

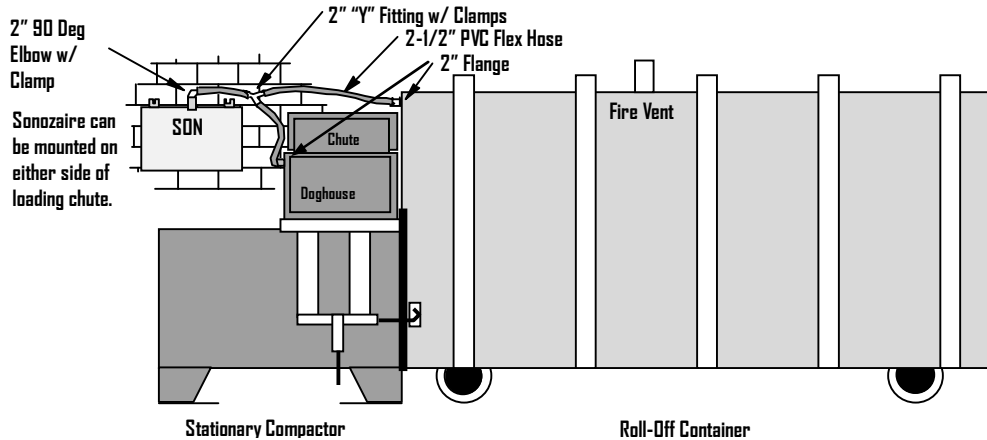
SONOZAIRE ODOR NEUTRALIZER

Application Section

WASTE MANAGEMENT INDUSTRY

COMPACTORS/CONTAINERS

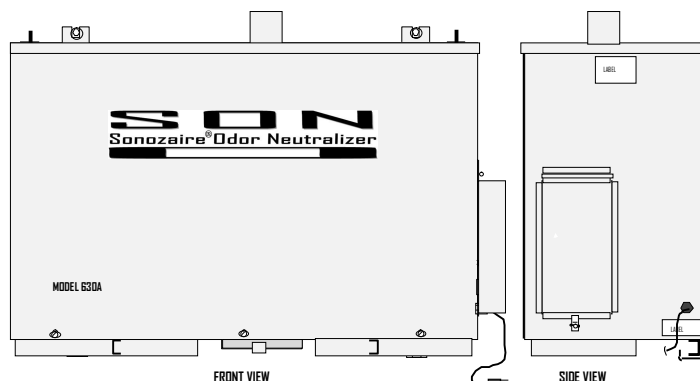
The Sonozaire units are recommended for garbage compactors/containers for the control of odors. Ozone controls or removes garbage odors, prevents fermentation, retards bacterial growth and slime production, destroys odors that attract pests (flies, bees, wasps, etc.), and provides cooling to the compactor/container. SON models help reduce customer/consumer complaints as well as neighborhood odor complaints, and operate without expensive chemicals or masking perfumes. The Sonozaire costs only pennies per day for operation and requires only periodic cleaning.



COMPACTOR AND ROLL-OFF CONTAINER INSTALLATION

Normally, the Sonozaire mounts separately from the compactor/container, and the ozone discharge is "piped" into the compactor/container. The Sonozaire works best if mounted indoors, where it has a cool, dry air supply and has the ozone piped outside to the compactor/container. If the Sonozaire is not mounted indoors, the unit should be installed where it will be protected from the weather or ordered with the weather protection option (not CSA approved). To prevent any moisture from draining back into the Sonozaire, mount it with the discharge higher than the connection point to the compactor. The piping can consist of PVC pipe type I (un-plasticized) or flexible PVC hose (ozone and sunlight resistant), flange(s), and a "Y" fitting, which may be required to direct the ozone to the desired locations. Use hose clamps on the items with hose connections, such as the "Y" fitting, but do not use hose clamps where the hose must be disconnected for removal of the container. It is essential that the Sonozaire output piping be placed in such a way as to avoid any possible clogging of the opening with garbage. Install the flexible hose or piping to prevent low points, which might become filled with moisture or debris and block the ozone flow into the compactor/container. It is advisable to place the Sonozaire outlet at the chute or ram end (doghouse) of a compactor and at the upper end of a container. Ozone reacts quicker when it treats the odor at the source. Do not locate hose or flange connections where ozone blows towards the chute door.

The SON units supply 60 cfm or 100 cfm of ozonated air and require a means for the treated air to exit the compactor/container. The fire hose vent will normally provide this exhaust means and should remain open. If there is no location for treated air to exit the equipment, then a vent location must be added.



SONOZAIRE MODEL 630A WITH CONTROL COVER AND WALL HANGER KIT

When a SON unit is in service, adjust the ozone level knob on the side of the unit to eliminate the odor. If objectionable garbage odor is detected in the general area around the compactor/container, increase the control knob. If excessive ozone is detected, decrease the control knob. Higher ambient temperatures require more ozone to treat the greater odor levels caused by heat.

SONOZAIRE ODOR NEUTRALIZER

Application Section

The type of garbage will also determine the Sonozaire model selected. If the waste contains a large amount of organic, odor-producing materials, such as vegetables, meats, eggs, etc., and the compactor/container size is near the maximum size indicated, then the next size Sonozaire is recommended. An example would be if a 25 or 30-yard compactor/container were used with large amounts of organic waste, then a model 630A is recommended over a model 330A. The same is true if the ambient temperature is physically hot such in states or countries where the temperature can exceed 95-100 degrees F. In those cases upsize the SON model if the container is near the maximum size indicated.

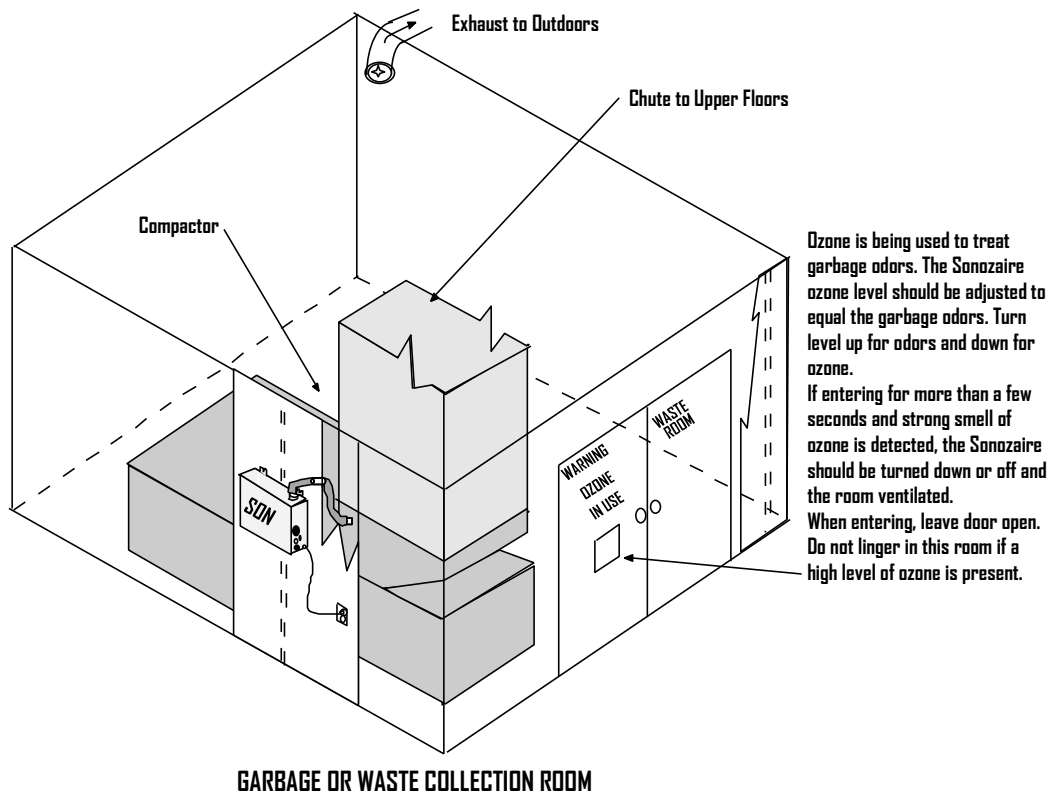
Compactor/Container Approximate Sizing:		
Model 115A	Model 330A	Model 630A
0 to 8 cu yd	8 to 30 cu yd	30 to 50 cu yd
0 to 6 cu m	6 to 23 cu m	23 to 38 cu m

GARBAGE ROOMS WITH OR WITHOUT COMPACTORS

When installing the SON in a compactor or garbage room, it is best to install it with the ozone piped into the compactor and attached to the chute or hopper. If possible, mount the Sonozaire outside the room and pipe into the room, and over to the compactor. A vent from the room to the outside is necessary to allow air to leave the room.

If the garbage room does not have a compactor or if it has an open container, then the room partially serves as the ozonated area. In all cases, the Sonozaire should have the output adjusted to equal the garbage odors. If ozone is noticed, lower the level control knob. If garbage odor is noticed, then increase the level control knob. There is no reason to saturate the room with ozone; just adjust the ozone output to what is necessary to control the odor. The ozone should be injected as close to the garbage as possible.

For an enclosed garbage room, certain precautions should be observed. A **warning sign** should be placed on the doors entering the room, warning that ozone is being used. It is also advisable that the door(s) remain open when entering the room. If anyone enters the room for more than a few moments and smells excessive ozone, then the Sonozaire should be turned off. The room should then be mechanically ventilated or a time period must be allowed for the ozone level to decrease. This time limit should be 15-30 minutes at a minimum. If anyone enters the room, caution should be exercised so that they are not exposed to ozone for prolonged periods. Ozone sensors that automatically control the ozone level are available. Please contact your distributor or factory for this option.



SONOZAIRE ODOR NEUTRALIZER

Application Section

This demonstrates that it is better to have the SDN mounted outside the room, so it is controllable without going into the garbage room. It is also easier to clean and provide any normal maintenance required without being in the garbage room. However, if the SDN is mounted in the garbage room, it should be mounted on the wall near the container. If a container is not used, the recommended installation is that the unit be mounted near a doorway and piped over to the treatment area. The room should allow some fresh air to enter, as the SDN needs fresh air as a source to make ozone. The SDN output piping should be routed in such a way as to avoid any possible clogging of the opening with garbage. Install the flexible hose or piping to prevent low points, which might become filled with moisture or debris and block the ozone flow into the compactor/container.

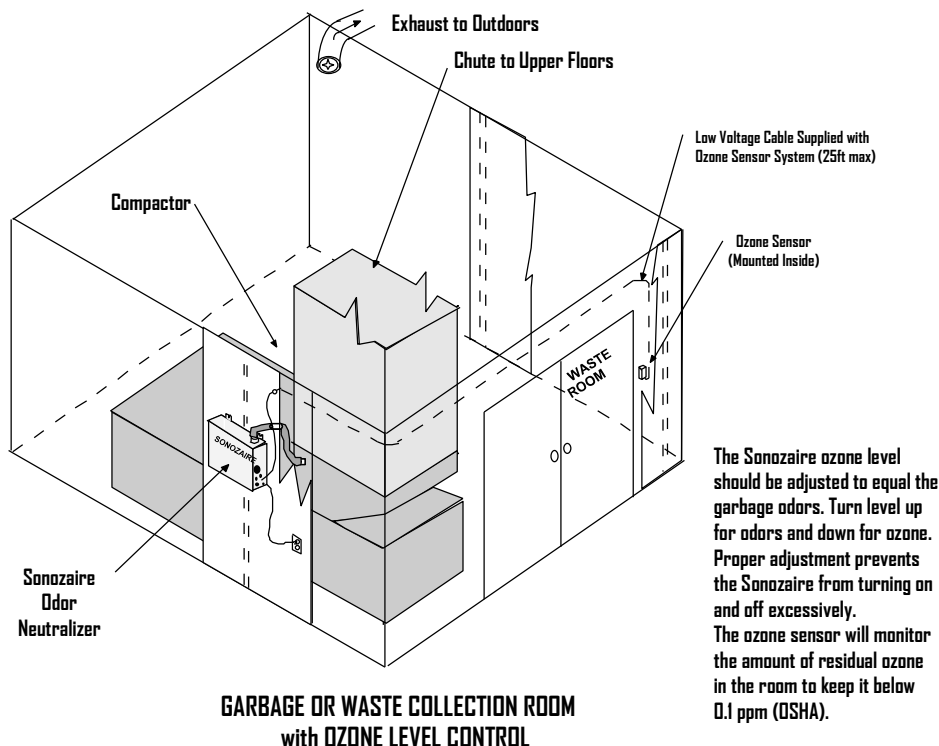
Often the garbage room or containers load from chutes coming from upper floors, and garbage bags drop down to the room or container. With this arrangement, the odors can draft upwards to the chute openings. Placing the SDN at the garbage area will generally solve this problem because the ozone will either destroy the odors at the source and prevent the odors from being drafted upwards, or if updraft is adequate then some of the ozone will be drafted upwards and destroy odors in the chute. If excessive ozone is noticed, lower the setting on the level control knob.

In garbage rooms or holding areas, the cubic yardage of garbage determines the proper selection of the Sonozaire model. It is not necessary to use the room volume when calculating, only the volume of garbage. Use the chart for the compactor container sizing based on volume. Below, however, is an estimated volume of room that contains some amounts of non-compacted garbage:

Garbage Rooms Approximate Sizing:		
Model 115A	Model 330A	Model 630A
405 to 3,240 cu ft	3,240 to 12,150 cu ft	12,150 to 20,250 cu ft
11 to 92 cu m	92 to 344 cu m	344 to 574 cu m

How much ozone is enough? When a SDN unit is in service, adjust the ozone level knob on the side of the unit to eliminate the odor. Typical initial setting is 50-60 on the output dial. In the garbage room, if objectionable garbage odor is detected, increase the control knob. If excessive ozone is detected, decrease the control knob. Higher ambient temperatures require more ozone to treat the greater odor levels caused by heat.

Some garbage rooms have minimal odors; therefore, it may not be necessary to operate the Sonozaire units 24 hours a day. In this case, the units can be ordered with the optional 12-hour timer with a hold-on feature. Another method of operation is to order the outdoor clock timer accessory that cycles the unit on and off periodically. In garbage rooms, ozone sensors are also available to turn on and off the SDN based upon residual ozone levels. The use of OSHA level sensors are most often used in garbage rooms in locations like mall food courts, or large company waste rooms where multiple employees are in and out of the room daily and a higher degree of control of the ozone level is desired or required.

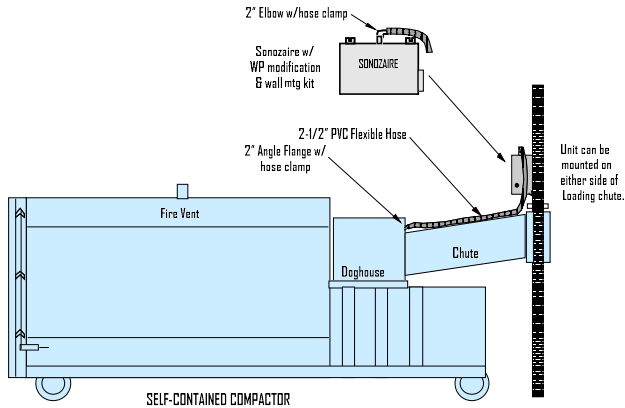


SONOZAIRE ODOR NEUTRALIZER

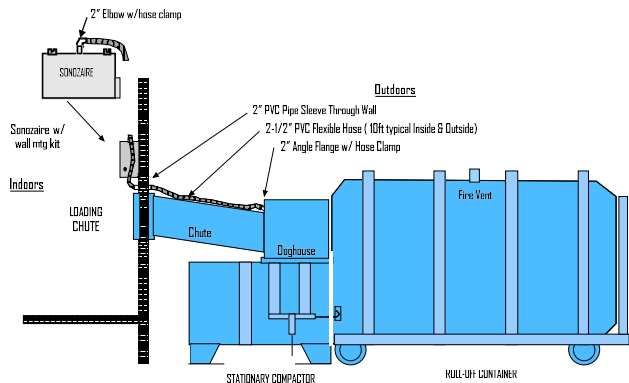
Application Section

The Sonozaire models can also be used in other areas of the waste management industry. They can be used with balers, packers, and at transfer stations. The SON units are to be used in a manner that prohibits excessive exposure to workers. Ozone can also be used to treat garbage trucks while they are not in use. Sonozaire units can be mounted on stands and have the ozone piped over to the refuse body for odor removal at nights, or during off-hours. The ozone destroys the odors and bacteria, improving the truck's sanitation for the employees.

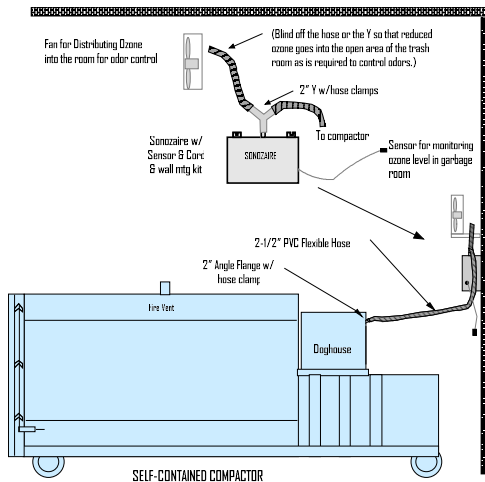
Below are some additional installation drawings showing various connections possible for different applications of compaction equipment.



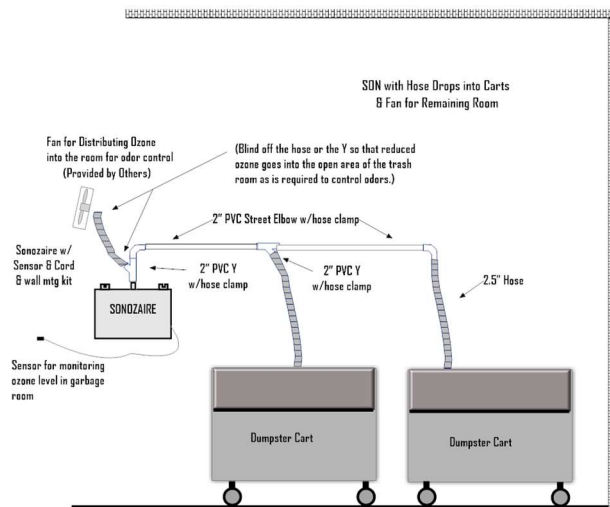
TYPICAL INSTALLATION OF SONOZAIRE ODOR NEUTRALIZER ON A SELF-CONTAINED COMPACTOR



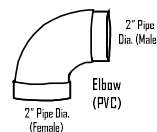
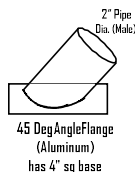
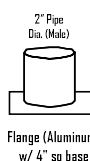
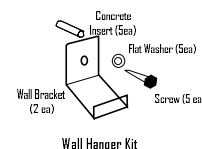
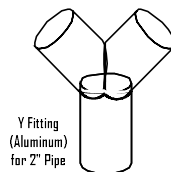
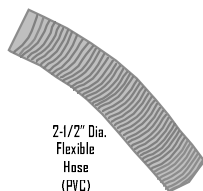
TYPICAL INSTALLATION OF SONOZAIRE ODOR NEUTRALIZER MOUNTED ON A STATIONARY COMPACTOR AND ROLL-OFF CONTAINER



SELF-CONTAINED COMPACTOR



Below are some optional items available to make installation easier.



SONOZAIRE ODOR NEUTRALIZER

Application Section

RESTORATION

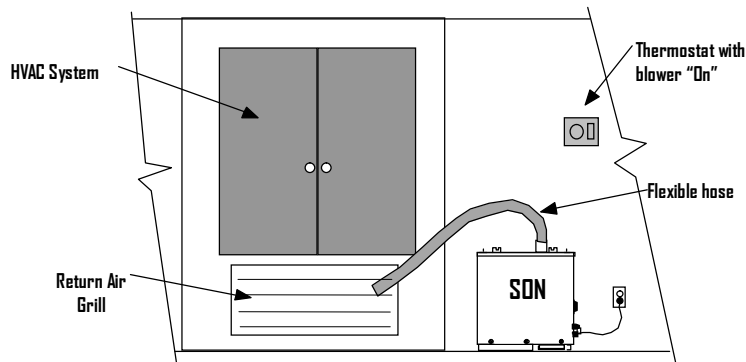
Removing odors in homes, apartments, hotels, motels, offices, buildings, etc., due to fire or flood, are businesses that utilize all models of the Sonozaire Odor Neutralizer. SDN units destroy smoke and mildew odors by the use of ozone. Fires cause smoke and soot to cover almost all surfaces, as well as penetrating within the wall and beneath the floor surfaces. Water damage can occur from floods, fire hoses, storms, etc. To treat all of the various damages several methods of treatment are typically required. Some methods include: thoroughly cleaning all surface areas, sealing exposed surfaces, replacing contaminated or damaged materials, and utilizing neutralizing counteractants such as fogging, thermal fogging, and ozone treatment.

Ozone is the method of choice for eliminating smoke odors from contaminated clothing, fabrics, draperies, books, paintings, or any moisture sensitive surface. Ozone works thoroughly because it permanently removes the odor. Even when other methods are utilized, ozone is often the final method to remove any traces of odors that have not been removed. If an item is composed of natural rubber or latex, it should not be treated, since ozone will disintegrate rubber. This does not apply to foam rubber cushions covered with fabric or synthetic rubber used in dry cleanable fabrics. If a rubber surface is exposed, then a dry silicon spray should be used to coat it before treating. Items to be considered are the back of drapes, rubber belts on electronic equipment, rubber rollers on cassette players, children's toys or dolls, furniture coasters, etc. Plants, especially moist type, should be removed if exposure time or concentration is high. Pets should be removed. If fish tanks cannot be removed, they should be covered to prevent excess ozone from getting into the water. Valuable items such as irreplaceable paintings should be removed and processed properly. Electronic items should be evaluated to determine if they should be opened and cleaned of soot and treated separately.

Ozone is effective in destroying mold and mildew and the odors they generate. Mold and mildew thrive in warm, moist environments. Therefore drying and dehumidifying the room or area is necessary. Ozone can be used to destroy the airborne mold and mildew spores. Ozone can also destroy small growths of mildew on walls, floors, items, etc. However, the exposure time needs to be a few days, at adequately high concentrations, to kill not only the surface of the mold and mildew, but also the spores that will migrate through the dead surfaces.

Ozone is normally dispensed by two methods for disaster restoration. One method is commonly referred to as "shock" treatment. This method consists of placing the SDN in a room and treating the room at maximum output with the room sealed. This method will blast or shock the room with a large dose of ozone, and allow it to penetrate all areas and seek out the odors. The residual ozone in the room needs to be exhausted, or vented, before inhabiting the room again. This method is often used in rooms or areas that have strong odors, perhaps from being closer to the fire or flood. The second method is referred to as "soak" treatment, and consists of exposing larger areas to smaller amounts of ozone. This method not only allows longer time for ozone to seek out the odors, but it also allows odors time to seep out of areas and mix with ozone. In both methods, additional circulating fans are necessary to provide the mixing of odors with ozone. Both methods can be used effectively, and each user should utilize the method that works best for the type of odor being treated.

Utilizing the SDN adjacent to the return air vent of a building's HVAC unit completes many disaster restoration jobs. The HVAC blower fan should run continuously. This utilizes the building blower to spread the ozone throughout the entire area, and provide a final treatment of any remaining odors. This method is an example of the "soak" method. If it is possible, use the HVAC in the cooling mode with the blower on constantly. The cooling mode has two beneficial effects. First, it keeps the building cooler and allows more ozone to form. Second, the cooling will remove much of the moisture that can be formed by the oxidization of odors.

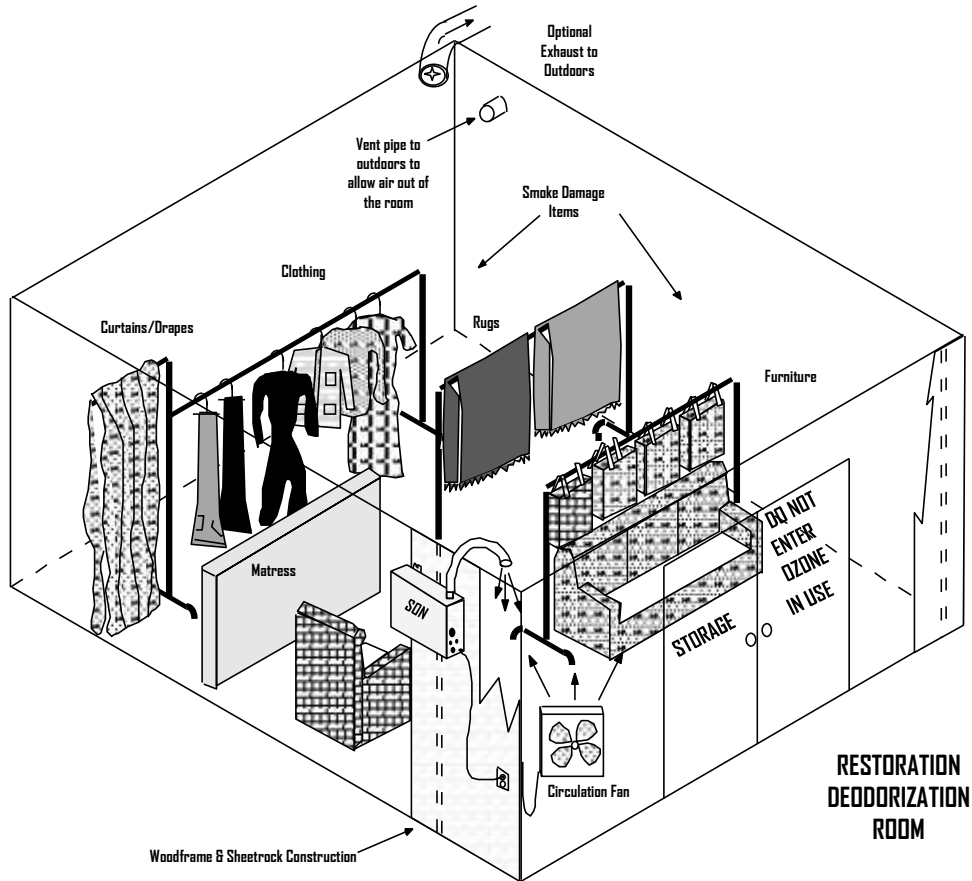


"SOAK" TREATMENT FOR RESTORATION

Many restoration contractors use Restoration Rooms similar to those utilized by dry cleaners, except the rooms are generally larger, since furniture is usually being treated in them. Items such as carpets, drapes, etc., are also treated. Many of these items may need additional services to them, which the restoration contractor is also providing. When using a restoration room, generally the treatment is "shock," although the items can be "soaked" by running the SDN at a lower setting for a longer period of time. Furniture treatment times typically can be between 12 and 48 hours. These restoration rooms require moving furniture to the room, but provide the convenience of complete control of the odor removal process. See also the Dry Cleaning section.

SONOZAIRE ODOR NEUTRALIZER

Application Section



Ozone is being used in all areas of restoration in concentration levels that exceed those recommended by OSHA, for inhabited areas; therefore, it is essential that warning signs be posted on all doors of rooms or buildings being treated. Nighttime treatment is recommended while all personnel are absent. It is useful to have timers or other external means of turning off the ozone generator. It is also important that methods of venting or removing any residual ozone from the room be used before entering. This will provide additional levels of safety. Wait at least 1.5-2 hours after Sonozaire units have turned off before entering the area to allow the majority of ozone to revert back to oxygen. Leave air circulation going in the room during the waiting time before entering, and introduce fresh air into the treated area after waiting period.

Always remember that flammable gases or liquids (including oils) should not be used where the gas or liquid can be drawn into the air intake of the ozone generator. Remember that the Sonozaire is an effective tool, but the best tool is the knowledge of the restorer.

Use the chart below to select the Sonozaire model that will provide the best ozone output for treating the size of buildings you normally handle in disaster restoration. Each machine can be used in larger areas, but the exposure time required will be longer.

Onsite Fire or Disaster Restoration Volumes:		
Model 115A	Model 330A	Model 630A
2,500 to 15,000 cu ft	6,000 to 150,000 cu ft	15,000 to 750,000 cu ft
70 to 425 cu m	170 to 4,250 cu m	425 to 21,240 cu m

Carpets often require cleaning and deodorization after a fire, flood, or other disaster. The treatment is typically part of the procedure of fire or disaster restoration previously described. However, cleaning the carpet requires additional steps. Most restoration companies send technicians to training seminars to provide instructions for cleaning carpets that work well for the particular disaster that is common for their area. An example would be that flood disasters are more common on coastlines and along rivers than on mountainous areas.

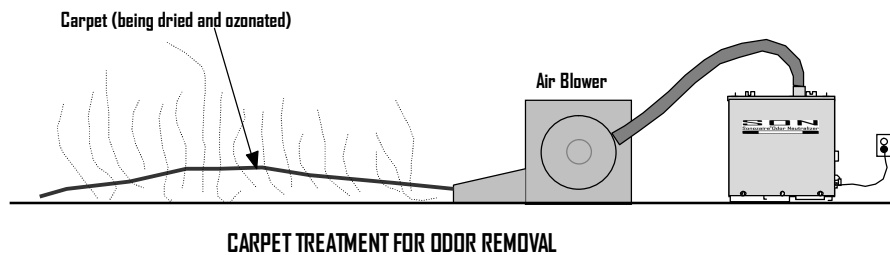
Some of the ideas below may be accomplished in slightly different methods, but the following ways have produced positive results. Use these suggestions as beginning guidelines, but experience and good procedures are the best tools available to a carpet-cleaning technician.

SONOZAIRE ODOR NEUTRALIZER

Application Section

One of the important items in carpet cleaning is that the carpet should be treated with the conventional methods to remove the contamination. Remove moisture as completely as possible. Sonozaire Odor Neutralizers produce ozone for removal of odors that are imbedded in the carpet and not removable by other methods. Do not use the Sonozaire unit or any electrical arc producing equipment if flammable gases are present. This is also true of cleaning products containing oil-based substances, including fragrant oils. Flammable gases and oils could ignition of the fumes that can cause, at minimum, smoke. Be careful and know what chemicals are being used.

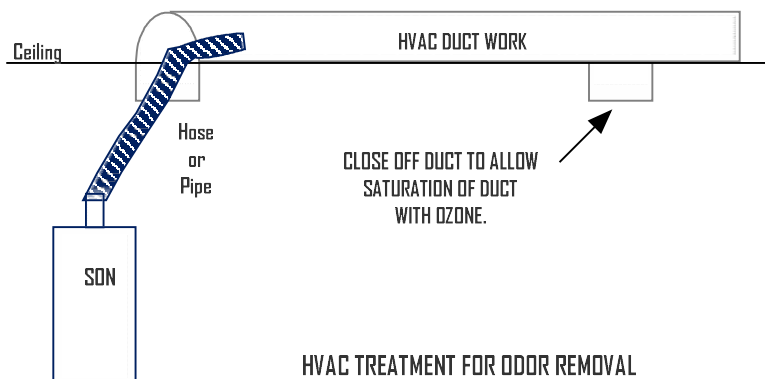
For onsite carpet cleaning, one of the procedures in removing moisture is to blow dry the carpet after cleaning. Forcing air beneath the carpet allows the air to absorb moisture in the carpet. To remove odors, such as smoke, mildew, urine, or fragrances from treatments, ozone is added to the air stream blowing under the carpet. The Sonozaire can be piped into the suction of the blower, or it can be piped so that it mixes with the air. The ozone will be diluted, and unless it is treated for a long period, it will not harm the carpet or its backing. Most rubber-backed carpets have material that is largely vinyl, which has good resistance to ozone. However, it is always advisable to know the carpet and to contact the manufacturer if any concerns exist concerning treatment with ozone. Please note that ozone is not recommended for mixing with moisture. However, it can be used during the drying of carpet. This is because the carpet, while being aerated, should contain very little moisture, and the ozone levels should be very low.



Carpets can also be removed from the premises and taken to a carpet treating facility where the treatment procedures include the use of ozone in at least one step. This treatment often is in the final step of the cleaning process where ozone is used to remove any remaining odors, including those caused by the other treatment phases. Ozone can provide a fresh smell to treated carpet that cannot be provided from other sources.

A difficult odor for most carpet cleaners to remove is that of urine, especially pet urine. Pet urine (including cats) consists of a lot of urea, creatine, uric acid, and other detoxified substances, along with sodium chloride and other electrolytes. Fresh urine has little smell, but bacterial decomposition causes the ammoniac odor to develop. Urine often penetrates into the wood or concrete substructure, as well as baseboards, wall materials, etc., and even after being washed, the odors can reoccur. Since oxygen and humidity will break down urine odors, then by using ozone, this process can be accelerated. If the urine area is small, or has only a slight odor, then treating directly with ozone without removing the carpet can often remove the odor. However, for more serious problems, pull back the damaged carpet and remove the affected padding. Clean and treat the substructure with water, enzymes, and/or antimicrobial. Clean both sides of the carpet thoroughly with lots of water and antimicrobial. After drying, the substructure can be coated with a sealant such as urethane, or both the carpet and the substructure can be treated with ozone before the sealant is applied. If the carpet has only slight odors, then direct the ozone onto the affected area. On greater odors, direct the ozone under the carpet and force the ozone to pass through the carpet. Put new carpet padding down and place the carpet over the area. Treat the entire room with ozone if any faint odors still exist.

HVAC duct cleaning often includes treatment with ozone. Typically the duct work is cleaned using conventional methods, and then ozone is used in the previously shown "soak" method, or it is piped up into the duct system without the HVAC blower operating for a higher concentration to destroy the remaining bacteria. The Sonozaire, equipped with flexible hose, can be routed into the duct system through one of the HVAC outlets.



SONOZAIRE ODOR NEUTRALIZER

Application Section

DRY CLEANING

Odor removal in the dry cleaning business is a service that is often overlooked. Fire and flood damage in homes, offices, storage facilities, etc., are areas where odor removal services can save the customer, or insurance company, the cost of replacing damaged items. The Drycleaning and Laundry Institute (DLI) recommends the use of an odor treatment chamber for removal of smoke and other odors from clothing, drapes, furniture, carpets, etc. Sonozaire models are ozone generators that are extremely effective in removing odors. In dry cleaning, smoke is the main source of odors. Ozone is used to oxidize the smoke odor into carbon dioxide (CO₂) and water (H₂O). Ozone also removes other odors caused by mildew, pets, urine, spoiled food, fish, sewage, tear gas, mothballs, ammonia, skunks, etc. Many clothing items are irreplaceable to their owners. Dry cleaners can remove the odor from garments and clean the garments successfully, which makes happy customers. Odor removal is an expansion that dry cleaners need to consider -- because if someone else provides the odor removal service, they are also providing the dry cleaning.

Silk, wool, cotton, synthetic fabrics, and other materials can trap odors that require treatment other than normal dry cleaning methods. Articles that contain odors should be treated with ozone before they are dry-cleaned. Most dry cleaning solvents lock in the odors, making it more difficult to remove. However, if garments must be dry-cleaned first, then ozoning afterwards can have some satisfactory results. If garments or fabrics are "dry clean only," then they should be acceptable for treatment with ozone in an odor treatment room. If the garments or fabrics are washable, they should be washed instead of treated by ozone. Verify that garments or articles are not composed of natural rubber (latex). Latex should not be treated, since ozone will attack rubber. This does not apply to foam rubber cushions covered with fabric or synthetic rubber used in dry cleanable fabrics. Some dry cleaners will dry clean the items that have elastic in them, and simply replace the elastic. If collar, cuffs, or waste band of dry cleanable items have elastic with latex and need to be treated, these should be treated for only very short time. These elastic bands can then be covered with plastic, and clipped or pinned in place to prevent exposure to ozone. If a rubber surface is exposed, then a dry silicon spray should be used to coat it before treating. If furniture is treated, remove the cushions and expose the surfaces of the fabric to the ozonated air.

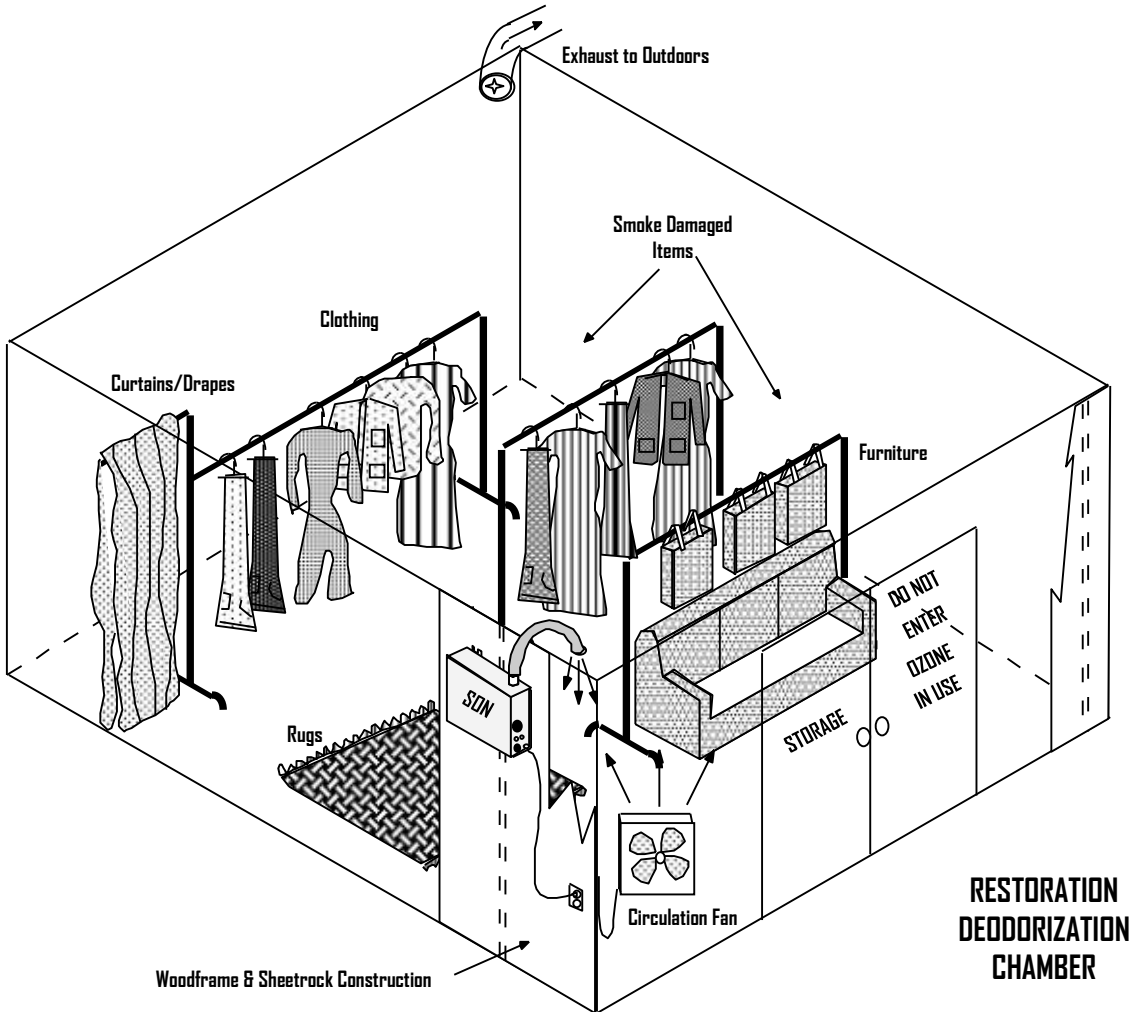
Remove any soot or residue from the garments by shaking or vacuuming, and hang them on racks with open buttons and zippers; leaving a minimum of three inches of spacing to insure exposure of entire garment surfaces to ozonated air. Thick garments, such as heavy wool coats or ski jackets, should be treated, turned inside out, and treated a second time. Treatment times vary with the type of odor, but 8-12 hours has shown to produce the best overall results. Fires that are classified as protein fires will typically require longer treatment times. Note that articles should not be treated while wet or moist. Ozone, when mixed with water, can form a mild form of hydrogen peroxide that can cause bleaching.

The odor treatment area is typically a sealed, dedicated room, which is uninhabited. The odor treatment chamber can be made out of sheetrock, plastic sheets, or can be an existing storage room, restroom, boiler room, etc. It should have a door wide enough to accommodate furniture. It should also contain a circulation fan to thoroughly mix the ozone with the odors. The Sonozaire can be installed inside the room, but works best if mounted outside the room and piped into the top of the room. This allows the controls and the on/off switch, or timer, to be operated without going into the room. Also, the ozone generator will produce the maximum level of ozone, with a constant supply of oxygen. A method of exhausting the room of ozone or forcing fresh air into the room is recommended. The room must have a ventilation path from the room as ozonated air is being forced into the room. If it is impossible to have an exhaust fan in the room, turn down the Sonozaire ozone level to zero and allow the blower to purge the room with air. Purging the room with one volume of air takes a minimum of 20 to 30 minutes (1200-1500 cubic feet). Please note that an "Ozone in Use" warning sign should be placed on the entry points into the room to prevent unwarranted entry into the treatment chamber. Locking the room is another method for further preventing workers from entering the room during treatment.

DO NOT ENTER!
Ozone Treatment in Progress.
Room must not be occupied
during treatment.

SONOZAIRE ODOR NEUTRALIZER

Application Section



**RESTORATION
DEODORIZATION
CHAMBER**

The most common method of treatment in an odor treatment room is to ozonate the articles at night while you sleep. This further minimizes chances of personnel exposure to ozone. If the odor load requires longer than a 12-hour treatment time, then turn the timer counter-clockwise and the model will stay on continuously until it is turned off. Allow between 90 minutes to 2 hours for the residual ozone to revert back to oxygen. Should quicker entry into the room be required, use the exhaust fan to ventilate the room. When an exhaust fan is operating, the door is opened slightly to allow air to be drawn into the room. Treatment can be performed any time of the day following all safety procedures to prevent exposure to ozone.

Below is the maximum room volume for selecting the proper model of Sonozaire to match the size of the user's room. Room volume is simply the length times the width times the height of the interior of the room. If additional information is needed, please contact the local dry cleaner association, DLI, NCA, or Sonozaire LLC for help.

Odor Treatment Chamber:		
Model 115A	Model 330A	Model 630A
1,700 cu ft	7,500 cu ft	15,000 cu ft
48 cu m	210 cu m	420 cu m

SONOZAIRE ODOR NEUTRALIZER

Application Section

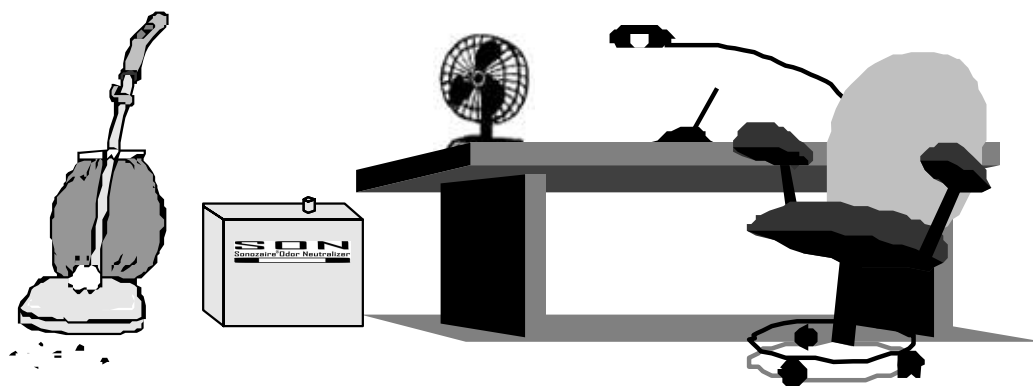
CLEANING MANAGEMENT

Cleaning management is a modern description for cleaning maintenance, janitorial services, and custodial duties. The new millennium brings a new emphasis on indoor air quality (IAQ). This requires cleaning management companies, from single entrepreneur to multilevel service companies, to be properly prepared to handle volatile organic compounds (VOCs), bacteria, and odor control. VOCs, bacterial disinfecting, and odor control can be handled in numerous ways, and ozone is one of the best methods. IAQ problems may consist of odors such as: fire/smoke, mold, mildew, paint, sewage gas, tobacco, athletic body odor, urine, chemicals, cooking, spoiled food, new installation materials, cleaning products, bacterial odors associated with illness or death, etc. Treatment with ozone is often used to improve IAQ in offices, stores, showrooms, bathrooms, malls, schools, health facilities, restaurants, clubs, warehouses, homes, etc. Ozone is a clean, easy, and thorough method of odor removal that can be added to present cleaning methods and does not require expensive chemicals.

Providing IAQ services are essential for buildings that are energy efficient and perhaps suffering from sick building syndrome in some degree. The Sonozaire Odor Neutralizer is an industrial strength ozone generator that can effectively improve IAQ. Ozone is generated from oxygen, and is an oxidizer that destroys odors by breaking them down into odorless compounds such as carbon dioxide, water, and oxygen. Ozone destroys most bacteria by breaking into the cellular membrane and disrupting the enzymatic system. Treating a room or area for a short time may be all that is necessary to remove the odors and keep bacteria destroyed. Studies show that clean air promotes less absenteeism, and reduces illnesses of unknown origin. Cleaning management firms can include the IAQ improvements along with their general services, or they can offer these services when requested. These services can improve the air quality, satisfy your customers, and increase profit margins. Most IAQ programs include cleaning with chemicals using environmental friendly components. Ozone is produced from oxygen and will revert back to oxygen. Advantages of using Sonozaire to improve IAQ are they operate unattended, they reduce the labor costs, and existing employees can be taught how to use the Sonozaire models easily and safely.

A common method of treatment for a single office, room, etc., is after the cleaning technician completes the normal room cleaning, simply move the Sonozaire into the room, adjust the ozone level and time desired, and let it operate. If the room is large, an additional fan or blower may be necessary to thoroughly mix the room odors with ozone. Since the Sonozaire models produce ozone levels above OSHA and NIOSH levels, no one should be allowed in the room during treatment.

If an entire building, floor, etc. has a central air handler and has an IAQ problem, locate the machine near the return grill and turn the thermostat fan from the "automatic" to the "on" position. This causes the air handler to operate continuously and allows the ozonated air to be drawn through the air handler and circulated throughout the affected area. When areas are being treated via ductwork, make sure that workers or other personnel are not in the treatment area. After treatment by ozone, allow at least 1.5-2 hours before entering the area. If ozone is detectable, wait an additional hour. Large areas are treated with smaller levels of ozone, while small areas, where odor problems can be pinpointed, are treated with higher concentrations. Always secure the areas being treated and place a warning sign on all doors. The sign should indicate that ozone treatment is in progress, and the room should not be entered. At end of treatment, return the thermostat fan switch to the "automatic" position.



SONOZAIRE USED IN CLEANING MANAGEMENT

SONOZAIRE ODOR NEUTRALIZER

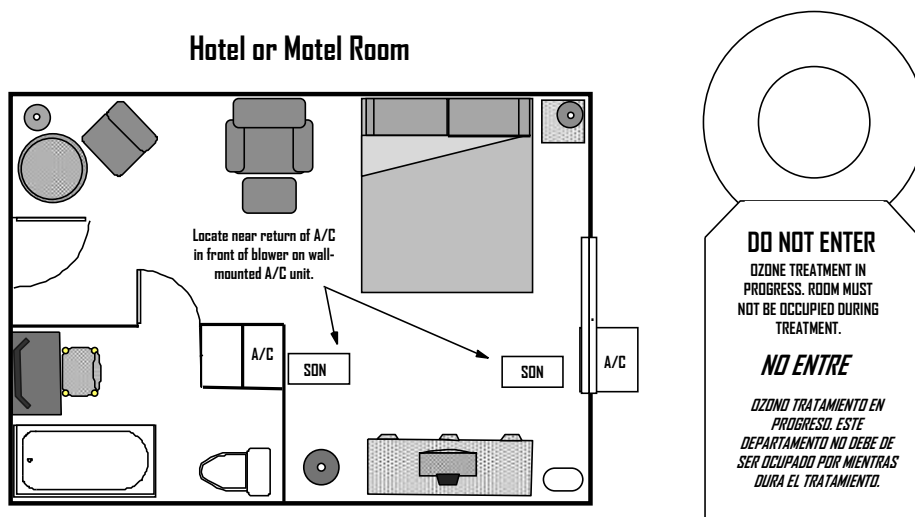
Application Section

HOTELS/MOTELS/APARTMENTS/CONDOMINIUMS

Hotel/motel rooms often hold odors such as tobacco smoke, which may prevent the room from being occupied by someone who requests a nonsmoking room. Someone moves out of an apartment and leaves behind smells such as tobacco smoke, spoiled food, mildew, pet odors, urine, or perhaps odors caused by someone being sick. Fresh paint smells often require removal before someone will rent the apartment. The condo has been closed up for several months and the musty smells are awful.

If any of the above "smells" familiar, what can be done about it? The method that has been proven extremely effective is to destroy the odor by using the Sonozaire Odor Neutralizer. Ozone effectively destroys the odors in a short time for these applications. Odors can be removed and a clean, fresh smell produced. The model 105A is the unit most often used for hotel/motel rooms, but the larger 115A is also quite popular especially for larger rooms, conference rooms, or ballrooms.

After the cleaning person completes the normal cleaning of the room, they turn on the wall-mount air conditioner blower to run continuously and plug in the Sonozaire near the air conditioner blower. The Sonozaire model should have the output adjusted to a preferred level and the optional timer adjusted. The cleaning person should leave the room and allow the ozone to destroy the odors. After the unit times off, the cleaning person should wait about 1 hour before entering and moving the unit to another room.



The purpose of turning on the air conditioner is to move the air around in the room. Air movement speeds up the reaction of ozone with odor molecules. If the A/C is a central unit, locate the machine near the return grill so the ozone will be drawn through the air handler and circulated throughout the room. Turn on the thermostat fan switch from "Auto" to "On." For a wall-mounted unit, place the Sonozaire so that the discharge from the air conditioner will blow and mix with discharge from the Sonozaire. Switch the A/C fan control to "On." Typical treatment time at maximum output would typically be approximately 1/2 - 2 hours for tobacco or similar odors. Longer times will be required for more severe odors. Lowering the output level requires longer treatment times, but is often preferred because of maintaining a lower level of ozone in the room.

The method for treating an apartment or a condominium is very similar to that of a hotel/motel room, except the treatment time needed may be longer. Since many apartments consist of several rooms, the Sonozaire can be placed in each room along with a fan. If a room can be closed off and treated without having excessive ozone escaping from the room, then personnel can simultaneously work in other rooms. Alternately, for treating the entire apartment, the Sonozaire may also be placed near the return air grill and use the central unit to circulate ozonated air throughout the apartment via the air ducts.

When treating a room, it is always recommended that additional air circulation be provided to insure a good mixture of odors with ozone. This is essential if the room, apartment, etc. does not have a central HVAC system. The ozone must be mixed in with the odors. Allow approximately 1.5-2 hours before entering a room after the Sonozaire has turned off. Introduce fresh air if possible.

The above descriptions are also applicable to real estate or rental property, which has been closed up for some time, or has odors. Before a property is shown, use the Sonozaire with the HVAC system as described above. Treat the property for a few hours to remove the stale air. Make sure that the Sonozaire has turned off and allow the ozone to revert back to oxygen before showing the property. Introduce fresh air by opening windows and doors.

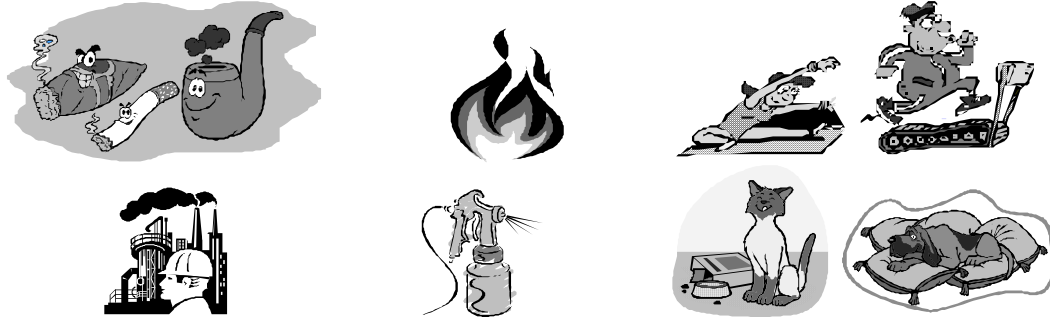
SONOZAIRE ODOR NEUTRALIZER

Application Section

INDOOR AIR QUALITY

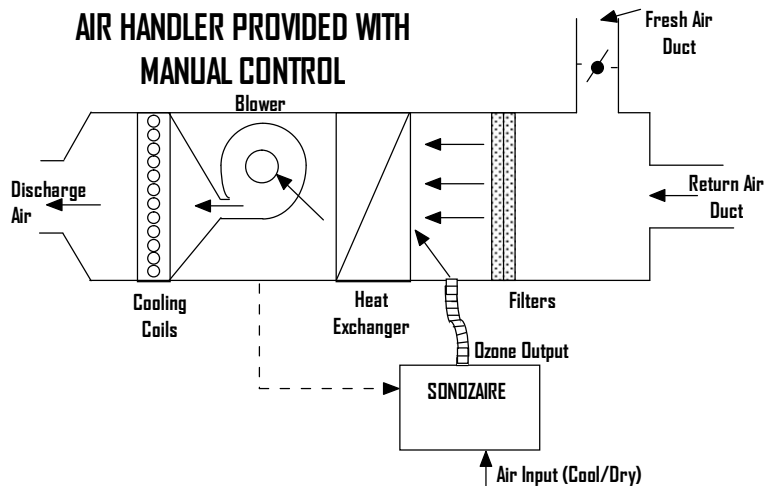
Indoor air quality is a current problem often associated with high-efficiency building designs. Buildings typically conserve energy by being more airtight, thus reducing the heating and cooling requirements, but resulting in less fresh or make-up air. This is a simple description that can lead to the "sick building syndrome" phenomenon. Air laden with odors, bacteria, impurities, etc., does not provide the fresh air sensation to occupants. However, using fresh make-up air is not always the solution to this phenomenon, as some fresh air taken in has more impurities than the indoor air being treated.

Additional problems with indoor air quality are tobacco smoke, fire/smoke, process odors, body odors from workers or athletic endeavors, pet odors, chemical odors, etc. Organic odors are unpleasant and result in stale, stuffy air. Fresh air is necessary, but is not always available as make-up air due to energy design, or outdoor air quality. Studies have advocated that people need fresh air. Poor air quality affects people in ways such as attitude, productivity, absenteeism, and sickness. Clean healthy air makes people work well and feel happier.



What can be done to improve indoor air quality? The first step is with air filters that are designed for removing some of the particulate that will be carried by air. Possibly, duct cleaning is the second step for removing odor-causing dust, mold, mildew, etc., which may have built up in the duct system. The third line of defense is ozone treatment of the air to destroy the odors and many of the bacteria, as well as deodorizing the air. Ozone is nature's method of freshening and cleaning the air. Ozone deodorizes by chemically reducing the odors to lesser compounds.

Offices, factories, warehouses, health clubs, casinos, bars, laboratories, schools, libraries, kitchens, restrooms, conference rooms, etc., all may need the Sonozaire models to purify the air. The simplest method of treating the facilities is to use ozone to treat the indoor air at periods of time when the building or rooms are unoccupied. This may be at nights, or weekends, or other periods of time when occupancy is zero. Ozone levels during off-hours should be adjusted to low levels, but levels that will clean and freshen the air. Timers are a method of turning on and off the Sonozaire machines. These units can be integrated into air handler controls for more advanced on/off switching. Ozone is not to be generated unless the HVAC blower is operating, so the units must be interlocked to air handler controls to switch on and off when the air handler cycles.



If a treatment area is to be occupied by people or animals, then the ozone unit must be controlled so that the ozone level will not exceed a 0.05 ppm ozone level. This is the lowest level is governed by the U.S. Food and Drug Administration. OSHA allows 0.1 ppm for an 8-hour day, 5-day week. Ozone level slightly above these, irritates the eyes, causes headaches, dries the throat, and stresses the lungs. When the air is stale or foul, ozone can freshen the air, and when properly controlled, will not expose anyone to excessive amounts of ozone. The Sonozaire units are industrial ozone generators that can be equipped with ozone sensors, controls and timers for automatically turning on and off the ozone generation sections to keep ozone use safe.

Application Section

The diagram illustrates the installation of a Sun Pro Air Purifier. The unit is shown with a flexible hose connected to the HVAC system. A thermostat is connected to the unit, and an O3 sensor is also connected to the unit. The unit is labeled "SUN Pro Air Purifier".

CONNECTION TO HVAC FOR AIR QUALITY CONTROL

AIR HANDLER PROVIDED WITH OZONE LEVEL LIMIT

The diagram illustrates the airflow and components of an ozone generation system. Air enters from the right through a "Fresh Air Duct" and a "Return Air Duct" (labeled "Return Air Duct" with a switch). This air passes through "Filters" and a "Blower" (indicated by a circular arrow). The air then flows through "Cooling Coils" and a "Heat Exchanger" before being discharged as "Discharge Air". A "Flex Hose" connects the "Heat Exchanger" to the "SONOZAIRE" unit. The "SONOZAIRE" unit has an "Air Input Cool/Dry" at the bottom and an "Ozone Output" at the top. A "D₃ Switch" is also shown near the "Ozone Output".

Please note that if ozone levels require measuring, then several methods can be utilized. First, ozone tags or badges are designed to change colors at low levels of ozone. Second, manual vacuum pumps and dragger tubes for measuring ozone levels can be used. Third, digital monitors for measuring ozone concentrations can be utilized. Many of these systems require engineering expertise and system installation. Please contact Sonozaire LLC for companies specializing in systems with ozone monitors, which will switch on when ozone is detected. The companies often provide other air quality services such as filters, duct cleaning, etc., and can do a complete system installation.

SONOZAIRE ODOR NEUTRALIZER

Application Section

VEHICLES

Removing odors from cars, vans, trucks, RVs, limousines, etc., can be difficult, if not impossible, using normal cleaning methods, and the expensive chemicals, or fragrant sprays. However, using ozone can turn a difficult problem into a profitable solution. Vehicles often are plagued with numerous odor problems, with the largest problem being tobacco smoke. Other common odors are: mildew, pets, sour milk, foods, decaying matter, vomit, body smells, urine, skunk, and general stale air odors. Ozone breaks these odors into chemical compounds that do not have odors. After treatment, and allowing adequate time for the ozone to change back to oxygen, the vehicle will have a fresh, clean, pleasant aroma, compliments of ozone.

Most car detailers, pre-owned car dealers, rental car companies, taxi companies, limousine services, bus services, RV rental and sales, yacht owners, etc., need to remove some of the odors described above. Vehicles that are clean and smell clean make happy owners, happy riders, happy renters, happy buyers, and happy sellers. All of this can be accomplished by adding an odor removal service to the normal cleaning already being provided. Purchasing Sonozaire is an inexpensive, one-time investment that requires no expensive chemicals.



The method of treating vehicles is simple. The vehicle should have the normal cleaning procedures such as cleaning, vacuuming, shampooing, etc. Finally, the vehicle should be treated for odor removal. Allowing a Sonozaire to blow ozone into the vehicle, destroys the odors, and provides that desired clean smell.

Do not treat the vehicle when the interior is hot, only when it is cool. Place the vehicle in a shaded area, and turn on the air conditioner and cool it down. Heat destroys the ozone before it can react. Place the Sonozaire on the ground near one side of the vehicle and route the flexible hose from the discharge nozzle into the window. Roll up the window until it will hold the hose in place. Then drape a towel or similar item over the remaining opening of the window. On the opposite side of the vehicle roll down another window about ½ to 1 inch to allow air to exit. This serves as a vent for the ozonated air being forced into the vehicle. Next, close all the vehicle doors until the only openings are the hose into the window, and the opposite window slightly opened.



Switch on the Sonozaire and adjust the ozone output to the desired level. For first time users, or for minimizing the treatment time, turn the generator up to the maximum setting. Treatment times will vary based on a few variables, such as the degree of the odor itself (most important), temperature of the vehicle, humidity of the outside air, and full voltage to the Sonozaire. Treatment times will vary typically from 30 minutes to 2 hours. Extremely large areas, such as vans, buses, RVs, limousines, etc., may take a little longer if the odors are extreme. Conversely, if the odors are not strong, then the times will be shorter.

SONOZAIRE ODOR NEUTRALIZER

Application Section

The Sonozaire models are industrial ozone generators and produce amounts of ozone that exceed OSHA levels for inhabited working environments. Do not sit in the car when treating with ozone or expose anyone to excessive amounts of ozone. Once the Sonozaire has been turned off, the ozone will revert back to oxygen within 90 minutes to 2 hours. A good procedure is to turn the Sonozaire level knob to zero and allow the Sonozaire fan to continue blowing. This will force the remaining ozone out of the car, allowing faster re-entry. And to speed up decay of ozone windows and doors can be opened for a few minutes after treatment to dilute any remaining ozone. Additional method to protect against excessive ozone is to use respirators with ozone cartridges.

Before starting the ozone treatment, crank the engine of the vehicle and place the air conditioner in the re-circulate mode so that the ozonated air will be circulated through the vehicle ductwork, removing existing odors. The recommended time for duct treating is 10-15 minutes, minimum. Begin treatment of the vehicle with ozone after exiting the vehicle. After the designated time, turn off the Sonozaire, open the door and turn off the vehicle. Do not linger in the vehicle, but exit and restart the ozone treatment for the remaining time period.

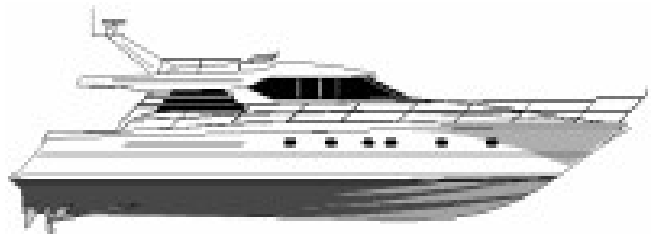
Additional treatment ideas include placing a small circulating fan inside the vehicle to circulate ozone better. Place the Sonozaire inside large vehicles. Move the hose in the window to direct ozone flow into the front seat area and later direct it to the back seat area. If possible, ensure that ozonated air goes under the seats to areas that might contain odors. Direct the ozone flow toward problem areas. After treating, allow the vehicle approximately 15-30 minutes with the windows closed. Then roll down the windows and open the doors and windows for 15 minutes. If slight ozone smell lingers in the vehicle, drive with windows down to air out as necessary.

A method of treating two vehicles simultaneously is shown below. For treating more than one vehicle, it is recommended that a small fan be used in each vehicle to ensure good airflow. If only one vehicle is being treated, cap off the remaining hose.



Natural rubber surfaces are vulnerable to ozone. It is recommended that a dry silicon spray be applied to coat and protect rubber surfaces. Older autos and antique vehicles will have more natural rubber items than new vehicles. Neoprene door gaskets on newer vehicles should not require protection. Remove the item or silicon-protect any items that are believed to be rubber. Treatment times for leather seats should be limited to a few hours and for extreme odors a maximum of eight hours should not be exceeded unless the seats have a protective coating applied to them.

If any waterproofing or stain resisting fabric treatment is to be applied to vehicle seats, carpets, or headliners, deodorize with ozone before applying the fabric treatment.



SONOZAIRE ODOR NEUTRALIZER

Application Section

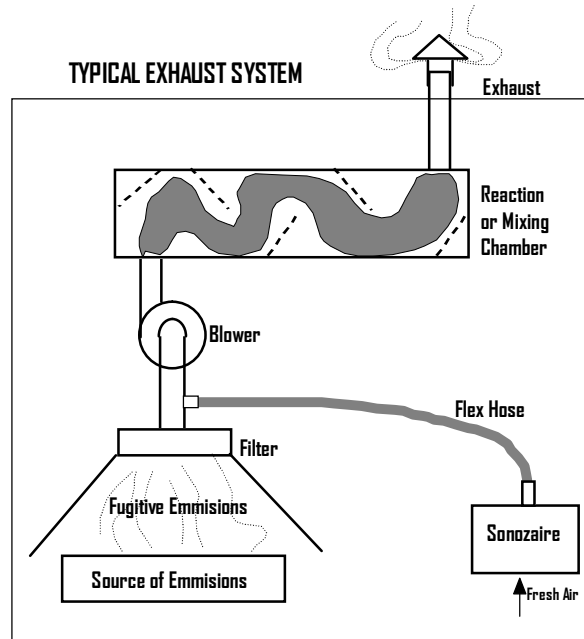
EXHAUST GAS TREATMENT

Ozone in exhaust gas treatment has been used successfully for many years. The basic principle involves adding ozone into the exhaust air stream containing the malodorous compounds. The ozone is diluted when added to the larger airflow of the exhaust, but when added in proper ratios, will eliminate the odors by oxidizing them. Sonozaire models can be used in exhaust systems for commercial kitchens, restaurants, cafeterias, food or fish processing facilities, rendering facilities, chemical plants, rubber compounding, paint spraying, sewage treatment, etc.

Ozone must be added to the suction side of the exhaust and should not be used directly in an area where people are present without proper control. Ozone is an oxidizing agent, and exposure to people must not exceed 0.1 ppm for an 8-hour day, as determined by OSHA. An exhaust ductwork system serves well as the confined area for ozone reaction with odors. The exhaust draws the ozone into the duct and prevents leakage into the general area. The exhaust gas must be vented outside the building.

The concentration, or intensity of the odor, is usually where complaints begin. Some odors are detectable, but are not unpleasant at limited levels. However, given higher levels, the threshold concentration can cause odoriferous problems. In many cases, the malodors do not have to be eliminated, only lowered. The odor problems may only occur during peak periods of operation, and it may be possible to control the concentration by using small levels of ozone during these periods.

The temperature and humidity in exhaust systems also affect the amount of ozone required for odor control. Ozone is generated in higher quantities at low temperature and humidity conditions, but reacts quickly in a warm, slightly humid, environment. However, it can react too quickly if the temperature or humidity is too high. Generally, the exhaust gas temperature where the ozone is injected should not exceed 130 degrees F and 90% relative humidity. The best location for a Sonozaire is to mount it in an area with cool, dry air as the main air source, and pipe the discharge over to the connection point to the ductwork.



In most exhaust systems, the retention time of ozone treating should be a minimum of 3-4 seconds. The time period is from the point of injection of ozone to the discharge of the exhaust outside. Longer retention times will produce better results, specifically if the mixing of ozone with the air is inadequately designed. Determine the retention time by finding the cfm of the exhaust fan (i.e., 2000 cfm), calculating the volume of the duct, and then dividing by 60 (sec/min). Calculating the duct volume is accomplished by the following calculations:

Round duct Volume in cubic feet	$V = (D/2) \times (D/2) \times 3.14 \times L$
Rectangular duct Volume in cubic feet	$V = W \times H \times L$
Retention Time in seconds	$RT = V / (CFM / 60)$

D = Diameter in feet	L = Duct Length in feet	W = Duct Width in feet
H = Duct Depth in feet	CFM = Cubic Feet per Minute of Air Flow	

If the retention time is not long enough, increasing the volume of the duct system can extend the time. Increase the volume by making the ductwork longer or larger. If this is not possible, or not economical, then a reaction chamber can be added to the ductwork to provide a longer retention time. The reaction chamber should be designed with baffles to insure that air is thoroughly mixed within the chamber.

SONOZAIRE ODOR NEUTRALIZER

Application Section

The mixing of ozone within the exhaust duct or stack is extremely important. If ozone is not mixed with the odors, it will not react with them. If ozone is injected directly into the duct, it can "channel," meaning it flows along in its own stream and does not mix. Methods of insuring good ozone mixture are: always inject ozone on the suction side of the blower, place baffles or turns in the duct work, inject the ozone into the air stream within a perforated pipe, injecting into a venturi mixer, or combinations of all of these methods.

The amount of ozone needed varies with the degree and amount of the odor, but generally 1-3 ppm of ozone is needed for the volume of air. This amount can be reduced in some cases because the air volume is high enough to insure some reduction of odors, even without ozone. In large airflow cases, 0.3-0.5 ppm is adequate. In low ppm cases, a longer retention time or good mixing becomes more important. To calculate the amount of ozone needed, use the following formula:

$$\text{Ozone (gm/hr)} = \text{Air flow of blower (cfm)} \times \text{PPM of ozone needed} \times 0.0034$$

KITCHENS

Using ozone in restaurant, cafeteria, or other types of kitchen exhaust systems can be a successful and economical method of controlling odors. Not all kitchens need ozone control, but many cooking odors are offensive to surrounding businesses and neighborhoods. Restaurants that receive complaints or citations can generally modify their existing systems, or on new installations, add the proper Sonozaire equipment to eliminate the odor problems.

Significant considerations in the selection of an ozone system for controlling malodors in restaurant or kitchen exhaust systems are:

- ✕ Type of odor
- ✕ Concentration of odor
- ✕ Temperature and humidity of exhaust system
- ✕ Retention time in the exhaust stack
- ✕ Mixing or distribution of ozone with the exhaust stack system

The type of odor is extremely significant because some foods will generate various odors that may exceed the thresholds of odor tolerance. This can be compounded if the odors do not agree with business or ethnic neighborhoods. Odors high in amines, mercaptans, and sulfides, such as fish, can have strong odors as well as other foods. Many restaurants are required to limit odor levels by building restrictions, city ordinances, etc. Many odor problems can be solved with proper planning and study of similar food establishments. Proper planning can provide odor control using the Sonozaire models as very economical control methods.

It is also important in kitchens that a good grease removal system be installed before the ozone injection point. Ozone will not remove the particulate matter that is in the exhaust gas, so it is necessary to remove the grease particles by the grease filter system. Removing the grease vapor and fumes from the exhaust system allows the ozone to react with the odors. Some of the most effective grease filters or removal systems use a detergent bath to strip the grease. These can consist of scrubber type of filters that are detergent wet. With an ineffective or dirty removal system, a greasy layer builds up on the duct walls reducing ozone reaction.

Below is a **sample** calculation for a typical restaurant:

Restaurant that serves hamburgers (Select 1ppm of ozone for the odors)

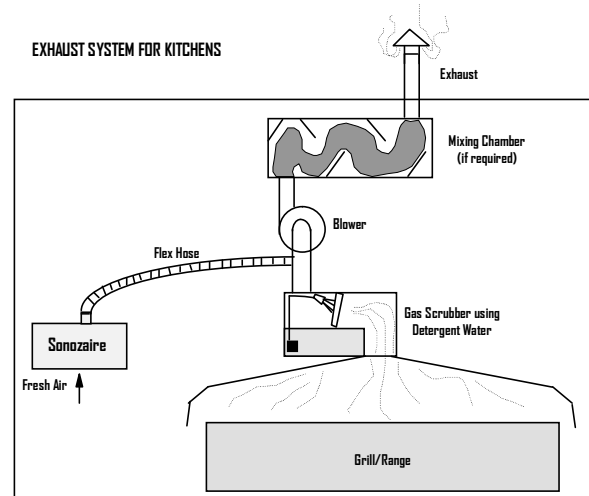
Temperature and humidity at ozone injection point 100 degrees F and 80-90%

Exhaust fan 1800 cfm and has round exhaust duct work 24" diameter 5 feet vertical length, 20 feet horizontal length, and then 15 feet vertical length.

$$\text{Duct Volume} = (1) \times (1) \times 3.14 \times 40 = 125.6 \text{ cu ft}$$

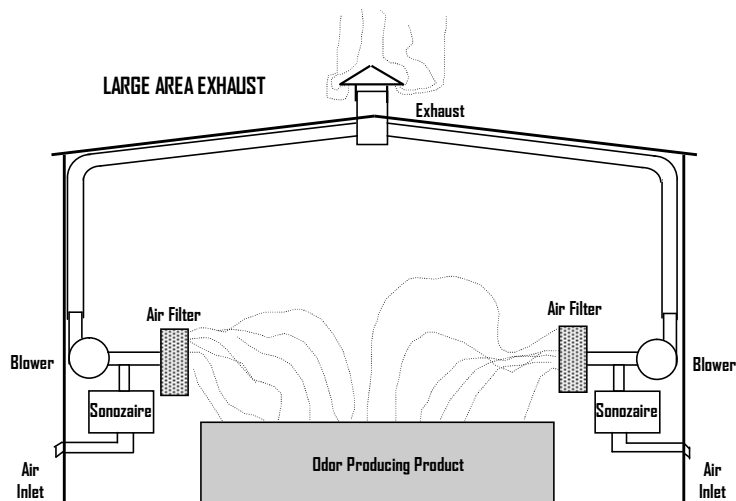
$$\text{Retention Time} = 125.6 / (1800 / 60) = 4.19 \text{ seconds}$$

$$\text{Ozone (gm/hr)} = 1800 \text{ cfm} \times 1 \text{ ppm} \times 0.0034 = 6.12 \text{ gm/hr}$$



SONOZAIRE ODOR NEUTRALIZER

Application Section



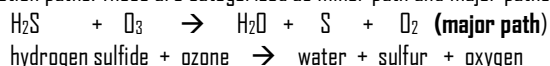
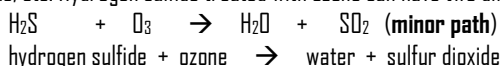
When installing the Sonozaire units with the exhaust systems, the Sonozaire should be interlocked with the exhaust fan, so that when the exhaust fan turns off, the Sonozaire turns off also. This will prevent ozone from being blown back into the kitchen or other areas that might be occupied. Refer to some of the interlocking methods described under the Indoor Air Quality section of this manual.

SEWAGE TREATMENT

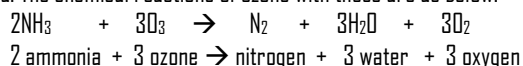
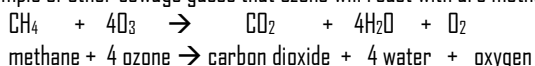
Ozone has been used effectively for odor control associated with sewage treatment for many years. There are several methods of application, but the direct method is the simplest and is described herein for use in wet wells and lift stations. In many cases a single unit can be used, and more units can be used for larger applications. Note that Sonozaire models have a maximum of 1/2" discharge pressure. Therefore the Sonozaire must be installed where there is no static pressure, or in an installation where a slight vacuum exists. Generally, this means that if an exhaust fan is used, the Sonozaire must be installed on the suction side of the fan.

The method of odor removal by ozone is fundamentally simple. Malodors are electron-rich and ozone is electron-deficient and therefore they are attracted to one another. When these two are brought into contact an oxidation reaction occurs. The ozone molecule loses the extra ozone molecule and reverts back to oxygen (O₂). The addition of the single oxygen molecule to the odor compound causes the compound to breakdown into smaller, less odoriferous compounds, or to combine into a compound that is stable (e.g., CO into CO₂ or H₂ into H₂O). Since oxidation of malodorous compounds requires several steps, time and contact between odors and ozone are critical.

Sewage odors are made up of various chemicals. Sulfides are oxidized to sulfoxides and amines to amine oxides, both being non-odoriferous. The chemical that has the most easily detectable odor is hydrogen sulfide (H₂S), which has the aroma of rotten eggs. Other detectable odors are ammonia, sulfides, mercaptans, etc. Hydrogen sulfide treated with ozone can have two different chemical reaction paths. These are categorized as minor path and major paths.



Example of other sewage gases that ozone will react with are methane and ammonia. The chemical reactions of ozone with these are as below:



Some important items in treating sewage odors with ozone are the concentration of the odors, the temperature and humidity, the distribution of ozone into the sewage gasses, the retention time for ozone to react with the gases, and the exhaust blower airflow volume. Ozone can be used to completely destroy odors or reduced the odors to an acceptable level. Generally, experience has shown that 1-2 ppm is generally enough if other conditions are good. For complete destruction, or in high temperature and humidity times (summer months), a slightly higher level may be necessary. Installations, such as sludge storage tanks, and some filter screens will require greater levels.

Temperature and humidity are important in two separate ways. The Sonozaire should be placed in an area that is cool and dry, such as an air-conditioned room or building. Cool, dry air will produce the largest amount of ozone and will allow the longest times between cleaning of electrodes in the Sonozaire models. The ozone can be hose connected to the site of injection. Alternatively, ozone reacts best when it is injected into a warm, humid air stream, however hot streams should be avoided. Ozonated air blown into the air space of a wet well and sewer pipes reduces concrete corrosion as well as drying the walls and ceiling of the lift station.