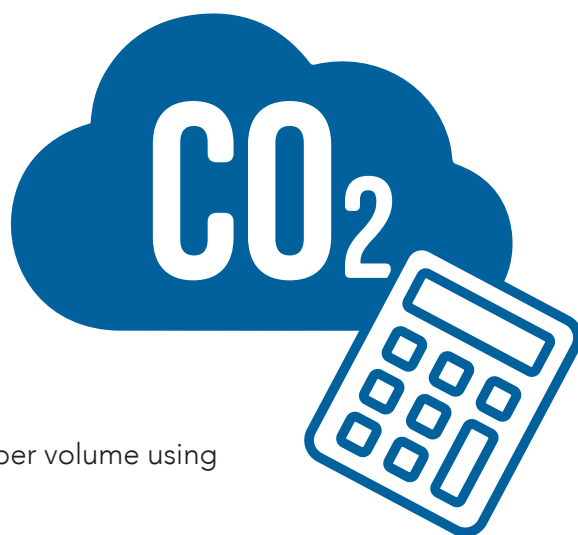


PLANNING GUIDE FOR DEPOPULATION WITH CARBON DIOXIDE (CO₂)

Introduction

This spreadsheet can be used to help pork producers plan for depopulation using CO₂ gas. It calculates:

- The total pounds of CO₂ needed based on the number of animals to be depopulated
- The estimated number of days it will take to depopulate based on animal numbers, chamber size, chamber number and total work hours per day
- The CO₂ flow rate to fill the chamber according to American Veterinary Medical Association's Depopulation Guidelines
- The vaporizer size (lbs/hr)
- Approximate heat capacity required based on chamber volume using field-constructed vaporizer
- Number of heaters required
- Volume per foot of AgBag length
- AgBag length required for 1 chamber volume



Spreadsheet inputs

- **Number of chambers** – Enter the number of chambers you have access to for the length of time scheduled for depopulation. This assumes the chambers have the same dimensions. If size of the chambers is variable, then you will need to complete the spreadsheet calculations for each chamber size available.
- **CO₂ cycle time (hrs)** – Enter the estimated time it will take to load pigs into the chamber, seal the chamber, apply CO₂ at a displacement rate of 20% of the chamber volume/min for 5 minutes, dwell time, and removal of carcasses. In general, you can assume 1 hour per cycle.
- **Chamber dimensions** – Enter the width, length, and height of the chamber.
- **Total work hours per day (hrs)** – number of hours per day you plan to be depopulating pigs
- **Number of head to depopulate by average weight of pigs** – Enter the number of pigs in each weight category that need to be depopulated. If the average weight is between two categories, round up to the next weight category. Enter "0" if there are no pigs in that weight category.
- **Diameter of AgBag (ft)** – enter the diameter in feet of the AgBag being used.

Step 1

Identify the number of chambers you have access to. Commonly available chambers are dump trucks, dump trailers, semi-trailer, roll off dumpsters and shipping containers. The chart below can aid in decisions on what type of chambers best meet the need based on pig size. You can also build a [custom chamber](#) if time permits.

TQA Transport Space Recommendations		Number of Pigs by Weight per Square Footage of Container Space					
Average Weight	Sq Ft / hd	# Pigs - Dump Truck (11.5'X7.2'X4')	# Pigs - Dump Trailer (7.6'X18'X4')	# Pigs - 20-yd Roll-off (21.5'X7'X4')	# Pigs - Semi (48 ft) (47.6'X8.2'X4')	# Pigs - Semi (53ft) (52.5'X8.2'X4')	# Pigs - Custom (16'X48'X4')
12	0.65	127	210	232	600	662	1182
50	1.53	54	89	98	255	281	502
100	2.32	36	59	65	168	185	331
150	2.95	28	46	51	132	146	260
250	4.26	19	32	35	92	101	180
275	4.57	18	30	33	85	94	168
300	4.79	17	29	31	81	90	160
350	5.48	15	25	27	71	78	140
400	6.39	13	21	24	61	67	120
450	7	12	20	22	56	61	110
500	7.69	11	18	20	51	56	100
550	8.39	10	16	18	46	51	92

Step 2

In the spreadsheet, enter the number of chambers, CO₂ cycle time, chamber dimensions, total work hours per day and number of head to depopulate by average weight of the pigs.

Step 3

Make sure your [carcass disposal plan](#) can accommodate the number of pigs being depopulated daily. If not, you will have to adjust lower the total work hours per day to adjust daily numbers to match your disposal capacity.

Step 4

Call CO₂ supplier to determine if the total pounds of CO₂ or the pounds of CO₂ needed per day that is calculated in the spreadsheet can be acquired over the duration of depopulation. A CO₂ supplier list can be found [here](#). If you can't get CO₂ then look at other approved methods for depopulation. If you can get CO₂ but not at the pounds you need there are a few possible solutions to match what supply of CO₂ is available.

- Adjust the number of head to be depopulated with CO₂ to match what supply is available.
- Adjust the total work hours down to decrease the pounds of CO₂ needed per day (this can extend the number of days to complete the total number of cycles).
- Extend the time between days that you depopulate pigs (e.g. every other day, every third day) using CO₂. While the total amount of CO₂ will not change it could help with supply issues.

Step 5

Identify method to generate gas from liquid CO₂ to warm CO₂. The spreadsheet calculates the flow rate that the chosen method will need to achieve to a displacement rate of 20% of the chamber volume/min for 5 minutes.

If the answer to 2 – 4 is yes then guidance can be found [here](#).

1. I have access, time and funding to acquire a commercial vaporizer.
 - a. Yes, work with vendor on specifics.
 - b. No, See 2.
2. I have the ability and time to construct a low-cost, field constructed vaporizer.
 - a. Yes (click on link above). Spreadsheet estimates heat capacity and number of heaters.
 - b. No, see 3.
3. I have the ability/time to construct a system for releasing liquid CO₂ into a low-pressure tank.
 - a. Yes (click on link above).
 - b. No, see 4.
4. I have the ability and time to acquire an AgBag.
 - a. Yes, examples can be found here (click on link above). Spreadsheet estimates volume per foot of length (cubic feet) and length required for 1 chamber volume based on the diameter of the Agbag.
 - b. No, look at other approved methods for depopulation.

Step 6

Make sure that method for moving warmed CO₂ gas to the chamber meets the calculated flow-rate as possible. Flow rates on commercial vaporizers can be adjusted. If you are using a field-constructed vaporizer then a blower can be used to move warmed CO₂ to the chamber. For example, a 550 CFM Axial leaf blower can fill a 40'X16'X4' chamber (2,560 cu. ft.) in 5 minutes. This size of container could hold 117 head of 350 lb pigs. This type of blower can also work with an AgBag being used for CO₂ storage. If constructing a system for releasing liquid CO₂ into a low-pressure tank then refer [here](#) for guidance.

