PRESSURIZED CONTAINERS

This factsheet covers pressurized containers, including both aerosol cans and compressed gas cylinders, with a focus on those that are commonly available to consumers, and those that may be found disposed of in the solid waste stream. When disposed of improperly, these products pose a serious risk, and in fact are the cause of a significant number of incidents in solid waste facilities. The factsheet addresses safer disposal options that are currently available, and advocates for policy solutions that can help mitigate the risks posed.

AEROSOL CANS

Aerosol cans, also known as spray cans, contain a variety of contents and are widely available to consumers. They may contain paint, other flammable substances, pesticides, and many other products. Even when the product being dispensed is not hazardous, there is a propellant involved, most often flammable, with a residual amount of propellant and pressure remaining in the can even when "empty". Aerosol cans are generally made from steel, though plastic aerosol cans have recently become available.

Some HHW programs may also handle aerosol cans from non-household sources, including VSQGs, or in those states that have added aerosol cans to the Universal Waste Rule, even fully-regulated generators.

COMPRESSED GASES

Compressed gases are typically defined as materials that have a vapor pressure greater than 40 psia (pounds per square inch absolute). Typical pressures in compressed cylinders are 2400 psi, some are as high as 10000 psi. The most common in household settings are propane cylinders, both the small usually non-refillable size, containing about 1 pound of propane, and the larger size commonly used in barbecues and other appliances, typically containing 20 pounds or more of propane. Refillable cylinders in the smaller size are starting to become available (see more under Policy options below). Other compressed cylinders commonly available to consumers include helium, fire extinguishers, oxygen, carbon dioxide, and two-part foams.

Commercial and industrial sources may generate a wide variety of compressed gas cylinders, many that are not commonly found in households. Because they may be disposed of in the solid waste system, an appendix with information on hazards and management options is attached.

NAHMMA
North American Hazardous Materials Management Association

RISKS OF IMPROPER DISPOSAL

Propane cylinders in particular pose a risk in solid waste facilities. Processing equipment can rupture the cylinder, and any spark can cause an explosion. Anecdotally, they are the second leading cause of solid waste facility fires (the first being lithium batteries, see the NAHMMA factsheet on batteries for more information). Aerosols and compressed cylinders can pose other risks as well, as contents may be flammable, corrosive, or toxic, and releases could threaten human health, the environment, or equipment, if disposed of in the solid waste system or other improper disposal.

MANAGEMENT OPTIONS

A number of options are available to properly manage aerosol cans and pressurized cylinders to minimize the risks identified above. All options presented are generally preferable to disposal in the solid waste stream. The best option in a given situation may vary depending on local conditions, including budgets, regulatory considerations, staff availability, space, etc. Where possible, follow the waste reduction hierarchy, prioritizing reuse first, then recycling, then other environmentally sound disposal options.

POLICY RECOMMENDATIONS FOR AEROSOLS & COMPRESSED CYLINDERS

- Pass and implement producer responsibility laws that mandate convenient collection and environmentally sound management of consumer-generated cylinders, with programs fully-funded by the cylinder manufacturers.
- Add spray paint to the PaintCare program, the manufacturer-operated program that collects paint in several states.
- Make refillable 1 lb. propane cylinders widely available and promote their use.
- Phase in a ban on single use propane cylinders. They should be phased out on a timetable that allows for refillables and refilling services to be sufficiently available.

Policy Resources:

- Product Stewardship Institute: www.productstewardship.us/page/Gas-Cylinders
- National Stewardship Action Council www.nsaction.us/
- California Product Stewardship Council www.calpsc.org/
- California's refillable propane cylinder campaign www.refuelyourfun.org

WARNING

Before implementing any of the in-house options described below, it is essential to have a risk assessment conducted by a qualified safety professional, and to check on any restrictions that your state environmental agency may have governing the activity.

AEROSOLS

AEROSOLS WITH CONTENTS

There are three primary options for managing aerosols that have contents remaining: reuse, on-site puncturing, and contracted disposal.

REUSE

Many aerosols with contents are still usable, and aerosols are in fact particularly suitable for reuse programs because the contents are very unlikely to be adulterated or not as labeled. A simple check that there are contents and that they do spray when the nozzle is pressed can be suitable quality control. In some cases it may only be the nozzle that is clogged, and simple replacement of the faulty nozzle with a good one may make the can usable. Programs that are not currently set up to do reuse may want to seek out assistance from NAHMMA members through NAHMMA's various resources to get a reuse program started.

ON-SITE PUNCTURING

With on-site puncturing aerosol cans are pierced and the contents are drained into a drum for proper disposal, typically as an alternative fuel, though some may need to be handled and disposed separately such as pesticides and corrosives. There are several commercially-available manual aerosol puncturing units. These may be satisfactory for handling small volumes, but they may not hold up well to repeated use, and can present ergonomic challenges. Automated units can be a good choice for high volumes, but these are expensive to purchase and maintain.

There are several factors to consider when deciding whether to puncture on site. A primary consideration is fugitive emissions, both the propellant in the can and any potentially volatile contents. Some programs have chosen to vent these emissions to the air, both environmental and regulatory factors should be considered when making this choice. Activated carbon filters are an option for both manual and automated units, but with large volumes of emissions these filters tend to get used up very quickly, adding considerable costs and disposal considerations of their own.

CONTRACTOR DISPOSAL

Contractors that provide transportation and disposal services to HHW facilities can provide options for aerosol disposal, typically handled in drums or pallet-mounted gaylords. End disposal options will vary, some may go to a high volume can puncturing facility, some may be introduced drum and all to combustion chambers in permitted energy recovery facilities, some may be incinerated without energy recovery.

EMPTY AEROSOLS

Because spent aerosol cans still contain propellant, they can cause problems when disposed of in trash. Some curbside recycling programs accept empty aerosols, though this is not available everywhere- there is considerable debate about this option, a couple of websites provide good background:

- https://www.cancentral.com/media/news/new-study-shows-aerosol-containers-are-accepted-most-recycling-programs-available
- https://www.isri.org/scrap-articles/aerosol-can-recycling-can--do-or-can--don't

Another option is to manage them with the aerosol cans that still have contents remaining, see those management methods below.

COMPRESSED GASES

PROPANE- 1 POUNDERS (NON-REFILLABLE)

There is quite a bit of variety in how HHW programs handle 1-pound propane cylinders. Reuse is an option when contents remain, and there are both on-site and contractor options.

REUSE

When there is propane remaining in these cylinders, it is easy to find willing takers (unless the valve is corroded shut). Programs that do not distribute reuse directly to the public may want to seek out scouting troops, sanctioned homeless camps, or other users in the community. Do consider what is going to happen to the empties with these users though.

PREPARING FOR SCRAP METAL

Some programs send empty one pounders to scrap metal recyclers. Scrap dealers do not want pressurized containers, but there are methods for de-pressurizing these. It is important to first ensure they are empty, weighing them against known tare weights is one option. It is then possible to remove the pressure relief valve using a modified bike tire valve tool, or commercially available venting apparatus, or simply to place a visible plastic insert into the main valve, demonstrating to the downstream transporters and recyclers that there is no pressure inside (see picture at top right). Some just smash a hole in the cylinder. Some programs have been known to empty cylinders that have gas remaining, by using them up in the facility lab, or simply burning off the contents with a torch accessory.

While there is information on the internet about refilling the conventional 1 lb. propane cylinder that were not designed for refilling, this is a very unsafe –and illegal- activity.

CONTRACTOR OPTIONS

Even programs that find users for full cylinders and prepare empties for scrap metal will have a small volume of cylinders with contents that have corroded valves, these must be disposed by a contractor. Pricing varies considerably. In some areas contractors are set up with creative reuse or recycling options like those described above, these may be offered at more reasonable prices.

PROPANE- LARGER SIZES

The most common size of larger propane cylinders, frequently used for barbecues, outdoor heating, RVs, etc., is 20 lb, but they do come in sizes both smaller and larger than that. Exchange programs are widely available for the 20 lb size, the largest U.S. exchange programs for 20 lb propane tanks are operated by Blue Rhino and AmeriGas. These manufacturers collect, refill, and redistribute propane tanks for sale and exchange at retail sites (generally wire cages outside stores and gas stations). After a cylinder has been used for 12 years or has become corroded, the manufacturer recycles it. When exchange is not an option a contractor must be used for recycling/disposal. Contractor pricing varies considerably, reasonably priced contractors typically extract the gas for use, and refurbish or scrap cylinders.

HELIUM CYLINDERS

The helium cylinders sold for balloon filling are thin-walled and easily punctured on site at HHW facilities. It is important to make sure cylinder is empty before puncturing. The punctured cylinder can then go to scrap metal. Otherwise these require contractor disposal.

FIRE EXTINGUISHERS

Those with metal valves can in many cases be refilled by local fire extinguisher suppliers. For those with plastic valves Kidde, a large manufacturer of fire extinguishers, has recalled some models, and will take them back. Kidde recall information. Extinguishers with powder contents that cannot be refilled or returned to manufacturers can be depressurized and emptied. Depending on the type of fires they are designed for, there are two kinds of powder, the yellow powder is monoammonium phosphate, the white is usually sodium bicarbonate. It may be possible to collect the powders separately and find users for them.

COMMERCIAL & INDUSTRIAL CYLINDERS

While many HHW facilities do not accept these, some have chosen to accept them if they legitimately end up in a household setting. And HHW programs may be responsible for managing any cylinders that are found in their agency's solid waste load checking programs. Please see the Appendix for some management options.

APPENDIX

HANDLING COMMERCIAL/INDUSTRIAL GAS CYLINDERS

INTRODUCTION

A wide variety of compressed gases are commercially available, and on occasion compressed gas cylinders end up in the solid waste stream. In addition, operators of household hazardous waste (HHW) programs or Very Small Quantity Generator (VSQG) collection programs may have customers wishing to dispose of unwanted compressed gases.

Compressed gases are potentially among the most dangerous wastes that can end up in the trash or be received by collection programs, and extreme caution is necessary in their handling. Even when the contents are non-reactive and non-toxic, there are significant hazards due to the very high pressures that can be contained in a gas cylinder. When the contents are substances with hazardous properties, the possibility of rapid dispersal in all directions adds a level of risk not present with non-pressurized waste materials.

DEFINITION OF COMPRESSED GAS CYLINDERS

Compressed gases are typically defined as materials that have a vapor pressure greater than 40 psia (pounds per square inch absolute). Typical pressures are 2400 psi, some are as high as 6000 psi.

Compressed gas cylinders are generally heavy-walled metal cylinders, and may contain either substances in the gas phase under pressure, or liquified gases. Some contain materials that are liquids under normal conditions along with a compressed propellant gas. Note that heavy walled metal cylinders are also sometimes used for extremely hazardous materials that are not under pressure, but are in this type of container due to the high degree of protection afforded.

Compressed gas cylinders vary greatly in size, from very small, such as cartridges for BB guns or seltzer dispensers, to very large units weighing hundreds of pounds.

Propane cylinders of all sizes are a common problem at solid waste facilities. Other common compressed gases include: CFC refrigerants, helium, oxygen, acetylene, hydrogen, ethylene oxide, and ammonia.

HEALTH, ENVIRONMENTAL AND OPERATIONAL CONCERNS

Compressed gas cylinders can contain gases with a variety of hazardous properties. They can be flammable, corrosive, oxidizers, or toxic substances. Even cylinders containing inert substances are potentially hazardous due to the high internal pressure. While compressed gas cylinders are heavy duty containers designed to safely contain their contents, cylinders that are old, rusting, or damaged can release their contents. Releases may be slow or sudden. The sudden release of pressure in any compressed gas cylinder can propel the cylinder swiftly over large distances, with the potential to cause severe damage to anything it impacts. In addition, cylinders containing liquified gases can generate extreme cold when the contents are released, with the potential to cause serious injury.

The release of compressed gases with hazardous properties can quickly create an atmosphere that is flammable or toxic over a large area. For example, a release of 10 pounds of gaseous ammonia could create IDLH (immediately dangerous to life and health) conditions in the surrounding 1 million cubic feet of air. Release of inert gases can be hazardous due to displacing atmospheric oxygen, creating the risk of asphyxiation.

An unusual hazard resulting from illicit drug manufacture operations is the storage of ammonia or hydrogen chloride gas in propane cylinders. Propane cylinders are not designed to contain corrosive gases, and so rapid degradation of the cylinder or valve can occur, potentially resulting in release of dangerous vapors. In addition, an unknowing attempt to use the contents in propane equipment can result in damage to the equipment, as well as release of corrosive vapors.

It is strongly recommended that compressed gas cylinders never be disposed of as MSW, even when empty. Identification and removal of gas cylinders should be part of a waste screening program. Even cylinders that have had the contents discharged should be removed from MSW, due to the difficulty in determining with certainty whether there is any pressure left in the cylinder.

HANDLING AND MANAGEMENT

HANDLING AND STORAGE

OSHA regulations contain a number of requirements for handling and storage of compressed gas cylinders. Generally, cylinders need to be chained or otherwise stored to prevent the possibility of falling over and possibly damaging the valve. See the OSHA website cited below for specific requirements. It is also prudent to store cylinders in an area that is protected from precipitation, where access to the public is restricted, and warning signs are posted.

Safety glasses or goggles should always be worn while handling compressed gas cylinders. It is also wise to have gloves and other PPE that is resistant to a variety of chemicals. In some cases unpressurized liquids may remain in a cylinder, and the valve may be open, held in place by only a cap or plug, allowing the possibility of the contents spilling out unexpectedly.

DISPOSAL

Compressed gas cylinders can be extremely expensive to dispose of- it is not uncommon to be charged several thousand dollars each by disposal contractors. Some possibilities for less expensive disposal include:

Gas manufacturers/distributors. See if the manufacturer or distributor of the cylinder can be determined and try to locate them. If the company that manufactured the cylinder is still in business, they often will take back their cylinders (note that companies often are bought out or merge- the successor company may take responsibility for cylinders). Shipping of cylinders in accordance with DOT regulations can be tricky; try asking the company for advice.

Determining the manufacturer may be as simple as looking carefully at all labels, or may require looking at engraving on the cylinder shoulder. You should be able to find an engraved abbreviation indicating cylinder manufacturer. The US Department of Transportation Office of Hazardous Materials Transportation, Washington D.C. has a comprehensive list of these abbreviations. Some types of cylinders may not have manufacturer info.

Note also that some compressed gas distributors may take cylinders of common gases even if they were distributed by a different company.

INERT GASES

Gases such as nitrogen, carbon dioxide, compressed air, helium, argon, neon, xenon, or krypton may be vented to the atmosphere in modest quantities. Specific procedures for safe venting should be developed in consultation with a qualified safety proffesional. One hazard of venting is the possibility of rapid cooling and the formation of ice plugs, leading to the false conclusion that the cylinder is empty.

Once the gas is vented, most scrap steel recyclers will not take cylinders unless it is rendered obvious that the cylinder is no longer pressurized. This may include drilling a hole in the cylinder, cutting the cylinder in half, or removing the valve. Again this should be done cautiously, with oversight by a trained safety professional.

Of course it is critical that you are certain that the cylinder is empty before attempting to cut, drill, or remove the valve. Sometimes the valve becomes inoperational while there is still material remaining in the cylinder and it may seem empty.

WHAT IF CONTENTS ARE NOT KNOWN?

SOME WAYS TO DETERMINE CONTENTS INCLUDE:

1. Contact manufacturer or distributor. Once the manufacturer is determined and you have tracked down a contact number for them, record everything you can about the cylinder, including: all dimensions, color, valve style, any potentially helpful info on labels, and ICC or DOT number. Call them and see if they can help identify it.

2. If manufacturer cannot be determined, some other things to try are:

a) UN/NA number- if a UN/NA number (for compressed gases this will be UN followed by four digits) is anywhere on the cylinder, it can be cross-referenced to a chemical name by looking in the DOT "Emergency Response Guidebook".

b) Warning labels- warning labels can give an indication of the chemical contents. Industry standard warning labels for all compressed gases can be found in "Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Cylinders", published by CGA.

c) Valve and cylinder style. For many compressed gases specialized valve fittings, pressure relief valves, cylinder sizes, and materials of construction are specified by the Compressed Gas Association and DOT. It may be possible to determine the contents by consulting DOT and CGA specifications.

If none of these methods are successful, it will be necessary to contact a contractor who is qualified to safely take samples for analysis, which is usually a very costly service.

EMERGENCY RESPONSE

Because of the potential hazards of compressed gas cylinders, procedures for responding to releasing cylinders should be included in emergency action plans for solid waste facilities and HHW/CESQG collection programs. In particular, cylinders that are releasing unknown contents should be responded to with extreme caution, due to the likelihood of IDLH conditions in a wide area around the release.

RESOURCES

OSHA compressed gas information: https://www.osha.gov/compressed-gas-equipment

A great technical cylinder identification presentation: https://trainex.org/osc2012/uploads/516/40_Sec%205%20-%20Cylinder%20Identification%202.pdf

www.cganet.com Website of the CGA, the Compressed Gases Association, publisher of "Handbook of Compressed Gases", and numerous technical publications

https://www.ccohs.ca/oshanswers/chemicals/compressed/compress.html Canadian Center for Occupational Health and Safety, information on hazards and safe handling.