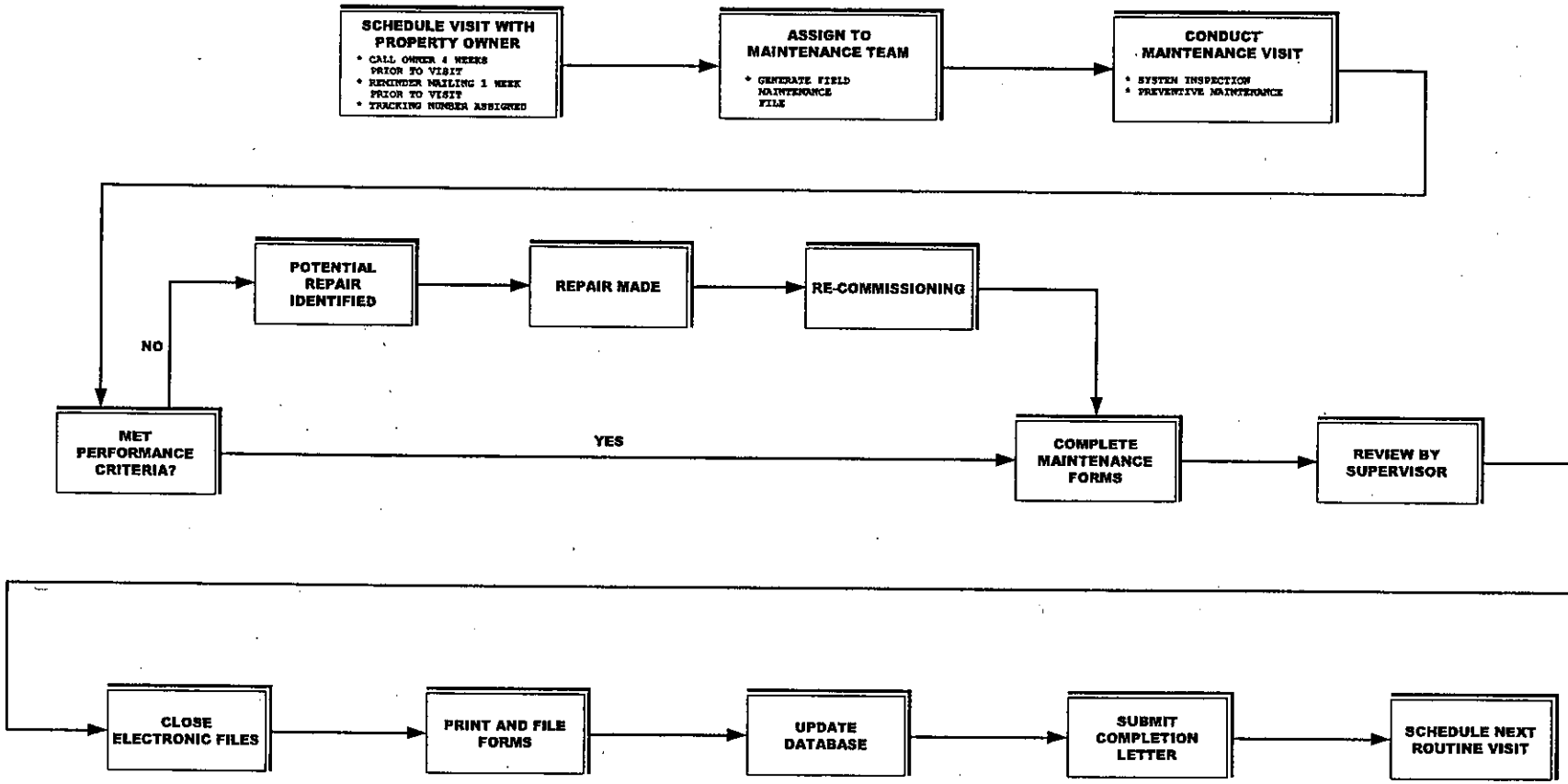
Maintenance Requests from Residents Flow Chart

FIGURE 1
MAINTENANCE REQUESTS FROM RESIDENTS
FLOW CHART



Routine Maintenance Flow Chart

FIGURE 2
ROUTINE MAINTENANCE
FLOW CHART



Maintenance Request Table

Maintenance Request Table
Groundwater Vapor Project
Endicott, NY

Tracking Number	Property Number	Street Name	Building Number	Date & Time of Call	Caller/Contact Info	Stated Problem	OBG Returned Call	Personnel Assigned	Investigation Date	Findings/Corrective Action	Construction Required	Construction Scheduled	Construction Complete	Action Item Complete	Modified IC/OC Required	Personnel Assigned	Date IC/OC completed	Comments	Action Item Complete

Maintenance Request Form

Maintenance Request Form
Groundwater Vapor Project
Endicott, NY

Date: _____ **Tracking Number:** _____

Time: _____

Requested By: _____

Address: _____

Requester's phone number: _____

Owner (if different): _____

Owners phone number (if different): _____

Request Taken by: _____

Problem Type

_____ 1. Fan Off
_____ 2. Fan Noise/Vibration
_____ 3. Condensate
_____ 4. Manometer
_____ 5. Wall/Floor (Including Dranjers)
_____ 6. Water in Basement
_____ 7. Leaking Building Penetration(s)
_____ 8. New Combustion Appliance(s)
_____ 9. Electrical Issue
_____ 10. Change to Building Footprint
_____ 11. Other

Stated Problem: _____

Investigation

Date: _____

Team: _____ Times on Site: _____

Findings: _____

Proposed Corrective Action: _____

Were structure changes noted: Yes _____ No _____

Repairs

Date: _____

Team: _____ Times on Site: _____

Actions Taken: _____

Was all work performed in accordance with current protocols:	Yes _____	No ____
Was redline drawing made:	Yes _____	No ____
Was the action reviewed with owner:	Yes _____	No ____
Was area left in the manner it was found:	Yes _____	No ____
Re-commissioning activities completed based on matrix:	Yes _____	No ____

Deviations/Comments:

_____

_____

_____

Supervisor Review:

Date: _____

Supervisor: _____

Forms completed fully: _____

Drawings updated as needed: _____

Maintenance Roll-up Updated _____

Database updated: _____

Completion letter sent: _____

All required activities completed and request closed: _____

Address: _____ **Tracking Number:** _____

System Inspection and Re-Commissioning Field Forms

System Inspection Field Form
Groundwater Vapor Project
Endicott, NY

STRUCTURE REVIEW

Routine or **Non-Routine** **(circle one)**

Address: _____ **Tracking Number:** _____

Have the following items changed since the last visit?

	Yes	No
Building Foot Print		
Basement/Slab Occupancy		
Heating / Ventilating Systems		
Crawlspaces		
Drains, Sumps, Floor Cracks		
Wall Penetrations, Cracks		
Appliances (in basement)		
Ownership		
Siding		

If any of these items have changed, a redesign may be required. Contact the maintenance supervisor for field review.

Deviations/Comments

_____

_____

_____

_____

_____

_____

Performed by: _____ **Date:** _____

O'BRIEN & GERE

System Inspection Field Form
Groundwater Vapor Project
Endicott, NY

FAN AND ELECTRICAL

Routine **or** **Non-Routine** **(circle one)**

Address: _____ **Tracking Number:** _____

Electric Meter Number
Prior visit: _____ Current visit: _____

Equipment Documentation

Prior Commissioning Date: _____

		Fan Inlet (' w.c. vacuum)		
Fan Model	**SSP#**	**Prior Commissioning**	**As found***	**As Left****

Fan System Inspection	**As Found***	**As Left****
Is each fan below its maximum vacuum? (HP220 = 2.5" w.c., GP501 = 4.25" w.c., FR-250 = 2.6" w.c., HS-5000 = 53" w.c., HP-175 = 1.6" w.c.)		
If fan vacuum is at maximum, measure velocity and record below (criteria >1 ft/min). *Measured velocity:* _____		
Fan cover in place?		
Each fan mounted securely?		
Coupling connections secure?		
Switch is locked in the ON position?		
Each fan starts/runs when switch is in the ON position?		
Each fan shuts down when the switch is in the OFF position?		
Is excessive noise heard when fan is running?		
Each fan induces suction when running?		

Electrical Check

Romex connections secure?		
Each junction box closed?		
Conduit properly supported?		
Are appliances affected by fan operation?		

Labeling Inspection

Labels applied?		
Correct labels applied in proper location?		

Deviations/Comments

* As Found conditions = before corrective action. [NA = Not Applicable]

** As Left conditions = after corrective action. [UC = Unchanged from As Found conditions]

Performed By: _____ **Date:** _____

System Inspection Field Form
Groundwater Vapor Project
Endicott, NY

PIPING, SLAB AND WALL

Routine or Non-Routine (circle one)

Address: _____ **Tracking Number:** _____

Piping Check	**As Found***	**As Left****
Glue is evident?		
System suction point seals are accessible?		
System suction points are sealed?		
Each component is installed?		
Piping system/stack is properly supported?		
Valves and manometers installed at proper locations?		
Excessive noise is heard in piping joints?		
Smoke test piping modifications and 10% of old joints?		
Did smoke enter joints?		
If Yes: Was joint sealed?		
Did smoke enter sealed joint?		
Slab Check		
Smoke each identified slab crack, repair, or modification?		
Did smoke enter?		
If Yes: Was area sealed with approved sealant?		
Did smoke enter sealed area?		
Checked/cleaned Dranjer(s)?		
Smoke Dranjer(s)?		
Is dranjer(s) in good condition?		
Wall Check		
Smoke each visible wall crack?		
Movement is observed at wall cracks?		
If yes: Crack was sealed with approved sealant?		
Smoke enters sealed crack?		
Smoke open course of top wall?		
Smoke enters top course?		
If yes: Open block sealed with approved sealant?		
Smoke enters open block tops?		

Deviations/Comments

_____

_____

_____

* As Found conditions = before corrective action. [NA = Not Applicable]

** As Left conditions = after corrective action. [UC = Unchanged from As Found conditions]

Performed by: _____ **Date:** _____

System Inspection Field Form
Groundwater Vapor Project
Endicott, NY

CRAWLSPACE DATA

Routine **or** **Non-Routine** **(circle one)**

Address: _____ **Tracking Number:** _____

Inaccessible Crawlspace

As Found*	Crawlspace 1	Crawlspace 2	Crawlspace 3	Crawlspace 4
SSP#				
Crawlspace Volume	cf.	cf.	cf.	cf.
Suction Pipe Diameter	in.	in.	in.	in.
Measured Velocity[1]	fpm	fpm	fpm	fpm
Flowrate	cfm	cfm	cfm	cfm
Number of Air Exchanges	hr-1	hr-1	hr-1	hr-1
Meets Criteria (Y/N)				

Is the measured velocity within +/-10% of original target velocity (see As-Built drawing)? _____

If answered no to this question, adjust valve accordingly and re-check all SSP and fan readings. If as-found measured velocity was less than 90% of the target velocity, conduct communication testing at point with lowest historical vacuum.

As Left*	Crawlspace 1	Crawlspace 2	Crawlspace 3	Crawlspace 4
SSP#				
Crawlspace Volume	cf.	cf.	cf.	cf.
Suction Pipe Diameter	in.	in.	in.	in.
Measured Velocity[1]	fpm	fpm	fpm	fpm
Flowrate	cfm	cfm	cfm	cfm
Number of Air Exchanges	hr-1	hr-1	hr-1	hr-1
Meets Criteria (Y/N)				

[1] *Velocity measured with Airflow Model TA45 hotwire anemometer or equivalent*

* As Found conditions = before corrective action. [NA = Not Applicable]
** As Left conditions = after corrective action. [UC = Unchanged from As Found conditions]

System Inspection Field Form
Groundwater Vapor Project
Endicott, NY

CRAWLSPACE DATA

Routine **or** **Non-Routine** **(circle one)**

Address: _____ **Tracking Number:** _____

Accessible Crawlspace

As Found*	Crawlspace 1	Crawlspace 2	Crawlspace 3	Crawlspace 4
SSP#				
Smoke test membrane joints and perimeter				
Smoke entered seam				
Manometer reading >0.1"				

As Left**	Crawlspace 1	Crawlspace 2	Crawlspace 3	Crawlspace 4
SSP#				
Smoke test membrane joints and perimeter				
Smoke entered seam				
Manometer reading >0.1"				

Deviations/Comments

_____

_____

_____

Baseboard Heater Preventive Maintenance (if present)

	Yes	No
Inspected and cleaned heater unit	_____	_____
Verified thermostat set points	_____	_____
Tested low temp alarm	_____	_____

* As Found conditions = before corrective action. [NA = Not Applicable]
** As Left conditions = after corrective action. [UC = Unchanged from As Found conditions]

Performed by: _____ **Date:** _____

O'BRIEN & GERE

SSP Manometer Readings and Re-Commissioning Field Form
Groundwater Vapor Project
Endicott, NY

TEST DATA AND BACKDRAFT

Routine or Non-Routine (circle one)

Address: _____ **Tracking Number:** _____

Manometer Reading at SSPs (" w.c. vacuum)

Note: For SSPs located in accessible crawlspaces with EPDM membrane, use the crawlspace field form to record the SSP manometer reading.

Prior Commissioning Date: _____

SSP#	1	2	3	4	5	6	7	8
Manometer Reading (Prior)								
Manometer Reading (As Found*)								
Meet Criteria?***								
Manometer Reading (As Left**)								

Valves and Manometers are installed in proper location? _____

*** Criteria is met if deviation is less than or equal to 0.25"wc (for all fans with the exception of the HS-5000). For an HS-5000 fan, criteria is met if deviation is less than or equal to 10% of the prior commissioned value or less than or equal to 0.25"wc, whichever is greater.*

If deviation exceeds criteria (0.25"wc or 10% of prior commissioned value, as applicable), conduct communication testing and document below.

Communication Test

As Found*	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
Test point Identifier								
Micromanometer Reading								
Distance to Closest SSP (ft)								
Did Smoke enter?								

As Left**	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
Test point Identifier								
Micromanometer Reading								
Distance to Closest SSP (ft)								
Did Smoke enter?								

All fans in operation during final communication test? _____
Winter conditions simulated? _____
Each test point tested? _____
Each test point sealed after testing? _____
Vacuum ≥ 0.004" w.c. observed at each test point? _____
All valves set prior to re-commissioning comm. test? _____

O'BRIEN & GERE

SSP Manometer Readings and Re-Commissioning Field Form
Groundwater Vapor Project
Endicott, NY

TEST DATA AND BACKDRAFT

Routine or Non-Routine (circle one)

Address: _____ **Tracking Number:** _____

Backdraft Test

Windows closed?		_____
Venting Appliances on?		_____
Doors closed?		_____
Combustion sources on?		_____
Backdraft Evident		_____
	Hot water heater	_____
	Furnace/Boiler	_____
	Fireplace	_____
	Dryer	_____

Owner notified of existing backdraft condition? _____
Was a previous backdraft condition present during any previous visit? _____

Redline Drawing

Piping redlines complete?	_____
Each switch and electrical tie in are identified?	_____
Cracks/penetrations are identified?	_____
As-built notes are complete?	_____
New ventilation devices identified?	_____

Deviations/Comments

_____
_____
_____
_____
_____
_____

* As Found conditions = before corrective action. [NA = Not Applicable]
** As Left conditions = after corrective action. [UC = Unchanged from As Found conditions]

Performed by: _____ **Date:** _____

Completion Letters

O&M Completion Letters
Groundwater Vapor Project
Endicott NY

[On IBM letterhead]

[date]

Dear _____,

This letter is sent to inform you that non-routine maintenance was completed on your ventilation system at your property at_____ on _____.

Your system is operating properly and no further maintenance work is required at this time.

Should you experience any difficulties with your ventilation system before then, or if you have any questions about the Groundwater Vapor Project, please call the IBM Information Line at toll-free 1-888-738-7968.

Thank you again for your cooperation and participation in IBM's Groundwater Vapor Project.

Sincerely,

M. E. Meyers

Mitch Meyers
Project Manger

O&M Completion Letters
Groundwater Vapor Project
Endicott NY

[On IBM letterhead]

[date]

Dear _____,

This letter is sent to inform you that routine maintenance was completed on your ventilation system at your property at_____ on _____.

Your system is operating properly and no further routine maintenance work is required at this time.

Should you experience any difficulties with your ventilation system before then, or if you have any questions about the Groundwater Vapor Project, please call the IBM Information Line at toll-free 1-888-738-7968.

Thank you again for your cooperation and participation in IBM's Groundwater Vapor Project.

Sincerely,

M. E. Meyers

Mitch Meyers
Project Manger

Existing Typical and Special Design Systems

CONTAINS CONFIDENTIAL DATA - TO PROTECT THE PRIVACY OF THE PROPERTY OWNERS APPENDIX HAS BEEN EXCLUDED FROM THIS DOCUMENT

Fan Check Field Form

O'BRIEN & GERE

Routine Fan Check of Ventilation Systems

Address Number	Street Name	Building #	Fan Operation Confirmation						Checked by (Initials)	Date	Comments/Findings	Corrective Measures	Date Completed
			Fan1	Fan 2	Fan 3	Fan 4	Fan 5	Fan 6					

Fan operation is confirmed by either of the following methods:
S: Sound form the fan can be heard.
V: Vibration from the fan can be felt.

Routine Maintenance Field Forms for Special Design Systems

Routine Maintenance Field Form
Groundwater Vapor Project
Endicott, NY

BASEBOARD HEATERS

Address: _____ **Tracking Number:** _____

Date of Last Maint. _____

Baseboard Heater Preventive Maintenance

	Yes	No
All Models		
Inspected and cleaned heater unit	_____	_____
Verified thermostat set points	_____	_____
Tested low temp alarm	_____	_____

Complete only for Model HVT 2411	Yes	No
Verify heater is dry and in good condition	_____	_____
Verify appropriate circuit breaker is closed (in the on position)	_____	_____
Mark current temperature setpoint using a pencil then lower temperature setpoint by adjusting thermostat until you hear the thermostate click	_____	_____
Verify that heater is energized and heat is being generated	_____	_____
Return thermostat to previous setpoint	_____	_____
Verify that heater is de-energized and heat is off	_____	_____

Deviations/Comments

_____

_____

_____

_____

_____

Performed by: _____ **Date:** _____

Routine Maintenance Field Form
Groundwater Vapor Project
Endicott, NY

HRV SYSTEM MAINTENANCE

Address: _____ **Tracking Number:** _____

Date of Last Maint. _____

Type of Maintenance (check one): Annual _____ Semi-annual _____

System Maintenance

	Yes	No
Inspected exterior air intakes and hoods (Annually)		
Cleaned (if necessary)		
Cleaned Core (Semi-annually)		
Cleaned Filter (Semi-annually)		
Cleaned condensate drain (Annually)		
Cleaned cabinet (Annually)		

System Testing

Target Air Velocity (from As-Built Drawing)	_____ fpm	
Measured Air Velocity	_____ fpm	
	Yes	No
Valve Reset Required (>10% difference from target)		
Valve Set to (if required)		
New Measured Air Velocity	_____ fpm	
Labels Completed and Applied		

Deviations/Comments

_____

_____

_____

Performed by: _____ **Date:** _____

Routine Maintenance Field Form
Groundwater Vapor Project
Endicott, NY

HVAC SYSTEM MAINTENANCE

Address: _____ **Tracking Number:** _____

Date of Last Maint. _____

Type of Maintenance (check one): Annual _____ Semi-annual _____

System Maintenance	Yes	No
Pressure Controller Calibrated (Annually)		
Filters Changed (Semi-annually)		
Bearings Lubricated (Annually)		
Fan Belts Inspected (Annually)		
Changed (As necessary)		
Drain Pan Cleaned (Annually)		
Condensate Drain Cleaned (Annually)		
Cabinet Cleaned (Semi-annually)		
Evaporator Coil Inspected (Semi-annually)		
Cleaned (Annually)		
Condenser Coil Inspected (Semi-annually)		
Cleaned (Annually)		

System Test (Pressure above slab)

Test Point Location _____

Micromanometer Reading _____ in wg

Pressure Controller Readout _____

If micromanometer reading is less than -0.004", notify maintenance supervisor.

Labels Completed and Attached		

Deviations/Comments

_____

_____

_____

_____

_____

Performed by: _____ **Date:** _____

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