

Salt Lake Area Source BACM Analysis

BACM Analysis Process

One of the requirements for a serious nonattainment area plan is to demonstrate that the plan includes the best available control measures (BACM) that can be feasibly and cost effectively implemented for all precursors. EPA defines BACM as being more stringent than reasonably available control measures (RACM), but less stringent than the lowest achievable emission rate (LAER), which does not take into consideration the cost effectiveness of implementing a particular control measure. The BACM analysis was conducted based on:

- ❖ Literature review of EPA guidance documents and regulations including:
 - Control Techniques Guidelines (CTG)
 - Alternative Control Techniques (ACT)
 - New Source Performance Standards (NSPS)

- ❖ A comparison of existing rules to the CTG to assure that all appropriate CTG's have been addressed in rulemaking

- ❖ Ozone Transport Commission (OTC) model rules

- ❖ A comparison of other serious nonattainment air districts rules for ozone and/or PM_{2.5} to UDAQ rules:
 - San Joaquin Valley (SJ) – PM_{2.5}
 - South Coast Air District (SC) – PM_{2.5}
 - Ventura County, CA – ozone
 - Sacramento Metro, CA – ozone

Additional air district rules may also be reviewed if the air districts listed above do not have a comparable UDAQ rule.

- ❖ An evaluation of technological/economical feasibility for newly identified controls or enhancement of existing controls

The BACM analysis is based on a seasonally adjusted inventory. That is to say that source categories that do not occur in the winter are not included. Temporal adjustments are also made in the inventory. For example, exterior coating operations are not performed during the winter-inversion periods.

Salt Lake Area Source BACM

Direct PM_{2.5} BACM Assessment

Source Category	Source Category Code	Utah Existing Rules and Federal Rules	Comments	2014 Uncontrolled Inventory Tons/winter Week Day
Combustion, Wood, All Devices	2104008320 2104008310 2104008330 2104008400 2102008000 2104008100 2103008000 2104008610 2104008210 2104008220 2104008510 2104008230 2104008700	R307-208 Outdoor Wood Boilers R307-302 Solid Fuel Burning Devices		2.41
Construction, Buildings	262003 231102 231101	Construction, Buildings		1.13
Commercial Cooking	2302002200 2302003000 2302003100 2302003200		Existing CA rules only apply to very large sources due to extreme cost (at least \$15K/ton) Prohibitive cost would shutter most sources.	1.03
Mining & Quarrying, All Processes	2325	R307-309 Fugitive Emissions & Fugitive Dust		0.77
Construction, Roads	231103	R307-309 Fugitive Emissions & Fugitive Dust		0.32
Backyard BBQ	2810025		Statutory exemption	0.13
Commercial Cooking, Chain-Driven Charbroiler	23020021	R307-303 Commercial Cooking		0.13
Combustion, Natural Gas, Residential	2104006000	R307-356 Appliance Pilot Light		0.05
Combustion, Natural Gas, Commercial & Institutional	2103006	40 CFR 63 Subpart DDDDD	MACT requires PM reduction	0.01
Landfills	2620030000	R307-309 Fugitive Emissions & Fugitive Dust		0.006
Combustion, Natural Gas, Industrial	2102006	40 CFR 63 Subpart DDDDD	MACT requires PM reduction	0.003
Combustion, Oil	2104004 2102005	R307-312 Aggregate Processing Operations 40 CFR 63 Subpart DDDDD	EPA-600/2-75-069-a Guidelines for Residential Oil-Burner Adjustments Procedures to Minimize Air Pollution	0.001
Combustion, LPG	2102007 2104007		No known control	9.3 x 10 ⁻⁴
Cremation, Human	28100601	R307-201-3 Visible Emissions Standards	Opacity Requirement May also use PM collection systems	6 x 10 ⁻⁴
Combustion, Kerosene	2103011000		No known control	1.1 x 10 ⁻⁴

Seven area source rules have been adopted that provide control of direct PM_{2.5}. Most of these rules are also helpful in providing control for precursors, such as VOC's. This section is dedicated to those control measures that provide the greatest control for direct PM_{2.5}. The rules discussed in this section are annotated in the table in bold print.

R307-312 and R307-356 are discussed in other sections dedicated to the SO_x and NO_x precursors.

Utah Existing Rules	Control	Parameter
R307-208 Outdoor Wood Boilers	Prohibits sale of units in nonattainment areas	VOC, PM _{2.5} , NO _x
R307-302 Solid Fuel Burning Devices	Establishes an emission standard and allowable burning period	VOC, PM _{2.5} , NO _x , SO _x
R307-303 Commercial Cooking	Emission controls for chain-driven charbroilers	PM _{2.5} , VOC
R307-307 Road Salting & Sanding	Emission control	PM
R307-309 Fugitive Emissions & Fugitive Dust	Emission control	PM
R307-312 Aggregate Processing Operations	Emission control	SO _x , PM _{2.5} , NO _x
R307-356 Appliance Pilot Light	Prohibits sale of pilot lights in the nonattainment areas	NO _x , PM _{2.5} , VOC, SO _x , NH ₃

PM_{2.5} Source Category Analysis

R307-208 Outdoor Wood Boilers: Prohibits the sale of new units in the nonattainment area and established a registry for units within the nonattainment area in existence prior to rule promulgation. Units on the Registry may be replaced with outdoor wood boilers with an EPA Phase 2 qualified wood pellet outdoor wood boiler. New EPA Phase 2 units may be sold in attainment areas.

The rule also prohibits the burning of waste and hazardous materials, establishes a 20% opacity limit and prohibits burning during restricted burning days.

Federal Regulation or Guidance: EPA published the residential wood burning NSPS on February 3, 2015. The NSPS included a PM emission limit for outdoor wood boilers however, the NSPS does not resolve the issues that may lead outdoor boilers to cause nuisance emissions.

Comparison of Other State Rules:

- ❖ Utah is the only state that bans outdoor wood boilers, therefore there is no comparable rule to compare.
- ❖ Manufacturers who wish to sell wood-fired hydronic heaters in Washington State must have the device tested using EPA Method 28 WHH or ASTM E2618 but using Douglas fir test fuel; and submit test results to the State showing the device emits no more than 4.5 grams of fine particles per hour. This rate limit applies to both the annual average emissions and the highest individual test run emissions.

Salt Lake Area Source BACM

- ❖ Maine Department of Environmental Protection Chapter 150: Control of Emissions from Outdoor Wood Boilers, establishes a particulate matter emission limit of 0.60 lbs/MMBtu heat input, setback and stack height limits.

BACM Conclusion: All state rules are less stringent than R307-208.

Any replacement unit permitting under R307-208 would have to meet the NSPS. UDAQ estimates that there are less than 50 outdoor wood burning units in the nonattainment area. This estimate is based on the number of people who attended the two public hearings held during the R307-208 public comment period.

There are no opportunities beyond the current ban that would lead to further emission reductions.

R307-302 Solid Fuel Burning Devices: Residential fireplaces and wood stoves contribute PM emissions to the atmosphere. To minimize the amount of emissions from these devices, they are regulated by an opacity standard. When operated properly, these devices will produce visible emissions of less than 20% opacity from the chimney or smoke stack. The proper operation of these devices is required to meet the visible emission standard of 20% opacity during normal operation. The 20% opacity limit applies at all times except for an initial start-up period of 15 minutes and a 15 minute period in any three hour period for reloading the device.

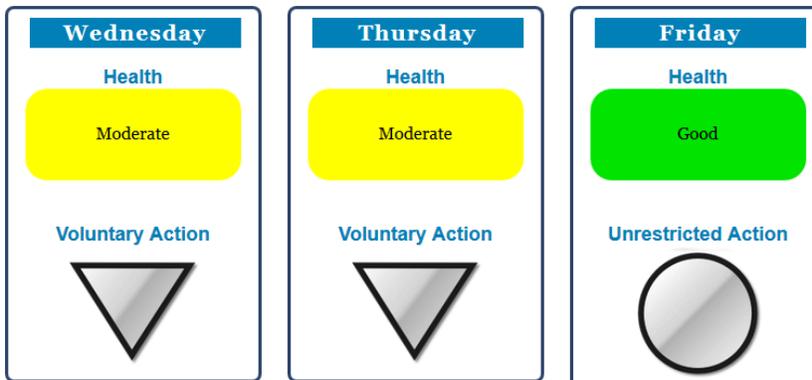
UDAQ issues mandatory no burn actions when PM_{2.5} levels build up to unhealthy levels during winter inversions. The no-burn period extends from November 1st to March 1st. R307-302 prohibit residents from burning wood or coal on no burn days. The Division reports current action levels twice a day to local media outlets such as newspapers, TV, and radio stations. The Division posts action levels on its Web site. Residents can register to receive free e-mail air quality alerts or download the UtahAir app for Androids (Google Play) and iPhones (Apple Apps store, coming soon) to get the latest information on current conditions and air quality actions by county.

UDAQ Web Page Forecast

Salt Lake County—3 Day Forecast

Box Elder Cache Carbon Davis Duchesne Salt Lake Tooele Uintah Utah Washington Weber

Last Updated: December 14, 2016 9:52 AM



Individuals are asked to voluntarily not use solid fuel burning devices, reduce/stop open burning, and reduce vehicle use by consolidating trips. Salt Lake County prohibits burning solid fuel in fireplaces or wood burning stoves and bans outdoor fires (including bonfires, patio pits and charcoal grill fires) on days that the State of Utah designates as either mandatory or voluntary air action (no burn) days. [Salt Lake County Health Regulation 35](#)

Explanation

The forecast indicates the highest pollution level of the day. During the **summer**, Ozone pollution levels are generally low during the morning, evening and night. During the winter, particulate matter (i.e., PM 2.5) pollution levels build up until a storm or weather system moves the air out of the valley.

The **health forecast** helps to determine how the highest pollution level of the day will affect people with various health conditions. Click on the "Health Forecast" legend to plan your physical activity to help minimize the effects of pollution on your health.

The **action forecast** notifies the public of the voluntary or mandatory actions (e.g., carpooling, wood burning) they need to adhere to for the current pollution levels. Click on the "Action Forecast" legend for a description of the action regulations.

Action Forecast	Health Forecast		
	Air Quality Index (AQI)	PM 2.5	Ozone
Unrestricted Action 	Good	0 - 12.0 µg/m ³	0 - 0.054 ppm
Voluntary Action 	Moderate	12.1 - 35.4 µg/m ³	0.055 - 0.070 ppm
Mandatory Action 	Unhealthy for Sensitive Groups	35.5 - 55.4 µg/m ³	0.071 - 0.085 ppm
	Unhealthy	55.5 - 150.4 µg/m ³	0.086 - 0.105 ppm
	Very Unhealthy	150.5 - 250.4 µg/m ³	0.106 - 0.200 ppm
	Hazardous	Above 250.5 µg/m ³	Above 0.201 ppm

Based on a 24-hour average. Based on an 8-hour average.

No solid fuel burning devices (including EPA certified units) are allowed to burn during a mandatory action period unless the device was registered as a sole source of heating for the residence with the Division.

Mandatory no burn days are called when the PM_{2.5} levels are forecasted to reach or exceed 25 µg/m³.

The rule also includes prohibition on burning waste and hazardous materials.

Further, the rule mandates that all solid fuel burning devices sold in the nonattainment area must meet the residential wood burning NSPS requirements. The exemptions in the new NSPS are therefore not carried over into R307-302.

Federal Regulation or Guidance: New Source Performance Standards for Residential Wood Heaters applies emission rating for solid fuel combustion devices.

Comparison of Other State Rules: SJ Rule 4901, Wood Burning Fireplaces and Wood Burning Heaters was evaluated and compared to R302-302. There are many similarities in the way the Rule 4901 and R307-302 are structured. The no burn thresholds are both based on forecasted PM_{2.5} levels. Rule 4901 no burn threshold is a range in which the low point is set at 20 µg/m³ with an allowable exemption for EPA certified wood stoves that have been inspected and registered with SJ. The no burn threshold in R307-302 is set at 25 µg/m³ but there is no exemption for any wood stoves therefore, R307-302 is more stringent in that regard.

R307-302 permits a real estate transfer containing a non EPA certified stove within a residential dwelling that was installed prior to March 6, 2014 so long as the unit remains intact within the real property of sale. Rule 4901 does not permit real estate transfer containing a wood stove unless the wood stove is an EPA Phase II or better under a current NSPS, is a pellet stove exempt from EPA certification or is rendered inoperable. Rule 4901 is more stringent in this regard.

BACM Conclusion: Overall, R307-302 is more stringent because there is no exemption from the NSPS, nor does it exempt EPA certified stoves.

An area of improvement to R307-302 may be to consider a requirement to remove non-EPA certified stoves during real estate transactions, although that is likely beyond BACM.

R307-303 Commercial Cooking: R307-303 was promulgated as RACT for chain-driven charbroilers, which are predominately found in large fast food restaurant chains. Other cooking methods using underfire charbroilers and flat griddles account for more of the PM_{2.5} emissions from commercial cooking, but were not included in R307-303 because current control technology options are limited for these types of cooking and carry extreme cost. Emission control cost to control underfire cooking range from approximately \$10-40K/ton, depending on the selected technology with capital cost that range from \$30-70K (SC restaurant emission analysis study, August 2009).



Chain-driven Charbroiler

Federal Regulation or Guidance: None

Comparison of Other State Rules:

- ❖ Bay Area Air Quality Management District Regulation 6, Rule 2, Commercial Cooking Equipment. This rule applies to chain-driven charbroiler in a restaurant

Salt Lake Area Source BACM

that purchases 500 pounds of beef or more per week or an under-fired charbroiler in a restaurant that purchases 1,000 pounds of beef or more per week and an aggregate grill surface area of ten square feet or more. The rule targets PM₁₀ emission reduction.

R307-303 is intended to reduce direct PM_{2.5} and VOC and applies to all commercial chain-driven charbroilers. Consequently, R307-303 is more stringent as it relates to this SIP.

- ❖ SC Rule 1138, Control of Emissions from Restaurant Operations.
This rule is intended on controlling PM₁₀ and VOC emissions. Rule 1138 requires all chain-driven charbroilers that are used to cook 400 pounds or more meat per week must install a catalytic oxidizer.

R307-303 is more stringent than Rule 1138 because it applies to all chain-driven charbroilers.

- ❖ Ventura County Rule 74.25, Restaurant Cooking Operations.
The rule requires the same level of control as R307-303 but provides exemptions that are not included in R307-303; therefore, R307-303 is more stringent

BACM Conclusion: There are no current opportunities for additional program revisions that would lead to further emission reductions.

R307-307 Road Salting & Sanding: The purpose of this rule is to establish emission control for winter time road salting. This is an existing rule that was part of the PM₁₀ SIP (Section IX, Part A, Page 57) that was approved by EPA on December 6, 1999 (64 FR 68031). A RACT analysis was conducted as part of that SIP. The rule was amended by expanding the applicability to include PM_{2.5} nonattainment areas as part of the moderate PM_{2.5} SIP. The actual PM emission reduction is unknown however, past UDAQ studies have indicated that road salt plays a minimal role related to this SIP. Consequently, no further analysis is warranted.

R307-309 Fugitive Emissions & Fugitive Dust: Establishes minimum work practices and emission standards for sources of fugitive emissions and dust. The rule applies to all construction and soil disturbance for areas greater than ¼ acre, requires BMP's for mining, sand & gravel processes and other types of fugitive dust generating activities. Sources must file a dust control plan using the DAQ form (online dust plan development tool) before commencing dust generating activities.

Federal Regulation or Guidance: None

Salt Lake Area Source BACM

BACM Analysis:

DAQ conducted a thorough analysis of the UDAQ fugitive dust program that included:

- ❖ A review of other arid western non-attainment air district fugitive dust rules
- ❖ Options described in the WRAP Fugitive Dust Handbook
- ❖ Internal UDAQ engineering and inspectors insights.

The following table provides a summary of the analysis.

Requirement	Utah	Nevada	Washoe County, NV	Clark County, NV	Maricopa, AZ	South Coast, CA	San Joaquin Valley, CA
Construction & Excavation (acreage)	0.25	5 construction 1 acre soil clearing	1	0.25	0.1	5	10 res./5 non-res.
Demolition	√	√	√	1,000 Sq. Ft.	√	5 acres or 100 cu. Yd.	5 acres or 100 cu. Yd.
Trenching	-	-	-	100 ft.	-	-	-
Bulk Materials Transport	√	√	√	√	√	√	√
Carry out and Trackout	√	-	√		√	√	√
Open Areas Disturbance	√	-	√	√	√	√	√
Unpaved Vehicle & Equipment Traffic Areas	√	√	√	√	√	√	√
Material Handling	√	√	√	√	√	√	√
Storage Piles	√	√	√	√	√	√	√
Mineral Processing Operations	√	-	√	√	√	√	√
Opacity limits (%) (property boundary – onsite)	10 -20%	20%	0	0	0 -20%	0 – 20%	20%
Additional activity specific requirements	√	-	√	√	√	√	-
Wind Event Requirements	√	-	√+	√+	√+	√	√
PM10 Classification	Moderate	Unclassifiable	Maintenance	Serious	Moderate	Moderate	Attain

The outcomes of the analysis indicate that there are similarities between R307-309 and other state rules, especially the Clark County rule because it also requires use of established fugitive control best management practices (BMP's).

Salt Lake Area Source BACM

The most significant rule revision to R307-309 was the development and requirement of BMPs. Two BMPs are required of every plan, BMP 09 and 19 on the following table. These were determined to be most problematic for both air and stormwater due to soil disturbance projects. The following table shows the BMPs in the rule that address all fugitive dust source types.

BMP	Project Activity	Check All That Apply
01	Backfilling filling area previously excavated or trenched.	
02	Blasting soil & rock, explosive blasting of soil and rock – drilling and blasting.	
03	Clearing & grubbing, clearing and grubbing for site preparation and vacant land cleanup.	
04	Clearing forms, foundations, slab clearing and cleaning of forms, foundations and slabs prior to pouring concrete.	
05	Crushing of construction and demolition debris, rock and soil. Screening of rock, soil or construction debris.	
06	Cut and/or fill cut and/or fill soils for site grade preparation.	
07	Demolition – implosion, Implosive demolition of a structure, using explosives.	
08	Demolition - mechanical/manual demolition of walls, stucco, concrete, freestanding structures, buildings and other structures.	
09	Disturbed Soil THIS ACTIVITY MUST BE SELECTED FOR ALL PROJECTS.	X
10	Disturbed land - long term stabilization and erosion control of large tracts of disturbed land that will not have continuing activity for more than 30 days.	
11	Dust suppressants - selection and use of chemical and organic dust suppressing agents and other chemical stabilizers.	
12	Hauling materials.	
13	Mining and reclamation operations.	
14	Paving/subgrade preparation for paving streets, parking lots, etc.	
15	Sawing/cutting material, sawing or cutting materials concrete, asphalt, block or pipe.	
16	Staging areas, equipment storage, vehicle parking lots, and material storage areas.	
17	Stockpiles materials (storage), other soils, rock or debris, for future use or export.	
18	Tailings piles, ponds and erosion control.	
19	Trackout Prevention and Cleanup THIS ACTIVITY MUST BE SELECTED FOR ALL PROJECTS.	X
20	Traffic - unpaved routes and parking, construction related traffic on unpaved interior and/or access roads and unpaved employee/worker parking areas.	
21	Trenching with track or wheel mounted excavator, shovel, backhoe or trencher.	
22	Truck loading with materials including construction and demolition debris, rock and soil.	

BACM Conclusion: There are no current opportunities for additional program revisions that would lead to further emission reductions.

Salt Lake Area Source BACM

VOC BACM Assessment

Source Category	Source Category Code	Utah Existing Rules/Statute and Federal Rules	Comments	2014 Uncontrolled Inventory Tons/winter Week Day
Surface Coatings, Architectural	2401001000	R307-361 Architectural Coatings		5.38
Solvent, Consumer Use Household Products	2460200000	R307-357 Consumer Products		5.33
Solvent, Consumer Use Personal Care Products	2460100000	R307-357 Consumer Products		4.85
Pesticide Application, Commercial/Consumer (FIFRA)	2460800000	R307-357 Consumer Products		4.31
Solvent Degreasing	2415	R307-304 Solvent Cleaning R307-335 Degreasing		4.35
Solvent, Consumer Use Auto Aftermarket	2460400000	R307-357 Consumer Products		3.30
Combustion, Wood, All Devices	2104008320 2104008310 2104008330 2104008400 2102008000 2104008100 2103008000 2104008610 2104008210 2104008220 2104008510 2104008230 2104008700	R307-302 Solid Fuel Burning Devices		2.63
Solvent, Consumer Use Coatings	2460500000	R357 Consumer Products		2.30
Solvent, Consumer Use Adhesive & Sealants	2460500000	R307-357 Consumer Products		2.30
Solvent, Consumer Use Coatings	2460500000	R307-357 Consumer Products		2.30
Surface Coatings, High Performance Maintenance and Transportation	2401055000 2401200000 2401070000	R307-350 Miscellaneous Metal Parts & Products Coating		2.18
Solvent, Graphic Arts	2425000000	R307-351 Graphic Arts		1.23
Surface Coatings, Autobody Refinishing	2401005000	R307-354 Auto Body Refinishing		1.15
Surface Coatings, Wood Furniture and Fixtures	2401020000	R307-343 Emissions Standards for Wood Furniture Manufacturing Operations		1.13
Fuel Gas/Gasohol Pipelines	2505040120	40 CFR 49 Subtitle B	U.S. Dept. of Transportation is responsible for pipeline safety and spill prevention	1.10
Bakery Yeast	2302050000		Estimated to cost at least \$19,000/ton, requires double-w alled stainless steel stack plus catalytic oxidation of ethanol. High capitol cost w ould require a rule w ith high applicability threshold that w ould preclude regulating most bakeries that comprise these emissions.	0.85
Fuel Gas/Gasohol Under Ground Storage Tank	2501060201	DAQ enforces Federal UST regulations		0.84
Surface Coatings, Metal Furniture	2401025	R307-346 Metal Furniture Surface Coating		0.78

Salt Lake Area Source BACM

Source Category	Source Category Code	Utah Existing Rules/Statute and Federal Rules	Comments	2014 Uncontrolled Inventory Tons/winter Week Day
Residential & Commercial Portable Gas Cans Evaporation/Spillage etc.	2501011011 2501011012 2501011013 2501011014 2501011015 2501012011 2501012012 2501012013 2501012014 2501011015 2501012011 2501012012 2501012013 2501012014 2501012015	40 CFR Part 59, Subpart F, Control of Evap. Emission from New & In-use Portable Fuel Containers		0.72
Fuel Gas/Gasohol Bulk Plants	2501055120	R307-328 Gasoline Transfer and Storage		0.70
Fuel Gas/Gasohol Bulk Plants	2501055120	R307-328 Gasoline Transfer and Storage		0.70
Combustion, Natural Gas, Residential	2104006000	R307-356 Appliance Pilot Light		0.69
Leaking Underground Storage Tanks	266000000	Title 19 Chapter 6 Part 4 Underground Storage Tank Act		0.62
Cutback Asphalt Paving	2461021000	R307-341 Cutback Asphalt		0.38
Surface Coatings, Metal Containers	240104000	R307-352 Metal Containers, Closure & Coil Coating		0.32
Fuel Gas/Gasohol Stage 1	2501060050	R307-328 Gasoline Transfer and Storage		0.25
Surface Coatings, Paper, Film, and Foil	2401030000	R307-344 Paper, Film & Foil Coating		0.16
Landfills	262003	R307-221 Emission Standards: Emission Controls for Existing Municipal Solid Waste Landfills		0.14
Commercial Cooking	2302002200 2302003000 2302003100 2302003200		Current rules only apply to very large sources due to extreme cost (at least \$15K/ton) Prohibitive cost would shutter most sources.	0.14
Combustion, Natural Gas, Commercial & Institutional	2103006	R307-356 Appliance Pilot Light		0.14
Surface Coatings, Machinery	2401055000	R307-350 Miscellaneous Metal Parts & Products Coating		0.13
Surface Coatings, Traffic Markings	240100800	R307-361 Architectural Coatings		0.12
Fuel, Jet, Stage 1	2501080050		Not technically feasible for jet fuel due to low vapor pressure (0.125 psi)	0.09
Surface Coatings, Aircraft	2401075000	R307-355 Control of Emissions from Aerospace Manufacture & Repair Facilities		0.08
Surface Coatings, Factory Finished Wood	2401015000	R307-349 Flat Wood Panel Coating		0.05
Fuel Gas/Gasohol Tank Truck Transport	2505030120	R307-328 Gasoline Transfer and Storage		0.05
Combustion, Natural Gas, Industrial	2102006	R307-312 Aggregate Processing Operations		0.04

Salt Lake Area Source BACM

Source Category	Source Category Code	Utah Existing Rules/Statute and Federal Rules	Comments	2014 Uncontrolled Inventory Tons/winter Week Day
Surface Coatings, Electrical	2401065000	R307-348 Magnet Wire Coating		0.04
Backyard BBQ	2810025000		Statutory exemption	0.03
Commercial Cooking, Chain-Driven Charbroiler	2302002100	R037-303 Commercial Cooking		0.03
Sewer Treatment in Publicly Owned Treatment Works (POTW)	263002	Clean Water Act: all POTW's have to report to EPA VOC concentrations in discharges.	All major POTW's meet Best Available Technology	0.03
Fuel, Jet, Stage 2	25010801		Not technically feasible for jet fuel due to low vapor pressure (0.125 psi)	0.02
Surface Coatings, Railroad	2401085000	R307-350 Miscellaneous Metal Parts & Products Coating		0.002
Surface Coatings, Other Special Purpose	2401200	R307-353 Plastic Parts Coatings		0.01
Surface Coatings, Other Special Purpose	2401200	R307-350 Miscellaneous Metal Parts & Products Coating		0.01
Surface Coatings, Marine	2401080000	R307-350 Miscellaneous Metal Parts & Products Coating R307-353 Plastic Parts Coating		0.01
Solvent, Dry Cleaning	2420		Solvent dry cleaners use no transfer machines that eliminate vapor loss during transfer from washing to drying. Additional built-in controls include refrigerated condensers. Some units also include built-in stills to further recover vapors. No further controls would be feasible.	0.01
Combustion, LPG	2102007 2104007		Only controls developed for LPG combustion are to reduce NOx emissions (EPA AP 42, Section 1.5)	0.01
Fires, Structural	281005		Uncontrollable	0.005
Fires, Vehicle	281005		Uncontrollable	0.005
Surface Coatings, Appliances	2401060000	R307-347 Large Appliance Surface Coating		0.002
Tank Cleaning	246116	R307-304 Solvent Cleaning		4.7 x 10 ⁻⁴
Combustion, Oil	2104004 2102005		EPA-600/2-75-069-a Guidelines for Residential Oil-Burner Adjustments Procedures to Minimize Air Pollution	3.2 x 10 ⁻⁴
Cremation, Human	28100601		Catalytic oxidizer control cost would readily exceed \$15,000/ton	3.2 x 10 ⁻⁵
Combustion, Kerosene	2103011000		No known control	1.8 x 10 ⁻⁵

VOC Source Category Analysis

R307-221 Emission Standards: Emission Controls for Existing Municipal Solid Waste Landfills: The rule is intended to meet federal requirements noted below. Large landfills must reduce non-methane organic compounds by 98%.

Federal Regulation or Guidance: 42 U.S.C. 7411(d) and 40 CFR 60.30c – 60.36c. There are no further rule enhancements.

R307-304 Solvent Cleaning: R307-304 was adopted in 2017, which was originally part of the degreasing rule R307-335. UDAQ amended R307-335 by removing the Industrial Solvent Cleaning sections R307-335-7 and 8 from R307-335. UDAQ believes that we can achieve greater VOC emission control by including the former industrial solvent cleaning sections into a new solvent use rule. The requirements for R307-335-7 were derived from the EPA guidance for industrial solvent cleaning (EPA 453/R-06-001). EPA recommends that states set industrial solvent cleaning rule applicability at 15 lbs. of VOCs/day or approximately 720 gallons of solvent/yr. R307-304 provides a lower applicability threshold for gallons of solvent used than R307-335-7. R307-304 applies to all industrial solvent usage of 55 gallons or more in any 12 month period.

Federal Regulation or Guidance: Control Techniques Guidelines for Industrial Cleaning Solvents.

Comparison of Other State Rules: UDAQ's analysis of various state and air district rules that regulate industrial solvent cleaning indicates that most apply aqueous-based solvent cleaning limits based on density, which greatly limits solvent options.

- ❖ SJ Rule 4663, Organic Solvent Cleaning, Storage, and Disposal. Requires aqueous-based solvent cleaning with an applicability set at 55 gallons or more of solvent products in any consecutive 12 month period. Rule 4663 is the most stringent rule that UDAQ could identify that solely regulates industrial cleaning activities.
- ❖ SC Rule 1171 Solvent Cleaning Operations. The rule casts a wider net by including cleaning of many source types, including coating operations. SJ regulates coating sources and their cleaning requirements in separate coating rules, therefore Rule 1171 is not directly comparable to R307-304.
- ❖ Sacramento Rule 466, Solvent Cleaning. This rule is similar to SJ Rule 4663.

BACM Conclusion: The R307-304 rule applicability of 55 gallons in a calendar year (0.15 gallon/day) essentially regulates most industrial solvent cleaning and usage within

Salt Lake Area Source BACM

the nonattainment area that are not already regulated under industry specific coating rules.

The use of vapor pressure instead of a density based limit offers more solvent options while reducing evaporative losses, therefore is a preferred approach to limit VOC emissions.

No further reduction opportunities were identified for R307-304.

R307-328 Gasoline Transfer and Storage: Establishes emission controls for gasoline vapors during filling of gasoline cargo tank and storage tanks state-wide. The rule is based on the federal stage I vapor recovery guidance.

Federal Regulation or Guidance: Control of Hydrocarbons from Tank Truck Gasoline Loading Terminals.

Comparison of Other State Rules and BACM Conclusion: SJ Rule 4621, Gasoline Transfer into Stationary Storage Containers, Delivery Vessels, and Bulk Plants was reviewed and no further emission reduction opportunities were found.

R307-335 Degreasing: Provides VOC emission control for large degreasing equipment. The rule was based on the EPA degreasing CTG. Large degreasing equipment have been phased out over the years such that we believe there are few left to regulate.

Federal Regulation or Guidance: Control of Volatile Organic Emissions from Solvent Metal Cleaning.

Comparison of Other State Rules and BACM Conclusion: SJ Rule 4662, Sacramento Rule 454 and Ventura Rule 74.6.1 were reviewed and no further reduction opportunities were identified.

R307-341 Cutback Asphalt: Cutback asphalt is a bituminous coating that has been thinned with a petroleum distillate so that it may be applied without heat or low heat. Cutback is used during winter months to conduct road repair when asphalt manufacturing plants are not operating. R307-341 limits the oil distillate content to 7%. Cutback is normally formulated with 10-40% of petroleum distillate in order to reduce the viscosity so that it is malleable.

Federal Regulation or Guidance: Control of Volatile Organic Emissions from Use of Cutback Asphalt.

Comparison of Other State Rules:

- ❖ The Colorado Department of Public Health and Environment Regulation Number 7 XI permits the use of cutback asphalt during winter months without limiting the organic content.

- ❖ SJ Rule 4641, Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations permits up to 5% organic compounds.

BACM Conclusion: UDAQ consulted with Asphalt Emulsion Industries, a manufacturer of cutback, to determine whether it is feasible to reduce the petroleum distillate to 5%. A representative of the company stated that while special formulations down to 5% can be made, they do not recommend doing so for safety reasons. When the organic content is lowered to that extent, the product must be heated to 160 degrees Fahrenheit to increase the malleable, which can result in product fuming and possible flaming. Consideration must also be given to local winter time temperatures and its influence on product malleability. Consequently, there is no further emission reduction opportunity.

R307-342 Adhesive and Sealants: UDAQ adopted the most current Ozone Transport Commission (OTC) model rule. The model rule achieves VOC reductions through two basic components: sale and manufacture restrictions that limit the VOC content of specified adhesives, sealants and primers sold in the state; and use restrictions that apply primarily to commercial/industrial applications.

A reasonably available control technology determination prepared by the California Air Resources Board (CARB) in 1998 forms the basis of this model rule. In the years 1998-2001, the provisions of the CARB determination were adopted in regulatory form in various air pollution control districts in California including the Bay Area, Ventura County, Sacramento Metropolitan and San Joaquin Valley.

Federal Regulation or Guidance: None

Comparison of Other State Rules:

- ❖ SJ Rule 4653, Adhesives and Sealants is comparable to R307-342.

- ❖ SC Rule 1168, Adhesives and Sealants Applications contain more stringent VOC limits for some adhesive specific categories.

BACM Conclusion: The OTC is a multi-state organization created under the Clean Air Act in order to advise EPA on transport issues and for developing and implementing regional solutions to the ground-level ozone problem in the Northeast and Mid-Atlantic regions. The model rules developed by the OTC are relevant for secondary PM formation.

The OTC states work together on model rules and programs through three standing committees, organized by source category and/or function. Model rules are developed through a rigorous process that includes input from all stakeholders. The advantages of

a model rule is the assurance that the rule limits have been thoroughly evaluated and the continuity offered across states and regions that afford regulatory stability to manufacturers. It is for these reasons that UDAQ believes it is prudent to reserve future rule amendments to OTC model rule updates.

Coating Rules

Coating rule strengthening: the Air Quality Board has approved amendments in 2017 to strengthen the following coating rules:

- ❖ R307-343. Emissions Standards for Wood Furniture Manufacturing Operations
- ❖ R307-344. Paper, Film, and Foil Coatings
- ❖ R307-345. Fabric and Vinyl Coatings
- ❖ R307-346. Metal Furniture Surface Coatings
- ❖ R307-347. Large Appliance Surface Coatings
- ❖ R307-349. Flat Wood Panel Coatings
- ❖ R307-350. Miscellaneous Metal Parts and Products Coatings
- ❖ R307-352. Metal Container, Closure, and Coil Coatings
- ❖ R307-353. Plastic Parts Coatings
- ❖ R307-354. Automotive Refinishing Coatings

The applicability thresholds were reduced from 2.7 tpy potential to emit to 20 gallons or more of VOC containing coatings and solvent usage combined per year. The 20 gallon threshold was derived after a review of SJ and SC comparable coating rules. The applicability thresholds for these air district rules ranged widely; from applying to all commercial/industrial sources to 55 gallons. UDAQ believes that a 20 gallon applicability threshold discriminates between homeowners and hobbyists who conduct coating operations from commercial/industrial sources.

R307-348. Magnet Wire Coatings applicability threshold was reduced from 2.7 tpy potential to emit to 2 tpy based on the BACM analysis where R307-348 was compared to the South Coast Rule 1126.

Cleaning solvent limit: rules R307-343 through R307-347 and R307-349 through R307-353 contain a cleaning solvent VOC limit of 0.21 lb/gal. This limit was adopted from certain California air district rules and guidance as part of the RACT rulemaking for the moderate PM_{2.5} SIP in an aggressive attempt to attain the standard. This extreme VOC content limit for cleaning solutions precludes the use of any organic solvent but acetone. Acetone is not a universal solvent and is incompatible with many coating formulations. That is to say that acetone does not uniformly dissolve all coating materials so that it does not meet all cleaning requirements. An example of this limitation is explained in EPA's guidance (EPA 453/R-07-003) for coating on paper, film and foil, where EPA states, "little information is available regarding the types of low-VOC or VOC-free cleaning materials that could be used in the paper, film, and foil surface coating industry." Similarly, EPA states in its miscellaneous metals and plastic coating guidance (EPA-453/R-08-003), "cleaning materials with low VOC content would generate less VOC emissions than materials with high VOC content, but may not be feasible with the

Salt Lake Area Source BACM

broad range of coatings used in the miscellaneous metal product and plastic parts surface coating facilities.”

Additional concerns have been raised regarding possible equipment damage, such as rusting, by using aqueous based solutions.

The most serious concern is the extremely low flash point of acetone that could result in a fire hazard. Related to this is the rapid evaporation of acetone that limits its use in many cleaning operations and rapid drying of coatings.

These technical limitations clearly indicate that it was an over reach to use a 0.21 lb/gal VOC cleaning solvent limit for a RACT rule. In conducting our BACM analysis, we find the same technical limitations and no cost-effective alternatives to acetone. Parachlorobenzotrifluoride (PCBTF) is a VOC exempt chemical that is marketed as an alternative to VOC solvents. UDAQ requested PCBTF usage information from a host of coating sources and industry trade associations. We were unable to locate any use of PCBTF, predominately due to cost. The retail cost of a gallon of PCBTF is \$60, more than the cost of a gallon of a coating product.

A convincing argument can also be made that the 0.21 lb/gal VOC content limit is even beyond the most stringent measure (MSM) because MSM is defined as a control measure that has been reliably implemented and cost-effective. Since one aqueous limit cannot meet all coating solvent cleaning requirements, it fails to meet the reliability test.

Setting a solvent cleaning limit based on vapor pressure is a more appropriate approach and is consistent with EPA guidance. This approach expands the chemical formulation options while reducing evaporative losses from cleaning operations. All density based solvent cleaning limits have been replaced with vapor pressure limits corresponding to industry specific EPA guidance. In the absence of an EPA industry specific vapor pressure recommendation, 1 mm Hg at 20 degrees Celsius was applied based on the following rationale:

EPA determined that the “cleaning materials with VOC composite vapor pressure less than 10 millimeters of mercury (mm Hg) at 20 °C when used in conjunction with good work practices achieve a comparable emission reduction to cleaning materials containing 30 weight percent VOC (EPA-453/R-06-002, pg 12).” This ratio means that the 0.21 lb/gal is comparable to 1 mm Hg as follows:

Assuming VOC average solution weights 7 lb/gal, 0.21 lb/gal is equal to 3% VOC;

If 10 mm Hg vapor pressure is equal to 30% VOC, then 1 mm Hg is equal to 3% VOC.

Salt Lake Area Source BACM

R307-343 Emissions Standards for Wood Furniture Manufacturing Operations: The coating categories in R307-343 were updated in 2017 to the current types of coatings used in the industry. Polyurethanes were also included as new categories that previously fell under the topcoat or sealer category.

The VOC limits for the 2 component polyurethanes were slightly elevated from 0.9 to 1.0 lb VOC/lb solids because of the difficulty of transferring these viscous coatings to the wood surface under the previous VOC limit. UDAQ worked with the coating industry to derive the lowest workable VOC limits for these categories. We expect to mitigate the slight increase in VOC's from polyurethanes by lowering the rule applicability to 20 gallons/yr. We estimate that 75 sources throughout the 7 nonattainment counties were subject to the pre-2017 rule amendment. Reducing the applicability to 20 gallons/yr regulates an additional 191 sources within the 7 nonattainment counties with an estimated VOC emissions of 116 tpy.

Federal Regulation or Guidance: Control of Volatile Organic Compound Emissions from Wood Furniture Manufacturing Operations applies.

Comparison of Other State Rules and BACM Conclusion: The coating limits in R307-343 were reduced by half in January 1, 2015 and are more stringent than comparable rules SJ Rule 4606 and SC Rule 1136. Consequently, R307-343 is the most stringent measure available for this industry.

R307-344 Paper, Film & Foil Coating:

Federal Regulation or Guidance: Control Techniques Guidelines for Paper, Film, and Foil Coatings.

Comparison of Other State Rules and BACM Conclusion: SJ Rule 4607 and SC Rule 1128 were reviewed and were found to be comparable to R307-344

The Ventura County Rule 74.3 applies to all sources, but the coating limits in Rule 74.3 are an order of magnitude higher than those in R307-344.

The coating limits in R307-344 are extremely low, such that no further emission reduction opportunity exists based on the rule comparisons.

R307-345 Fabric & Vinyl Coating:

Federal Regulation or Guidance: Control of Volatile Organic Emissions from Existing Stationary Sources – Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks applies.

Comparison of Other State Rules and BACM Conclusion: SJ Rule 4607 and SC Rule 1128 were reviewed and no further emission reduction opportunity exists.

R307-346 Metal Furniture Surface Coating:

Federal Regulation or Guidance: Control Techniques Guidelines for Metal Furniture Coatings applies.

Comparison of Other State Rules and BACM Conclusion: SJ Rule 4603, SC Rule 1107 and Sacramento Rule 451 are comparable except that the applicability of R307-346 is stricter than Sacramento Rule 451. no further emission reduction opportunity exists.

R307-347 Large Appliance Surface Coating:

Federal Regulation or Guidance: Control Techniques Guidelines for Large Appliance Coatings applies.

Comparison of Other State Rules and BACM Conclusion: SJ Rule 4603 and SC Rule 1107 were reviewed and no further emission reduction opportunity exists.

R307-348 Magnet Wire Coating:

Federal Regulation or Guidance: Control of Volatile Organic Emissions from Existing Stationary Sources – Volume IV: Surface Coating of Insulation of Magnet Wire applies.

Comparison of Other State Rules and BACM Conclusion: SC Rule 1126 was reviewed and no further emission reduction opportunity exists.

R307-349 Flat Wood Panel Coating:

Federal Regulation or Guidance: Control Techniques Guidelines for Flat Wood Paneling Coatings applies.

Comparison of Other State Rules and BACM Conclusion:

- ❖ SJ Rule 4606 and SC Rule 1104 are comparable to R307-349
- ❖ Sacramento Rule 463, Wood Products Coatings is not a directly comparable to R307-349 because it broadly applies to many types of wood manufacturing. The rule has tighter VOC limits than R307-349 and exempts sources that use less than 55 gallons/yr., which is higher than the 20 gallon applicability of R307-349.
- ❖ Ventura Rule 74.30 is comparable to Sacramento Rule 463 with the exception that Rule 74.30 exempts sources below 200 gallons.

No further emission reduction opportunity exists.

R307-350 Miscellaneous Metal Parts & Products Coating:

Federal Regulation or Guidance: Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings applies.

Comparison of Other State Rules and BACM Conclusion: SC Rule 1107, Sacramento Rule 451 and Ventura Rule 74.12 were reviewed and are comparable to R307-350.

Rule 451 is less stringent than R307-350 because it exempts sources less than 55 gallons. No further emission reduction opportunity exists.

Rule 74.12 is less stringent than R307-350 because it exempts sources less than 200 gallons.

No further emission reduction opportunity exists.

R307-351 Graphic Arts:

Federal Regulation or Guidance: Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VIII: Graphic Arts-Rotogravure and Flexography, Control Techniques Guidelines for Offset Lithographic Printing and Letterpress Printing, Control Techniques Guidelines for Flexible Package Printing and Control of Volatile Organic Compound Emissions from Offset Lithographic Printing.

Comparison of Other State Rules and BACM Conclusion: Graphic art control measures were established under the original coating rule R307-340 that dated back to the ozone SIP. The rule applicability was original set at 100 tons/yr for graphic arts. R307-340 was replaced by separate industry specific coating rules during the moderate PM_{2.5} SIP and the graphic arts section became R307-351. The rule applicability in R307-351 was set at 25 tons/yr as per the recommendations in the CTG's.

A review of 7 California air district rules indicates that all of those rules apply to more sources than R307-351 and that the California rules require more conservative VOC limits.

- South Coast Air Quality Management District Rule 1130- applies to sources that emit to 10 tons/yr.
- San Joaquin Valley Air Pollution Control District Rule 4607-applies to sources that emit 200 lb/yr.
- Bay Area Air Quality Management District Regulation 8 Rule 20-applies to sources that emit 0.5 ton/year.
- Santa Barbara County Rule 354-applies to sources that emit 1.8 ton/year.

Salt Lake Area Source BACM

- San Diego County Rule 67.16-applies to sources that emit 2.7 ton/year.
- Ventura Rule 74.19-applies to sources that emit 200 lb/yr.
- Sacramento Metro Rule 450-applies to sources that emit 720 lb/yr.

UDAQ has revised the rule applicability to 450 gallons/yr, which is comparable to 1 ton/yr. This level was chosen based on consultation with the American Printing Association, which stated that sources below 1 ton/yr could not likely absorb the cost.

Further, UDAQ has completely revised this complex rule. The new rule was modeled after the simpler format in SC Rule 1130. The VOC limits for ink products and fountain solutions were reduced to the levels found in SC Rule 1130.

The solvent cleaning VOC limit has been tightened to include a vapor pressure limit in accordance with the EPA recommendation in the lithographic CTG and a reduction in VOC by weight.

The resulting rule revision is estimated to reduce VOC's by 69%.

R307-352 Metal Containers, Closure & Coil Coating:

Federal Regulation or Guidance: Control of Volatile Organic Emissions from Existing Stationary Sources – Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks applies.

Comparison of Other State Rules and BACM Conclusion: SJ Rule 4604, SC Rule 1125 and Sacramento Rule 452 are comparable to R307-352 except that Rule 452 applies to all sources. No further emission reduction opportunity exists.

R307-353 Plastic Parts Coating:

Federal Regulation or Guidance: Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings applies.

Comparison of Other State Rules and BACM Conclusion: SJ Rule 4603 was reviewed and no further emission reduction opportunity exists.

R307-354 Auto body refinishing

Federal Regulation or Guidance: Alternative Control Techniques Document – Automobile Refinishing applies.

Comparison of Other State Rules and BACM Conclusion: SC Rule 1151 and Sacramento Rule 459 were reviewed and no further emission reduction opportunity exists.

R307-355 Control of Emissions from Aerospace Manufacture & Rework Facilities

Federal Regulation or Guidance: Control of Volatile Organic Compound Emissions from Coating Operations at Aerospace Manufacturing and Rework Operations applies. The CTG offers a model rule.

Comparison of Other State Rules and BACM Conclusion: SJ Rule 4605, SC Rule 1124 and Sacramento Rule 456 were evaluated. All jurisdictions crafted their rules generally along the CTG model rule. The VOC coating limits vary across rules.

All of the California rules allow for more exclusions than R307-355, especially Regulation 8.

The rule applicability for R307-355 is 10 tpy, while the rule applicability's for Rule 4605, 1124 and 456 are set between 55 and 1460 gallons/year. Regulation 8 applies to all sources.

UDAQ has revised the rule to lower the applicability threshold.

R307-357 Consumer Products

Federal Regulation or Guidance: EPA promulgated a national regulation in 1998 (40 CFR, Part 59, Subpart C) for consumer products. CARB and the OTC member states have periodically updated their rules to obtain VOC reductions beyond those required by the federal regulation.

Comparison of Other State Rules: UDAQ was the first state to adopt the OTC 2014 model rule. Many east coast states are currently in the process of adopting the 2014 model rule.

The CARB consumer products rule is very similar to the OTC 2014 model rule. The OTC has established a policy that it will adopt currently enforceable CARB limits. As CARB establishes new final limits, the OTC will adopt those in the future. There are no current proposals to amend the 2014 model rule consequently, there are no further emission reduction opportunities at this time.

R307-361 Architectural Coatings

Federal Regulation or Guidance: CARB and various California air management districts implemented architectural and industrial maintenance (AIM) rules in the late 1990's-2000 based on RACT analyses. Updates to these rules have been made several times since their inception. EPA promulgated a national AIM rule in January 2005 (40 CFR Part 59 Subpart D). The OTC developed its first model AIM rule in 2001 based on

Salt Lake Area Source BACM

the work conducted by CARB in 2000. The OTC most current rule is dated 2011 and is the most current available model rule. No further emission reduction opportunity exists.

SO_x BACM Assessment

Source Category	Source Category Code	Utah Existing Rules	Comments	2014 Uncontrolled Inventory Tons/winter Week Day
Combustion, Natural Gas, Residential	2104006	R307-356 Appliance Pilot Light		0.07
Combustion, Wood, All Devices	2104008320 2104008310 2104008330 2104008400 2102008000 2104008100 2103008000 2104008610 2104008210 2104008220 2104008510 2104008230 2104008700	R307-302 Solid Fuel Burning Devices		0.05
Combustion, Oil	2104004 2102005	R307-312 Aggregate Processing Operations	EPA-600/2-75-069-a Guidelines for Residential Oil-Burner Adjustments Procedures to Minimize Air Pollution	0.02
Combustion, Natural Gas, Commercial & Institutional	2103006	R307-356 Appliance Pilot Light		0.01
Combustion, Natural Gas, Industrial	2102006	R307-312 Aggregate Processing Operations		0.004
Combustion, Kerosene	2103011000		No known control	0.002
Cremation, Human	28100601		No known control	0.001
Combustion, LPG	2102007 2104007		Only controls developed for LPG combustion are to reduce NO _x emissions (EPA AP 42, Section 1.5)	0.001

SO_x Source Category Analysis

R307-312 Aggregate Processing Operations: This is a Utah derived rule that establishes emission standards for sources in the aggregate processing industry, including aggregate processing equipment, hot mix asphalt plants and concrete batch plants. This rule primarily addresses SO_x. Additional minor level of controls is also realized for PM_{2.5} and NO_x. While this rule applies to area sources,

Hot mix asphalt plants are able to utilize a variety of fuels. The fuel that generates the lowest emissions is natural gas or propane. The fuel that generates the highest emissions is waste/used oil. Natural gas produces approximately half of the NO_x emissions that waste oil produces; however, the combustion of waste oil has beneficial uses in that the waste oil is not disposed of as a hazardous waste. The cost of the fuel

Salt Lake Area Source BACM

used has a great effect on the final cost of the product. Natural gas has in recent times been the lowest cost fuel available for hot mix asphalt plants; however, if natural gas prices increase or if waste oil prices decrease, it may not be economically feasible to use natural gas. During the winter inversion season, production of hot mix asphalt is significantly reduced. To allow sources the flexibility to utilize different fuels as necessary during the inversion season, sources are required to reduce hot mix asphalt production by half when utilizing a fuel other than natural gas thereby resulting in lower NO_x and SO₂ emissions.

Federal Regulation or Guidance: None

Comparison of Other State Rules: There are no known rules in other states that directly apply to R307-312. There are no current opportunities for additional program revisions that would lead to further emission reductions.

NO_x BACM Assessment

Source Category	Source Category Code	Utah Existing Rules and Federal Rules	Comments	2014 Uncontrolled Inventory Tons/winter Week Day
Combustion, Natural Gas, Residential	2104006	R307-230 NO _x Emission Limits for Natural Gas-Fired Water Heaters		11.75
Combustion, Natural Gas, Commercial & Institutional	2103006	R307-230 NO _x Emission Limits for Natural Gas-Fired Water Heaters	UDAQ researching boiler rule option	2.5
Combustion, Natural Gas, Industrial	2102006	R307-312 Aggregate Processing Operations Area Source Boilers NESHAP rule, 40 CFR 63.11195	UDAQ researching boiler rule option	0.72
Combustion, LPG	2102007 2104007		No known control	0.30
Combustion, Wood, All Devices	2104008320 2104008310 2104008330 2104008400 2102008000 2104008100 2103008000 2104008610 2104008210 2104008220 2104008510 2104008230 2104008700	R307-302 Solid Fuel Burning Devices		0.28
Fires, Vehicle and Structural	2810030000 2810050000		Uncontrollable	0.02
Combustion, Oil	2104004 2102005	R307-312 Aggregate Processing Operations	UDAQ researching boiler rule option	0.01
Cremation, Human	28100601		No known control	0.009
Combustion, Kerosene	2103011000		No known control	0.001

NO_x emissions are dominated by combustion of natural gas in residential, commercial and institutional structures. Other combustions sources, such as wood burning, have been addressed in other sections of the area source BACM analysis. The remaining NO_x sources are so insignificant that if they could be controlled, would be cost prohibitive.

NO_x Source Category Analysis

R307-230 NO_x Emission Limits for Natural Gas-Fired Water Heaters: NO_x-emitting area sources include natural gas-fired furnaces, boilers and water heaters. Appliance burners are typically rated at 40 ng/Joule of NO_x. Ultra-low NO_x water heater burners rated from 10-14 ng/Joule of NO_x are commercially available and have been in use in portions of California for nearly 10 years. The HVAC industry has been working on producing commercial ultra-low NO_x furnaces and boilers however, they are not

currently available. R307-230 requires future sales of ultra-low NO_x water heaters state-wide.

Federal Regulation or Guidance: None

Comparison of Other State Rules: SJVAB Rule 4902, SC Rule 4902 and BAAQMD Regulation 9 Rule 6 all require a NO_x limit of 10 ng/Joule for residential units and slightly higher limits for commercial units. R307-230 is consistent with the California rules. There are no current opportunities for additional program revisions for gas fired water heaters that would lead to further emission reductions.

Future opportunities may be available regarding gas fired furnaces and boilers once the HVAC industry is able to commercially produce economical ultra-low NO_x units. Several California air districts have already put in place rules for ultra-low NO_x furnace in anticipation that the HVAC industry would be further along in their research and development.

R307-356 Appliance Pilot Light: Prohibits the sale of appliance pilot lights (with the exception of water heaters) after January 1, 2014. A Canadian study determined that a gas fireplace pilot light accounts for 48% of the annualized gas usage for the appliance. We assumed that this gas usage is generally applicable to other appliances with a pilot light. Prohibiting standing pilot lights reduces gas consumption that translates to a reduction in PM_{2.5}, VOC, NO_x, SO_x and NH₃.

Federal Regulation or Guidance: The Department of Energy issued a regulation on November 18, 2011 called Energy Conservation Standards for Direct Heating Equipment (FR Vol. 76, No. 223). This rule established energy efficiency standards for direct heating equipment like gas fireplaces. Appliances that do not use a standing pilot light are exempt from the energy efficiency standards, thereby encouraging the use of intermittent pilot ignition consistent with the requirement in R307-356.

Comparison of Other State Rules: We are not aware of other comparable state rules.

BACM Conclusion: There are no known opportunities for additional emission reduction for this source category.

Ammonia BACM Assessment

Ammonia Area Source Inventory

There are many winter time area sources categories of ammonia. The 2014 area source national emissions inventory (NEI V1) for Utah is composed of the following.

Biogenic	81.4%
Animals	14.5%
Fertilizer Application	1.6%
Human Respiration	1.4%
Combustion	1.1%
Total	100%

The nonattainment area level inventory is shown below.

Source Category	Source Category Code	2014 Uncontrolled Inventory Tons/winter Week Day
Agricultural Livestock Cattle	2805020000	1.8
Human Respiration	2810010000	1.4
Animals, Wild (moose, antelope 25.56 tpy)	2807025000 2807030000 None for Moose and Antelope	0.57 + 0.07 (moose/antelope) = 0.64
Agricultural Livestock Poultry	2805005000	0.30
Animals, Domestic	2806010000 2806015000	0.28
Agricultural Livestock Horses	2805035000	0.20
Agricultural Livestock Turkeys	280501	0.16
Agricultural Livestock Sheep	2805040000	0.16
Combustion, Wood, All Devices	2104008320 2104008310 2104008330 2104008400 2102008000 2104008100 2103008000 2104008610 2104008210 2104008220 2104008510 2104008230 2104008700	0.13
Agricultural Livestock Goats	2805045000	0.01
Agricultural Livestock Swine	2805025000	0.01
Sewer Treatment (POTW)	263002	0.006
Combustion, LPG	2102007 2104007	0.001
Combustion, Oil	2104004 2102005	5.2 x 10 ⁻⁴
Combustion, Kerosene	2103011000	4.4 x 10 ⁻⁵
Landfill	262003	1.4 x 10 ⁻⁸

Combustion sources are addressed by control measures for other constituents because they play a greater role in reducing other parameters than ammonia.

All major POTW's meet Best Available Technology under the Clean Water Act and have an ammonia discharge limit in their permit.

Most of the ammonia is derived from commercial cattle and poultry manure, and manure processing, consequently, the BACM analysis will focus on agricultural control strategies for these source categories.

Control measures could not be identified for the remaining insignificant ammonia sources.

Agricultural Source Category Analysis

Because the majority of the ammonia is derived from commercial cattle and poultry manure, the agricultural control strategy focus is on these sources.

This section provides a discussion on ammonia control strategies that are technologically feasible for winter-time manure management. Manure injection and soil incorporation (including chemical treatments prior to land application) are not included as manure management strategies because these activities cannot be performed when the ground is frozen.

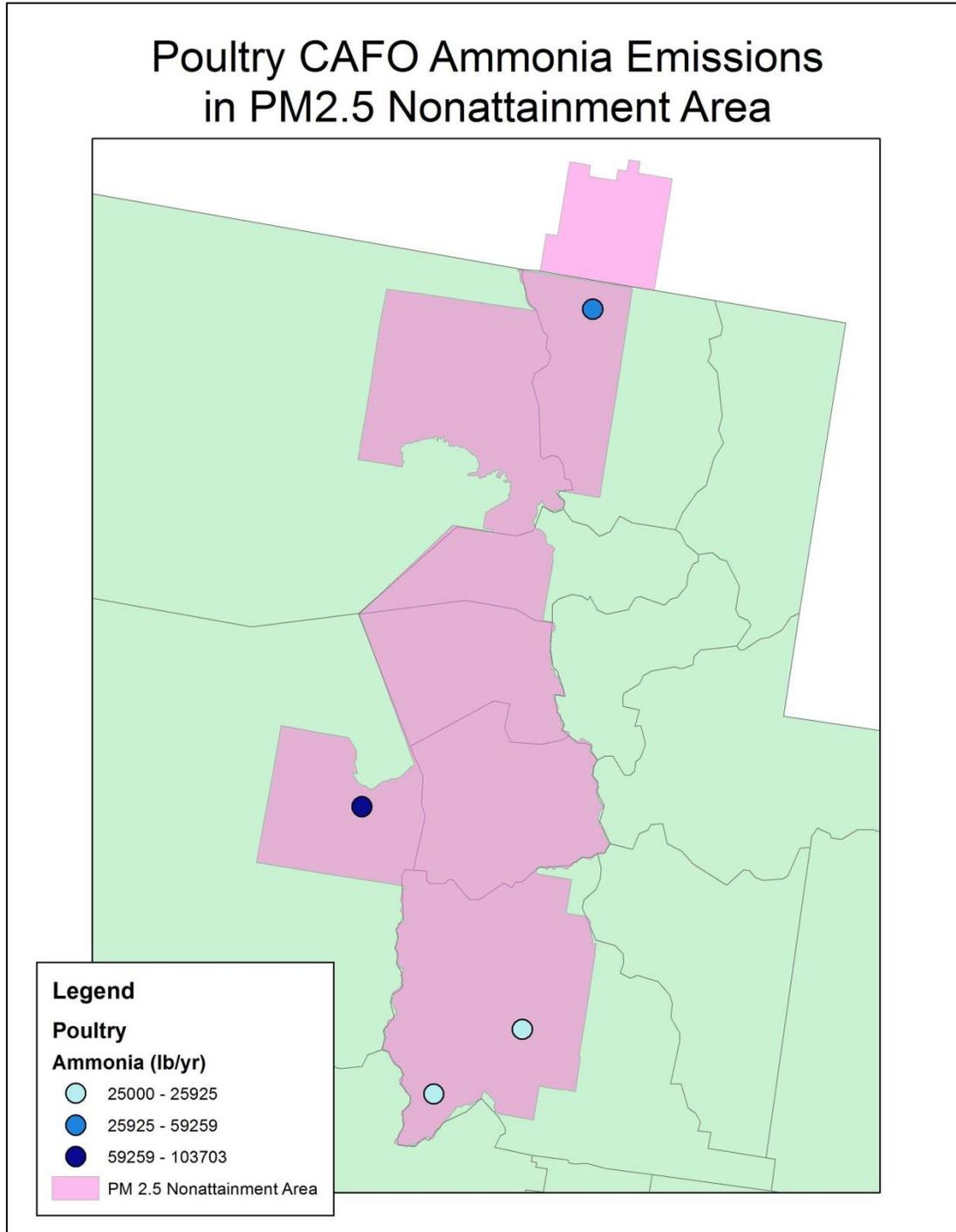
Ammonia Characteristics in Manure

Agriculture is responsible for over three-fourths of the ammonia emissions in the USA and Canada, with animal production accounting for the major share. Ammonia becomes a constituent of animal waste when nitrogen-rich protein in feed is not completely converted into animal products (such as meat, milk, wool, and eggs). For example, only 25 to 35% of the nitrogen fed to dairy cows is converted into milk, with the remainder excreted in urine and manure in a variety of simple and complex forms of nitrogen. Chemical and microbial processes release ammonia into the air. Nitrogen in poultry manure is mainly in the form of uric acid, which also rapidly converts to urea and to ammonia (Bittman and Mikkelsen, 2009).

Ammonia is a colorless, lighter than air gas with a pungent odor. Significant volatilization of ammonia can occur within the first 24 hours after land application of manure. More than 50% of the total emission of ammonia can occur within the first six hours after application. Ammonia volatilization is highly dependent on manure management techniques and environmental factors, such as temperature and wind. Researchers have found that 50% of total nitrogen is volatilized as ammonia at a temperature of 30°C compared to 35% volatilization when the temperature is 25°C. Wind speed will increase the rate of ammonia volatilization as the higher wind increases the mass transfer and air exchange between the manured surface and the atmosphere. (AGRI-FACTS, Agdex 538-3, February 2008).

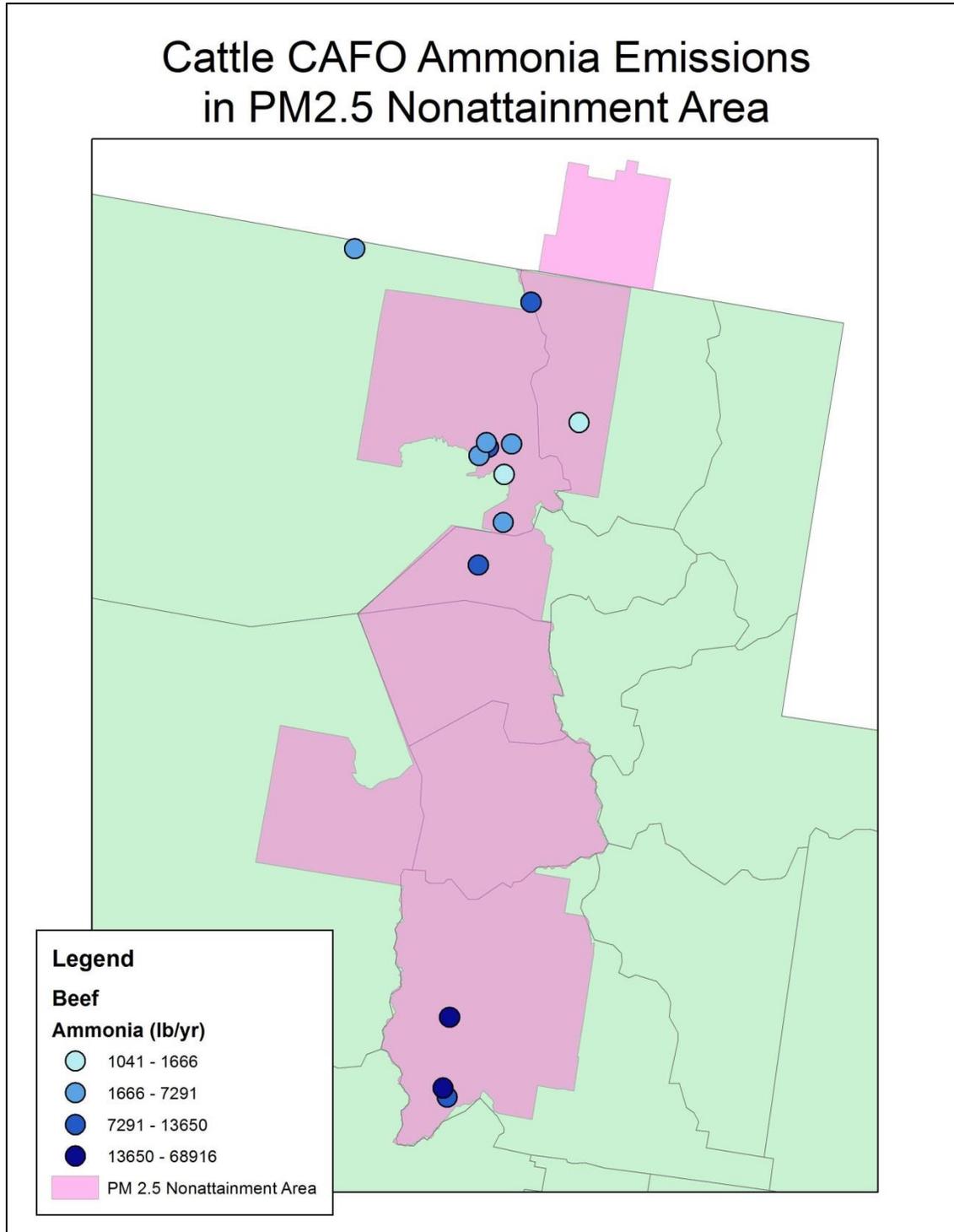
Poultry Inventory

Commercial poultry operations within the nonattainment area are limited to egg laying production. There are no commercial broiler operations or turkey growers. Ammonia emissions for the larger poultry operations can be calculated using the CAFO database. There are two in Utah County, one in Tooele County and one in Cache County.



Cattle Inventory

Cattle operations within the nonattainment area include dairy and beef production. The cattle CAFO's and their ammonia emissions are shown below.



Ammonia Control Strategies in Livestock and Poultry Manure

Dietary Manipulations

Excess nutrients not absorbed in the digestive tract are voided in the manure and urine. Dietary protein provides amino acids, nitrogen, sulfur, and other elements needed for animal reproduction, growth, and milk or egg production. Animals use less than half of the nitrogen that they consume, with the remaining excreted in the feces or urine. Fecal and urinary nitrogen are ammonia emission sources. Limiting crude protein levels in the diet to only that used by the animal limits nitrogen excreted in urea or uric acid, which contributes to emissions.

While reducing crude protein content will reduce nitrogen excretion and ammonia emissions, reductions in crude protein can severely impact animal performance. To effectively reduce crude protein concentrations of diets for poultry, additional supplementation of synthetic amino acids is needed. Animals require a specific ratios of available amino acids; thus, lowering crude protein levels requires supplementation with select amino acids that otherwise would be insufficient. Specific synthetic amino acids can be added to meet the nutritional needs of an animal according to genetic lines, age, sex, and other factors (Air Quality Education in Animal Agriculture, January 2012).

Research has shown that high-quality, protein-limited diets with appropriate supplementation of amino acids can effectively reduce nitrogen excretion and ammonia emissions from poultry, dairy and beef cattle operations without a loss in animal productivity. Commonly used amino acids are lysine, methionine, and threonine. Other amino acids may not be economically feasible (Applegate et al., 2008).

Researchers have found that for every one percent reduction in crude protein, there is an 8.5-10% reduction in ammonia in dairy beef and poultry. Addition of fermentable carbohydrates (bran or pulp) results in a 14% ammonia reduction (Iowa State Univ. Extension, 2004).

Undesirable sulfurous compounds often originate from sulfur-containing amino acids and sulfur-containing mineral sources. Limiting unnecessary sources of sulfur can reduce emissions of hydrogen sulfide and other volatile sulfur compounds (Air Quality Education in Animal Agriculture, January 2012).

Ultimately producers formulate their own feed and may rely on feed ingredients based on lowest market cost that will result in acceptable yield. Supplementing diets with amino acids other than lysine, methionine, or threonine may not be economically feasible at this time.

Dietary manipulation for the purposes of reducing ammonia production would require monitoring of a host of physiological factors, as well as monitoring feed ratio. Given the many complex variables, we cannot develop a universal SIP enforceable standard that would yield reliable control reduction while guaranteeing productive growth and/or yield. Consequently, dietary manipulation is screened out as a viable strategy.

Manure Management

Poultry Litter Amendments

Poultry litter is a mixture of bedding materials, excrement, spilled food and feathers. Acidifying litter with aluminum sulfate (alum) creates an acidic condition in the litter that result in converting ammonia to ammonium sulfate. Additional benefits of alum amendment include phosphorous binding, killing pathogens, causes the birds to grow faster and assist in using feed more efficiently. Due to the benefits of this practice (and cost-effectiveness), over one billion broiler chickens are grown with alum each year. The United States Department of Agriculture (USDA) supports the use of alum amendment through some cost-sharing programs (direct communications with Philip Moore, USDA).

Poultry manure treatment with alum in broiler houses has been demonstrated to reduce ammonia on average by 70% (Moore et al., 1999 and 2000). Alum is normally applied between each flock of birds at a rate of two tons of alum per broiler house. Alum costs about \$250/ton (USDA, *Treating Poultry Litter with Aluminum Sulfate (Alum)*).

Utah does not have commercial scale broiler houses but does have four large egg farms within the nonattainment counties. Given the successful use of alum in broiler houses, we explored the possibility of extending this control strategy for hen laying litter.

According to Philip Moore of the USDA, there has only been one good study conducted by the USDA on the use of liquid alum in high-rise laying hen houses. An automated misting delivery system was built at an Arkansas operation at a cost of \$30,000. The system delivered 1,000 gallons of liquid alum per month onto the litter at a cost of \$440/month. System testing showed ammonia levels were reduced from 70-90 ppm to around 10 ppm. Ammonia flux was reduced by 33%. Moore noted that the study high-rise house had higher than normal ammonia levels than one would find in newer high-rise houses with better management practices. Consequently, the dramatic ammonia reduction in this study was attributable to the very high levels of ammonia at the study site. Feed conversion and egg production were improved with alum such that there was a net return of \$426/week (excluding the capitol construction cost) (Moore et al., USDA grant report and direct communication). Moore stated during direct communications on this matter that he is not aware of any egg producer using an alum system.

This control strategy may be economically beneficial if a lower cost delivery system can be manufactured. At this juncture, there is no reliable data to support an expected control efficiency based on Moore's commentary that the ammonia levels in the project house were above normal. In the absence of verifiable control efficiency data and cost, we cannot retain this control strategy for SIP inclusion.

Mechanical Poultry Manure Processing

Automatic manure belt systems are belts that travel on rollers under egg laying hens. The belts deliver the manure to the end of the cage row where manure cross conveyors remove it from the hen house to a manure storage area. The manure can be more readily disposed of or treated on a timely basis. According to one of the larger poultry producers in Cache County and a representative of the Utah Farm Bureau, poultry

houses are preferably migrating to this expensive technology because removing the manure immediately after generation greatly reduces the fly population, rodents and odor. This mechanical process in itself does not reduce ammonia volatilization but it does collect the manure in a central storage area permitting timely treatment before large quantities of ammonia can evolve.

Composting

Ammonia loss during composting depends on the carbon to nitrogen (C:N) ratio. Ammonia volatilization is significant below a C:N of 15:1. Increased use of bedding (wood shavings, straw, etc.) helps maintain a higher C:N ratio. Application of a layer of 38% zeolite, placed on the surface of a composting poultry manure, reduced ammonia losses by 44% (Iowa State University Extension, July 2004). Composting requires routine pile mixing which would likely require amendment re-application. The cost for this control strategy is based on the amendment used and would be expected to be fairly low for carbon-based amendments like straw. One of the Cache County egg producers is currently composting his chicken litter with wood shaving and straw, then selling it commercially. A representative of the Utah Farm Bureau stated that producers are composting year round and that the piles generate enough heat to be effective even in winter. Since this strategy is already in common practice as a BMP, there is no reason to consider it further in the SIP.

Permeable Covers

Permeable covers, or biocovers, act as biofilters on the top of manure storage areas. Materials often used as covers include straw, cornstalks, peat moss, foam, geotextile fabric, and Leka rock. Permeable biocovers reduce emissions, in part, by reducing both the radiation onto the manure storage surface and the wind velocity over the liquid surface of the storage area. At the solution/air interface, humidity is relatively high, which creates a stabilized boundary that slows the emission rate of odorous volatiles. The aerobic zone within the biocover allows the growth of aerobic microorganisms that utilize the carbon, nitrogen, and sulfur from the emissions for growth. By further degrading and making use of these compounds prior to exiting the biocover, odors emitted from the biocover are altered and reduced. Reports of odor reductions of 40-50% are common whenever various straw materials are used. An odor reduction efficiency of 85% has been noted following the use of a floating mat or corrugated materials. Although ammonia emission reductions are undocumented, the processes that occur in the biocovers suggest that ammonia emissions may be reduced to the same extent (Iowa State University Extension, July 2004). Cost would vary greatly, with the greatest cost for a geotextile fabric.

Producers who practice composting are adding straw and wood shavings as the carbon source, essentially incorporating biocovers into their composting process. This control strategy is not retained for further consideration because it is already employed to some degree as a BMP and there is no reliable data to support an expected control effectiveness value for ammonia.

Liquid-Solid Manure Separation and Storage

Because ammonia results from the interaction of urine and feces in ruminants, efforts to separate them immediately upon excretion have reduced ammonia emissions

successfully (Iowa State University Extension, July 2004). The ammonia emissions reductions of urine-feces segregation in cattle has been reported to range from 21% with a 3% sloped solid floor collection (Braam et al., 1997a) to as much as 65% using a V-shaped pit floor with the gutter at the V (Braam et al., 1997b). A conveyor belt system was reported to reduce ammonia by 47-49% (Lachance et al., 2005; Stewart et al., 2004). All reported studies show ammonia reduction. The limiting factor is the cost of installing a system, maintenance, and ease versus cost of operation. Most dairies within the nonattainment area may already be using some liquid-solid separation method.

Given the structural complexity involved in installing these systems and the potential for high cost, we believe that this option is not well suited for SIP consideration, but should be encouraged as part of the USDA best management practices.

Animal Housing-Biofilters and Scrubbers

Biofiltration is a pollution control technique using living material contained on a fixed surface to capture and aerobically biologically degrade pollutants.

P.M. Ndegwa, of Washington State University, presented a review of emission mitigation techniques at the Mitigating Air Emissions from Animal Feeding Operations Conference in 2008. He reported that the literature presents a broad range of biofilter efficiencies in the removal of ammonia in carrier-air from 9-100%. The variability was attributed to the wide range of biofilter-material, bed moisture, residence time, ammonia loading and bed biological activity.

System cost in 2004 was reported to be \$150—200 per 1,000 cfm of air treated. Operational cost was estimated at \$0.25 per piglet, amortized over a 3-year for a 700-head farrow-to-wean swine facility. Reduction of ammonia emission at that operation was approximately 74% (Iowa State University Extension, July 2004).

Biofiltration will only work when there is a complete air capture system in place which limits this application in the nonattainment area to egg laying producers, who as an industry, have chosen to move towards installing expensive mechanical belt manure removal systems.

Federal Regulation or Guidance: EPA published the Utah Animal Feeding Operations (AFOs) and Concentrated Animal Feeding Operations (CAFOs) regulation in July 2012. The regulation requires CAFOs that discharge to water bodies to obtain a NPDES permit. The Utah Division of Water Quality (DWQ) is authorized to implement the NPDES CAFO program. As such, the DWQ issued a state rule that reflects the federal CAFO requirements. R317-8-10 authorizes the issuances of this general permit. Sources subject to the rule must develop a nutrient management plan (NMP) that is certified by a Natural Resources Conservation Service (NRCS) certified planner. While the NMP is designed to address surface body discharge, the plans utilize the NRCS BMPs that also serve as ammonia control.

Comparison of Other State Rules: A search was conducted of state rules designed to control agricultural ammonia sources. The following state rules have been identified.

Salt Lake Area Source BACM

- ❖ South Coast Air Quality Management District (SC) Rule 1127, Emission Reductions from Livestock Waste. The rule is intended to control ammonia, VOC, and PM₁₀ from dairy farms and associated cattle operations, composting operations and anaerobic digesters. The rule requires the use of best management practices (BMPs) for manure collection, minimization of water usage in corrals, manure disposal, manure disposal, composting and feed stock preparation. Sources may propose alternative control options. The rule applies to dairy farms with more than 50 cows, heifers, and/or calves.

The Utah inventory includes dairy operations that are being regulated under the CAFO rule R317-8-10.

- ❖ SC Rule 1133.2, Emission Reductions From Co-Composting Operations. The rule is intended to control ammonia and VOC from all co-composting operations that engage in composting chipped and ground greenwaste, woodwaste, and/or foodwaste with manure. The rule requires that all active co-composting be confined within a controlled enclosure with a controlled vent that permits no more than 20% release by weight.

There are no known co-composting operations in the non-attainment area in order to consider Rule 1133.2.

- ❖ San Joaquin Valley Air Pollution Control District (SJ) Rule 4565, Biosolids, Animal Manure, and Poultry Litter Operations. While this rule is intended to control VOC from operations involving the management of biosolids, animal manure, or poultry litter, certain provisions may also be helpful in controlling ammonia. This rule only applies to major sources whose throughput consists entirely or in part of biosolids, animal manure, or poultry litter and the operator who landfills, land applies, composts, or co-composts these materials. The requirements include operational constraints, the use of covers and 80% VOC control efficiency.

A representative of the Utah Farm Bureau stated that producers are composting year round and that the piles generate enough heat to be effective even in winter. Since this strategy is already in common practice as a BMP, there is no reason to consider it further in the SIP.

- ❖ Idaho permit by rule for dairy farms (IDAPA 58.01.01). The rule applies to dairy farms with a capacity to produce 100 or more tons of ammonia emissions per year. The rule prescribes various BMPs to control ammonia emissions, ranging from installing certain types of waste storage and treatment systems to implementing composting practices to exporting manure. A point value is assigned to each BMP. Dairy farms must employ BMPs totaling 27 points. The Idaho BMP's are in line with the control strategies under the NRCS BMP program.

Large dairy farms in Utah would be permitted under Utah R317-8-10.

BACM Conclusion: Utah has implemented the EPA CAFO rule under the Utah NPDES program that requires a certified nutrient management plan.

The USDA has derived manure BMPs that it encourages producers to follow and it appears that the few air districts that regulate agricultural ammonia have applied these BMPs. As presented above, many producers are actively engaged in BMP practices and some have an economic incentive to manage their manure in such a way as to reduce ammonia evolution (less ammonia loss results in a higher grade fertilizer) because they sell their finished compost.

There are numerous complex factors involved in ammonia agricultural controls, complicated by winter-time conditions, which make it impractical to derive further uniform air quality rulemaking.

References

Applegate, T. J., B. Richert, A. Sutton, W. Powers, and R. Angel. Diet and feed management practices affect air quality from poultry and swine operations. 2008. USDA, NRCS, Livestock and Poultry Environmental Learning Center.

P.A. Moore, Jr., M.G. Wilson, T.C. Daniel, T.R. Costello, and D.R. Edwards. Effect of Alum Applications to Hen Manure on Egg Production and Phosphorus Runoff. Final grant report, May 30, 2002.

Phillip A. Moore, USDA poultry production and products safety researcher, direct communications with Moore.

Shabtai Bittman and Robert Mikkelsen. Ammonia Emissions from Agricultural Operations: Livestock, Better Crops, Vol. 93 (2009, No. 1).

Moore, P.A., Jr., T.C. Daniel and D.R. Edwards. 1999. Reducing Phosphorous runoff and inhibiting ammonia loss from poultry manure with aluminum sulfate. Poultry Science 78:692–698.

Moore, P.A., Jr., T.C. Daniel and D.R. Edwards. 2000. Reducing Phosphorous runoff and inhibiting ammonia loss from poultry manure with aluminum sulfate. J. Environ. Qual. 29:37-49.

Iowa State University Extension, *Practice to Reduce Ammonia Emissions from Livestock Operations*, July 2004.

Braam C R; Smits M C J; Gunnink H; Swierstra D (1997a). Ammonia emission from a double-sloped solid floor in a cubicle house for dairy cows. J Agr Eng Res 68(4), 375-386.

Braam C R; Ketelars J J M H; Smits M C J (1997b). Effects of floor design and floor cleaning on ammonia emission from cubicle houses for dairy cows. Neth J Agr Sci 45, 49-64.

Salt Lake Area Source BACM

Lachance Jr I; Godbout S; Lemay S P; Larouche J P; Pouliot F (2005). Separation of pig manure under slats: to reduce releases in the environment. ASAE paper 054159.

Stewart K J; Lemay S P; Barber E M; Laguë C; Crowe T (2004). Experimental manure handling systems for reducing airborne contamination of fecal origin. ASAE Paper No. 044132. St. Joseph, Michigan.