Metro Compost Facility Standards

Compost Facility Standards

Final

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Metro

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Acronyms and Abbreviations

°C	degree(s) Celsius
AB	Alberta
AEP	Alberta Environment and Parks
ASP	aerated static pile
BC	British Columbia
BCMOE	British Columbia Ministry of the Environment
BMP	best management practice
BNQ	Bureau de normalisation du Québec
BPI	Biodegradable Products Institute
CA	California
CalRecycle	California Department of Resources Recycling and Recovery
CCME	Canadian Council of Ministers of the Environment
CCR	California Code of Regulations
CFIA	Canadian Food Inspection Agency
CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
COMAR	Code of Maryland Regulations
cy	cubic yard(s)
cy/yr	cubic yard(s) per year
D/T	dilution-to-threshold
DAS	Department of Administrative Services
DEP	Department of Environmental Protection
DOE	Department of Ecology
DOT	Department of Transportation
EIS	environmental impact study
EPA	Environmental Protection Agency
FIDO	Frequency, Intensity, Duration, and Offensiveness
GHG	greenhouse gas
Grimm's	Grimm's Fuel Company
Grimm's Report	*Grimm's Fuel Company Compost Assessment*
HDOH	Hawaii Department of Health
hr	hour
LEA	local enforcement agency
MA	Massachusetts
Maryland DEP	Maryland Department of Environmental Protection
Mass DEP	Massachusetts Department of Environmental Protection

MD	Maryland
mg/kg	milligram(s) per kilogram
mg/l	milligram(s) per liter
MPN	Most Probable Number
MSW	municipal solid waste
N/A	not applicable
NOS	Nuisance Odor Strategy
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
NWW	natural wood waste
OAR	Oregon Administrative Rules
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
OFC	Oregon Fire Code
OIMP	odor impact minimization plan
OMOE	Ontario Ministry of the Environment
OMP	odor minimization plan
OMRR	Organic Matter Recycling Regulation
ORDOT	Oregon Department of Transportation
PCB	polychlorinated biphenyl
PFAS	per-and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFRP	Process To Further Reduce Pathogens
POTW	publicly-owned treatment works
ppm	part(s) per million
project	Metro Compost Facility Standards Project
PSRP	Process To Significantly Reduce Pathogens
RCC	Recycling, Composting, or Conversion
RCSI	Report of Composting Site Information
RFP	request for proposal
RSL	regional screening level
SB	Senate Bill
SCS	Standard Construction Specification
STA	Seal of Testing Assurance
SWRCB	State Water Resources Control Board
TCEQ	Texas Commission on Environmental Quality

TMECC	Test Method for the Examination of Composting and Compost
TNRCC	Texas Natural Resource Conservation Commission
tpy	ton(s) per year
UK	United Kingdom
USCC	United States Composting Council
WA	Washington
WAC	Washington Administrative Code
WDOE	Washington Department of Ecology
WORC	Washington Organics Recycling Council
yr	year

Executive Summary

In January 2019, Metro contracted with Jacobs (formerly CH2M) to produce regionally-relevant research and generate recommendations to proactively inform Metro's oversight of compost facilities in the Metro region of Oregon. The project builds on the findings that were made as part of the *Grimm's Fuel Company Compost Assessment*[1] that was completed in 2018 and ultimately informed new license conditions for Grimm's Fuel Company. The overall goal of this Metro Compost Facility Standards Project (project) is to enhance Metro's regulatory and enforcement processes so that they are comprehensive, uniform, and transparent for regulated compost facilities within the Metro region while also improving material quality and minimizing the potential health and safety impacts of having compost facilities located within communities. Research areas were identified and categorized into the following topics:

- Topic 1A – Site Operation
- Topic 1B – Compost Pile Mass
- Topic 2 – Quality of Finished Compost
- Topic 3 – Compost Markets

Each topic contains focus areas that were researched and evaluated as part of that topic. These focus areas were generally outlined in the Work Order signed in January 2019 and then in the Introductory Memorandum submitted to Metro on March 15, 2019.

This report presents findings from each of the topics above. Table ES-1 lists the specific focus areas discussed in this report and the section in which they are discussed.

Table ES-1. Report Topics and Focus Areas

Topic and Focus Area	Location in Report
Topic 1A – Site Operation	
Odor	Section 1-3.2
Dust Control	Section 1-3.3
Housekeeping	Section 1-3.4
Litter Control	Section 1-3.5
Track-Out	Section 1-3.6
Vectors	Section 1-3.7
Compost Leachate, Groundwater, and Stormwater Management	Section 1-3.8
Throughput Capacity and Process Design Requirements	Section 1-3.9
Operations Equipment Exhaust	Section 1-3.10
Topic 1B – Compost Pile Mass	
Compost Size (Height, Width, and Overall Mass)	Section 2-2.2
Topic 2 – Quality of Finished Compost	
Metals	Section 3-2.2
Pathogens	Section 3-2.3
Testing Frequency	Section 3-2.4
Contaminants	Section 3-2.5

[1] Green Mountain Technologies, Inc. 2018. Metro – Grimm's Fuel Company Compost Assessment. Final. June 18.

Table ES-1. Report Topics and Focus Areas

Topic and Focus Area	Location in Report
Stability and Maturity	Section 3-2.6
Bioaerosols and Pesticides	Section 3-2.7
Per- and Polyfluoroalkyl Substances	Section 3-2.8
Topic 3 – Compost Markets	
Compost Use Incentives	Section 4-2.2
Compost Sales and Marketing	Section 4-2.3

Each focus area was researched using a variety of means including: internet research, interviews, and review of previously prepared reports, investigations, and other documents. Regionally relevant organizations/jurisdictions were selected to aid in this research. In addition, this report also includes a summary of findings from our tier structure research.

The organizations/jurisdictions or entities that were interviewed for each topic are shown below.

Topic 1A: Metro, Oregon Department of Environmental Quality (ODEQ), State of California Department of Resources Recycling and Recovery (CalRecycle), California State Water Resources Control Board, Washington Department of Ecology (WDOE), Alberta Environment and Parks (AEP), and Maryland Department of Environmental Protection (DEP). Additional internet research was conducted for Massachusetts, Texas, and British Columbia.

Topic 1B: Metro, Oregon Department of Environmental Quality (ODEQ), Maryland Department of Environmental Protection (DEP), Washington Department of Ecology (DOE), State of California Department of Resources Recycling and Recovery (CalRecycle), Ventura County Fire Protection District in California, and Alberta Environment and Parks (AEP).

Topic 2: Metro, Oregon Department of Environmental Quality (ODEQ), Washington Department of Ecology (WDOE), British Columbia Ministry of Environment, and Maryland Department of Agriculture. Additional internet research and/or other follow-up was conducted for State of California Department of Resources Recycling and Recovery (CalRecycle), State of Hawaii Department of Health (HDOH), Texas Commission on Environmental Quality (TCEQ), the United States Composting Council (USCC) Seal of Testing Assurance (STA) program, Canada (other provinces in addition to British Columbia), Australia, and the United Kingdom.

Topic 3: King County, Washington; Seattle Public Utilities, Washington; Denali Water Solutions, California; Virginia Biosolids Council; former consultant for the United States Composting Council (USCC); Northern Tilth, Maine; and an industry professional in the New England region and former employee of Agresource, Inc. who requested to remain unnamed. Several of the contacts have experience with biosolids compost, which is referenced in the information below. Although this project does not cover biosolids compost, this information and the experience of these individuals was deemed to be relevant since there is a vast history and body of experience associated with the marketing of biosolids compost and its associated barriers.

The findings and results from this research are presented in the main body of this report and provide the basis for the recommendations that are presented herein. Recommendations have generally been grouped into tiers, which align with ODEQ's Type I, II, and III[2] tiers of regulation for composting facilities in the State of Oregon[3] (note: Type X was not included in this project since it includes "specific risk material

[2] DEQ feedstock types have been referenced throughout this report as Type I, II, III, and X to be consistent with the terminology from the work order for this work. These are the same as DEQ feedstocks 1,2, 3, and X that are listed in OAR 30-090-0030.

[3] Oregon Department of Environmental Quality. n.d. Regulating Compost Facilities and Anaerobic Digesters. https://www.oregon.gov/deq/mm/swpermits/Pages/Composting-Regulations.aspx.

from bovine animal mortality and animal by-products" which are outside the scope of this project).[4] The one exception is that Topic 3, was not grouped by tiers due to the fact that we recommend that Metro consider implementing recommendations that would include all compost facilities when influencing compost markets and interviews did not show any variation relative to tiers.

Tables ES-2, ES-3, ES-4, and ES-5 present summaries of the recommendations for each topic. Recommendations are presented by tier for each focus area, except for ES-5, in which all recommendations are applicable to all facility tiers.

[4] Oregon Administrative Rules. Chapter 340, Division 93, Rule 30, Definitions. https://oregon.public.law/rules/oar_340-093-0030.

Table ES-2. Summary of Topic 1A Recommendations by Tier

Tier	Recommendations for Operators	Recommendations for Metro
Odor		
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit Tier	• OMP required • Annual OMP review or revise to address issues	• Enforce performance standards and initiate corrective action as issues arise • Require odor controls as part of design • Standardized performance standards in the license • More comprehensive OMP • Develop and implement Metro odor investigation protocol • Report confirmed complaints to ODEQ to support NOS
Poses Potential Risk / Individual Composting Facility Permit Tier	• OMP, odor modeling • Annual OMP review or revise to address issues	• Same as above with increased inspection frequency by tier, odor modeling
Dust Control		
Exempt	• No change recommended. Required in ODEQ and Metro operations plans	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit Tier	• No change recommended. Required in ODEQ and Metro operations plans	• Enforce performance standards and initiate corrective action as issues arise • Require dust controls as part of design • Standardized performance standards in the license • Dust management section in the operations plan
Poses Potential Risk / Individual Composting Facility Permit Tier	• No change recommended. Required in ODEQ and Metro operations plans	• Same as above
Housekeeping		
Exempt	• Housekeeping measures/BMPs will be implemented with other nuisance control plans	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit Tier		
Poses Potential Risk / Individual Composting Facility Permit Tier		
Litter Control		
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit Tier	• Include litter control plan in Operations Plan	• Enforce performance standards and initiate corrective action as issues arise
Poses Potential Risk / Individual Composting Facility Permit Tier	• Include litter control plan in Operations Plan	• Enforce performance standards and initiate corrective action as issues arise
Track-out Minimization		
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit Tier	• Include track-out minimization plan in Operations Plan	• Enforce performance standards and initiate corrective action as issues arise • Standardized performance standards and operation plan
Poses Potential Risk / Individual Composting Facility Permit Tier	• Include track-out minimization plan in Operations Plan	• Enforce performance standards and initiate corrective action as issues arise • Standardized performance standards and operation plan
Vector Control		
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit Tier	• Include vector management plan in operations plan	• Enforce performance standards and initiate corrective action as issues arise • Standardized performance standards and operation plan
Poses Potential Risk / Individual Composting Facility Permit Tier	• Include vector management plan in operations plan	• Enforce performance standards and initiate corrective action as issues arise • Standardized performance standards and operation plan
Compost Leachate, Groundwater, and Stormwater		

Table ES-2. Summary of Topic 1A Recommendations by Tier

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit Tier	• Manage facility performance	• Enforce performance standards and initiate corrective action as issues arise • Standardized performance standards and operation plan • Develop formal Metro/ODEQ reporting protocol for Water/Leachate impacts • Determine a minimum pond sizing requirement
Poses Potential Risk / Individual Composting Facility Permit Tier	• Implement ODEQ ground water and storm water protection requirements	• Enforce performance standards and initiate corrective action as issues arise • Standardized performance standards and operation plan • Develop formal Metro/ODEQ reporting protocol for Water/Leachate impacts • Determine a minimum pond sizing requirement
Throughput Capacity and Process Design		
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit Tier	• Create, submit, and implement throughput and capacity report/calculations	• Enforce performance standards and initiate corrective action as issues arise • Create facility specific tonnage or volume limits
Poses Potential Risk / Individual Composting Facility Permit Tier	• Create, submit, and implement throughput and capacity report/calculations	• Enforce performance standards and initiate corrective action as issues arise • Create facility specific tonnage or volume limits
Operations Equipment and Exhaust		
Exempt	• No change is recommended	• No change is recommended
Low Risk / Registration Composting Facility Permit Tier	• No change is recommended	• No change is recommended
Poses Potential Risk / Individual Composting Facility Permit Tier	• No change is recommended	• No change is recommended

BMPs = best management practices
D/T = dilution-to-threshold
N/A = not applicable
NOS = Nuisance Odor Strategy
ODEQ = Oregon Department of Environmental Quality
OMP = odor minimization plan

Table ES-3. Summary of Topic 1B Recommendations by Tier

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• Routinely monitor compost piles for evidence of fire, anaerobic conditions, and/or nuisance conditions	• Defer regulation of compost pile size to state and local fire code unless nuisance conditions develop • If nuisance conditions develop for a facility, regulate compost pile size as a Low Risk facility
Low Risk / Registration Composting Facility Permit	• Develop and propose to Metro pile sizing design and engineering controls with evidence that support favorable aerobic conditions, temperature, fire prevention, and nuisance conditions • Comply with permit and license conditions	• Pile size must meet state and local fire code, at a minimum • Require compost facilities to propose pile sizing design and engineering controls with evidence that support favorable aerobic conditions, temperature, fire prevention, and nuisance conditions • Utilize the following compost pile sizing as a guideline: – Height – 14 feet – Width – 25 feet – Length – 150 feet – Distance between piles – 20 feet • Negotiate compost pile sizing with each facility based on compost system design and implementation of engineering controls, with the option to default to guideline sizing. • Incorporate negotiated pile size limits into the license • Monitor facility for any fire or nuisance concerns related to pile size during routine inspections
Poses Potential Risk / Individual Composting Facility Permit	• Develop and propose to Metro pile sizing design and engineering controls with evidence that support favorable aerobic conditions, temperature, fire prevention, and nuisance conditions • Comply with permit and license conditions	

Table ES-4. Summary of Topic 2 Recommendations by Tier

Tier	Recommendations for Operators	Recommendations for Metro
Metals		
Exempt	• None	• Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to testing and thresholds similar to the STA program
Low Risk / Registration Composting Facility Permit Tier	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements	• Require facilities to participate in the STA program • Require that facilities electronically submit STA compost results to Metro • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives • Require facilities to retest and evaluate operations, if not meeting health and safety/quality requirements
Poses Potential Risk / Individual Composting Facility Permit Tier	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements	• Require facilities to participate in the STA program • Require that facilities electronically submit STA compost results to Metro • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives • Require facilities to retest and evaluate operations, if not meeting health and safety/quality requirements
Pathogens		
Exempt	• None	• No regulation, unless issues arise at the facility (such as violations or other issues), in which case Metro should consider regulating the facility per ODEQ requirements
Low Risk / Registration Composting Facility Permit Tier	• Implement pathogen reduction measures as required by ODEQ • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost should be sent back through PFRP. Then, the source of the problem must be determined and mitigated (e.g. pile size, time and temperature of active composting and deficiencies corrected)	• Adopt ODEQ requirements for pathogen reduction • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Require facilities to retest and evaluate operations, if not meeting health and safety/quality requirements
Poses Potential Risk / Individual Composting Facility Permit Tier	• Implement pathogen reduction measures as required by ODEQ • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost should be sent back through PFRP. Then, the source of the problem must be determined and mitigated (e.g. pile size, time and temperature of active composting and deficiencies corrected)	• Adopt ODEQ requirements for pathogen reduction • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Require facilities to retest and evaluate operations, if not meeting health and safety/quality requirements
Testing Frequency		
Exempt	• None	• Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to testing frequency similar to the STA program
Low Risk / Registration Composting Facility Permit Tier	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements	• Require facilities to participate in the STA program • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting other quality parameter requirements

Table ES-4. Summary of Topic 2 Recommendations by Tier

Tier	Recommendations for Operators	Recommendations for Metro
		• Require that facilities electronically submit STA testing results to Metro • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives
Poses Potential Risk / Individual Composting Facility Permit Tier	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements	• Require facilities to participate in the STA program • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting other quality parameter requirements • Require that facilities electronically submit STA testing results to Metro • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives
Contaminants		
Exempt	• None	• Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to contaminant testing and reporting
Low Risk / Registration Composting Facility Permit Tier	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost will need to be dealt with appropriately (e.g. compost deemed not saleable). Then, the source of the problem must be determined and mitigated (e.g. look at feedstock quality and screening procedures and correct deficiencies)	• Require facilities to participate in the STA program. Complaints about quality will trigger increased sampling and potentially process changes until the problem can be identified and addressed • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Work with USCC to create a customized Metro report format that includes physical contamination results per TMECC 03.08-A • Require that facilities electronically submit STA testing results to Metro to learn about amount of plastic, metal, glass, stones, and sharps present (percent by dry weight) • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives • Require facilities to retest and evaluate operations, if not meeting Metro's requirements
Poses Potential Risk / Individual Composting Facility Permit Tier	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost will need to be dealt with appropriately (e.g. compost deemed not saleable). Then, the source of the problem must be determined and mitigated (e.g. look at feedstock quality and screening procedures and correct deficiencies)	• Require facilities to participate in the STA program. Complaints about quality will trigger increased sampling and potentially process changes until the problem can be identified and addressed • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Work with USCC to create a customized Metro report format that includes physical contamination results per TMECC 03.08-A • Require that facilities electronically submit STA testing results to Metro to learn about amount of plastic, metal, glass, stones, and sharps present (percent by dry weight) • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives • Require facilities to retest and evaluate operations, if not meeting Metro's requirements
Stability and Maturity		
Exempt	• None	• Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to testing and thresholds similar to the STA program

Table ES-4. Summary of Topic 2 Recommendations by Tier

Tier	Recommendations for Operators	Recommendations for Metro
Low Risk / Registration Composting Facility Permit Tier	• Perform regular periodic sampling and analysis for stability and maturity as required by the STA program • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost should be sent back through PFRP. Then, the source of the problem must be determined and mitigated (e.g. pile size, time and temperature of active composting and deficiencies corrected)	• Update facility licenses to require stability sampling and analysis • Verify sampling is occurring by reviewing STA reports provided by the operator • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Require facilities to retest and evaluate operations, if not meeting requirements
Poses Potential Risk / Individual Composting Facility Permit Tier	• Perform regular periodic sampling and analysis for stability and maturity as required by the STA program • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost should be sent back through PFRP. Then, the source of the problem must be determined and mitigated (e.g. pile size, time and temperature of active composting and deficiencies corrected)	• Update facility licenses to require stability sampling and analysis • Verify sampling is occurring by reviewing STA reports provided by the operator • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Require facilities to retest and evaluate operations, if not meeting requirements
Bioaerosols and Pesticides		
Exempt	• None	• Do not impose requirements, unless issues arise at the facility (such as violations, other persistent issues), in which case Metro may consider subjecting the facility to regulation as a Low Risk facility
Low Risk / Registration Composting Facility Permit Tier	• Control dust emissions thereby minimizing bioaerosol emissions	• If a verified pesticide or herbicide issue arises, work with the Oregon Department of Agriculture to develop source control requirements • Require facilities to control dust emissions, thereby also controlling bioaerosol emissions • Verify during inspections that dust emissions are controlled
Poses Potential Risk / Individual Composting Facility Permit Tier	• Control dust emissions thereby minimizing bioaerosol emissions	• If a verified pesticide or herbicide issue arises, work with the Oregon Department of Agriculture to develop source control requirements • Require facilities to control dust emissions, thereby also controlling bioaerosol emissions • Verify during inspections that dust emissions are controlled
PFAS		
Exempt	• None	• Do not impose requirements, unless issues arise at the facility (such as violations, other persistent issues), in which case Metro may consider subjecting the facility to regulation as a Low Risk facility
Low Risk / Registration Composting Facility Permit Tier	• Accept food only feedstocks avoiding packaging • Refrain from composting biosolids until more is understood about the relationship between biosolids compost and plant uptake	• If Metro desires to understand more regarding the PFAS concentrations in compost produced in the region, then Jacobs recommends implementing a general sampling program at non-exempt facilities • Accept food only feedstocks, avoiding packaging • Refrain from composting biosolids until more is understood about the relationship between biosolids compost and plant uptake
Poses Potential Risk / Individual Composting Facility Permit Tier	• Accept food only feedstocks avoiding packaging • Refrain from composting biosolids until more is understood about the relationship between biosolids compost and plant uptake emissions	• If Metro desires to understand more regarding the PFAS concentrations in compost produced in the region, then Jacobs recommends implementing a general sampling program at non-exempt facilities • Accept food only feedstocks, avoiding packaging • Refrain from composting biosolids until more is understood about the relationship between biosolids compost and plant uptake

Table ES-4. Summary of Topic 2 Recommendations by Tier

Tier	Recommendations for Operators	Recommendations for Metro

ODEQ = Oregon Department of Environmental Quality
PFAS = per-and polyfluoroalkyl substances
STA = Seal of Testing Assurance
TMECC = Test Method for the Examination of Composting and Compost
USCC = United States Composting Council

Table ES-5. Summary of Topic 3 Recommendations

Focus Area	Recommendations for Metro
Compost Use Incentives	• Develop and adopt minimum soil specifications that introduce the use of compost produced in the Metro region for Metro's capital improvement projects, especially in areas where soil and stormwater health are important. Metro could start by comparing the soil specifications already adopted in Oregon and Washington and leveraging regional stakeholders to ensure specifications are appropriate for the Metro region. • Develop and adopt green construction or soil amendment programs for capital improvement projects that result in soil disturbance or for projects where soil health needs improvement. These programs should favor or require use of compost produced in the Metro region that meet specifications. • Implement regular learning sessions with engineers and landscape architects in the region. These learning sessions will advocate for the use of compost in soil disturbance projects and other capital improvement projects and will educate participants on the benefits of compost for improving soil health.
Compost Sales and Marketing	• As required in Topic 2, establish and enforce a requirement that all composters in the Metro region will produce high quality compost which meet or exceed USCC Seal of Testing Assurance (STA) program standards. • Implement training and education to promote the use of compost produced in the Metro region • Implement a variety of marketing practices to promote compost produced by composters in the Metro region. • Establish a dedicated market development budget. This may include staff who are responsible for attending trade shows, developing educational and marketing materials, engaging with industry groups, developing and updating website content, and managing social media. • Market the green construction or soil amendment programs established to promote the use of compost produced in the Metro region for Metro projects.

Introduction

In January 2019, Metro contracted with Jacobs (formerly CH2M) to produce regionally-relevant research and generate recommendations to proactively inform Metro's oversight of compost facilities in the Metro region of Oregon. This project builds on the findings that were made as part of the *Grimm's Fuel Company Compost Assessment*[5] that was completed in 2018 and ultimately informed new license conditions for Grimm's Fuel Company. The overall goal of this project is to enhance Metro's regulatory and enforcement processes so that they are comprehensive, uniform, and transparent for regulated compost facilities within the Metro region while also improving material quality and minimizing the potential health and safety impacts of having compost facilities located within communities.

Research areas were identified and categorized into the following topics:

- Topic 1A – Site Operation
- Topic 1B – Compost Pile Mass
- Topic 2 – Quality of Finished Compost
- Topic 3 – Compost Markets

This report summarizes the research, findings, and recommendations for each of these topics. The report contains a separate chapter for each topic which is organized as follows:

- Chapter 1: Facility Tier Structure and Standards for Site Operation (Topic 1A)
  - Section 1-1 – Introduction provides an overview of the project scope, purpose, and the regulatory context within which the project functions. Existing requirements or other factors for each focus area are summarized.
  - Section 1-2 – Research, Findings, Recommendations, and Level of Effort describes the research Jacobs performed, associated findings, recommendations, and level of effort needed for future action for facility tier structure.
  - Section 1-3 – Research, Findings, Recommendations, and Level of Effort describes the research Jacobs performed, associated findings, recommendations, and level of effort needed for future action for odor control; dust control; housekeeping; litter control; track-out; vectors; compost leachate, groundwater, and stormwater management; throughput capacity and process design requirements; and operations equipment exhaust.
- Chapter 2: Standards for Compost Pile Mass (Topic 1B)
  - Section 2-1 – Introduction provides an overview of the project scope, purpose, and the regulatory context within which the project functions. Existing requirements or other factors for each focus area are summarized.
  - Section 2-2 – Research, Findings, Recommendations, and Level of Effort describes the research Jacobs performed, associated findings, recommendations, and level of effort needed for future action for compost pile mass.
- Chapter 3: Standards for Quality of Finished Compost (Topic 2)
  - Section 3-1 – Introduction provides an overview of the project scope, purpose, and the regulatory context within which the project functions. Existing requirements or other factors for each focus area are summarized.
  - Section 3-2 – Research, Findings, Recommendations, and Level of Effort describes the research Jacobs performed, associated findings, recommendations, and level of effort needed for future action for metals, pathogens, testing frequency, contaminants, stability and maturity, bioaerosols and pesticides, and per- and polyfluoroalkyl substances.
- Chapter 4: Compost Markets (Topic 3)

[5] Green Mountain Technologies, Inc. 2018. Metro – Grimm's Fuel Company Compost Assessment. Final. June 18.

- Section 4-1 – Introduction provides an overview of the project scope, purpose, and the regulatory context within which the project functions. Existing requirements or other factors for each focus area are summarized.
- Section 4-2 – Research, Findings, Recommendations, and Level of Effort describes the research Jacobs performed, associated findings, recommendations, and level of effort needed for future action for compost use incentives and compost sales and marketing.

Chapter 1. Facility Tier Structure and Standards for Site Operation

1-1. Introduction

1-1.1 Scope and Purpose

As discussed above, research for this project was divided into various topics. Topic 1A addresses regionally-relevant research and recommendations associated with site operation. Site operational standards for the following focus areas were researched and evaluated by Jacobs on behalf of Metro:

- Odor
- Dust Control
- Housekeeping
- Litter Control
- Track-out
- Vectors
- Compost Leachate, Groundwater, and Stormwater Management
- Throughput Capacity and Process Design Requirements
- Operations Equipment Exhaust

In addition to the Site Operational focus areas listed above, Topic 1A also included exploring how various jurisdictions utilize tiers to reflect the progressive controls needed as risk increases with different types of compost facilities.

Facility tiers and each of these focus areas were researched using a variety of methods including internet research and/or follow-up interviews with regionally-relevant contacts and review of previously prepared reports, investigations, and other documents. Additional details regarding the research performed and the resulting recommendations are discussed in the sections that follow.

1-1.2 Regulatory Context

The existing applicable Oregon Department of Environmental Quality (ODEQ) composting rules and Metro code requirements are briefly summarized below to provide some context around the current oversight mechanisms for all compost facilities in the Metro region.

Oregon Administrative Rules (OAR) Chapter 340 (Department of Environmental Quality [DEQ]), Divisions 93 (Solid Waste: General Provisions), 96 (Solid Waste: Special Rules for Selected Solid Waste Disposal Sites), and 97 (Solid Waste: Permit Fees) address the various requirements for permitting a compost facility in Oregon.[6] More specifically, OAR 340-096-0060, outlines the applicability of “Special Rules Pertaining to Composting”, the performance standards that are required at all compost facilities in Oregon, and the permitting, design, and operational requirements of all non-exempt composting facilities (unless “the department determines the composting facility may adversely affect human health or the environment”). OAR 340-096-0070, describes the performance standards for addressing public health and the environment that all composting facilities (even exempt facilities) must follow. These performance standards set a base level of facility performance and provide ODEQ flexibility to exempt low-risk facilities from permitting requirements.[7] Permitted performance standards address:

- Protection of groundwater
- Proper management of stormwater, process water, leachate and liquid digestate
- Standards for pathogen reduction

[6] Oregon Administrative Rules. Chapter 340, Department of Environmental Quality, https://oregon.public.law/rules/oar_chapter_340.

[7] Oregon Department of Environmental Quality. n.d. Regulating Compost Facilities and Anaerobic Digesters. https://www.oregon.gov/deq/mm/swpermits/Pages/Composting-Regulations.aspx.

- Odor minimization
- Prevention of vector propagation

Each of these items will be addressed as applicable in the corresponding findings sections.

Feedstock type and quantity dictate whether a facility is exempt from obtaining a permit. Figure 1-1 summarizes the existing decision process for determining if a facility is exempt or not from permitting requirements.

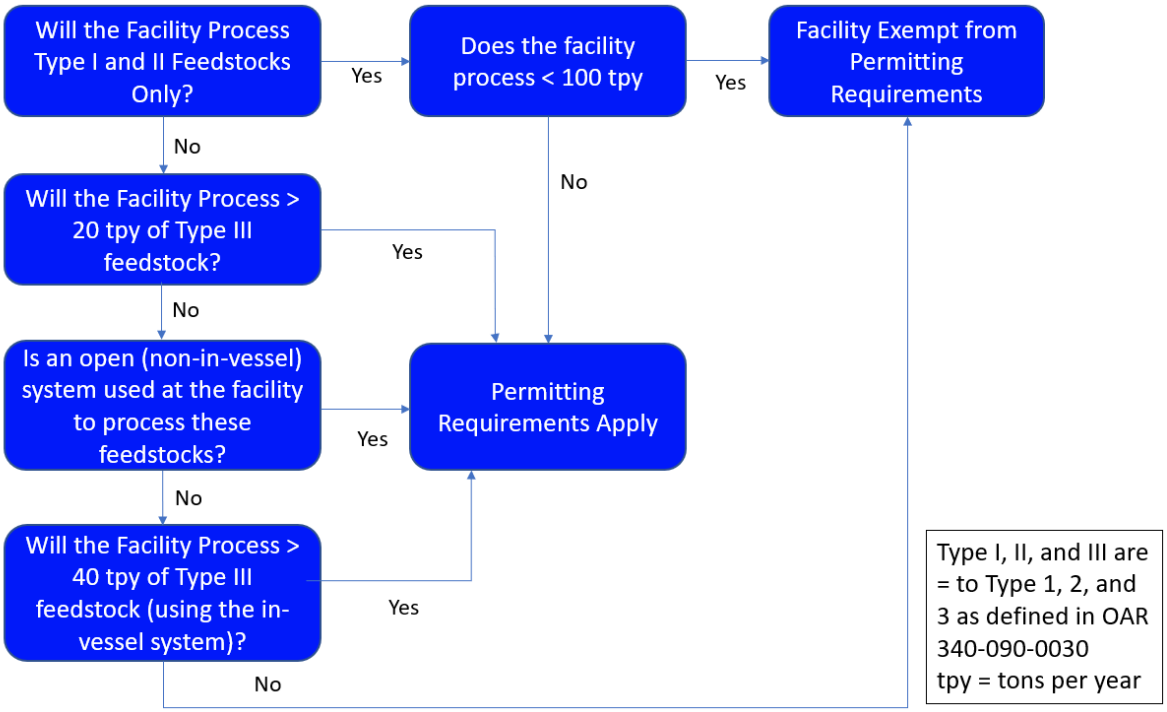

Figure 1-1. Existing ODEQ Decision Process for Determining if a Facility is Exempt from Permitting Requirements

For non-exempt facilities, the application process includes a series of steps as discussed on ODEQ's website and summarized in Figure 1-2.[8]

[8] Oregon Department of Environmental Quality. n.d. Regulating Compost Facilities and Anaerobic Digesters. https://www.oregon.gov/deq/mm/swpermits/Pages/Composting-Regulations.aspx.

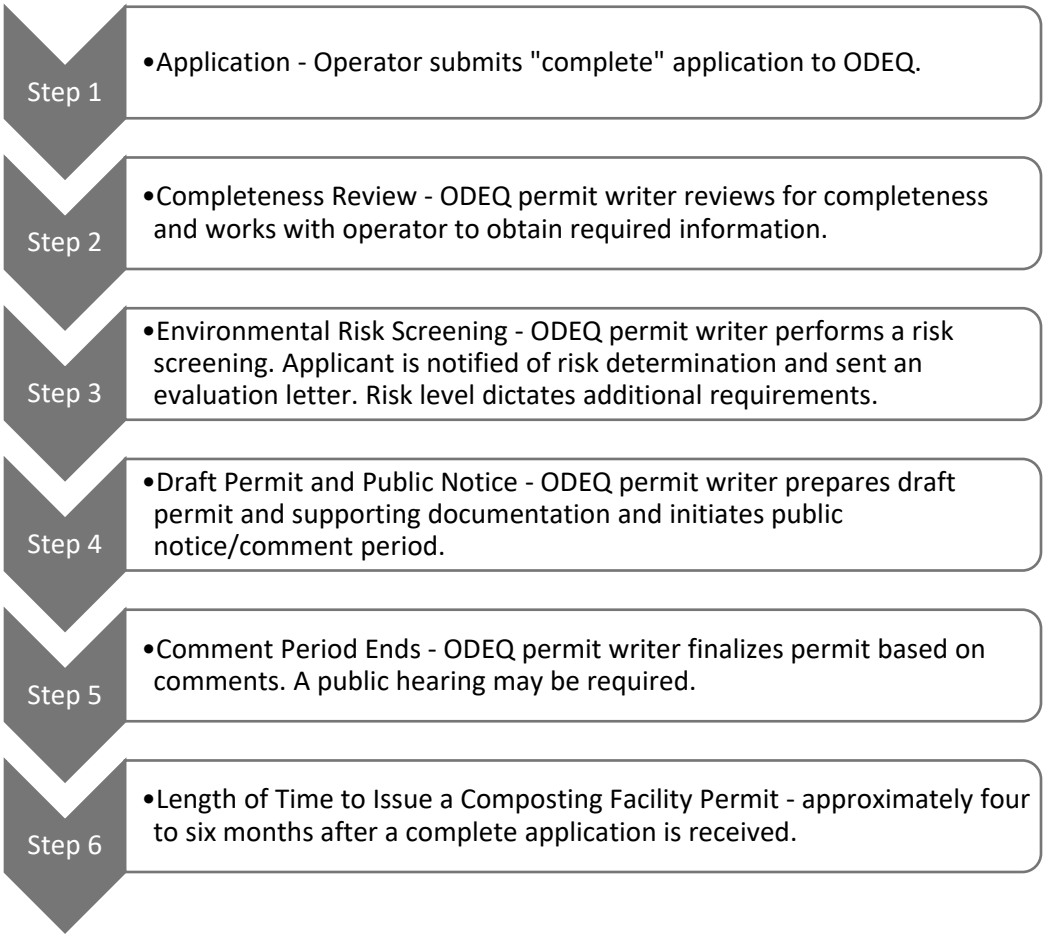

Figure 1-2. Existing ODEQ Compost Facility Permit Application Process

As shown in Figure 1-2, during Step 3 an environmental risk screening is performed as part of the application process. This screening is an important step in determining what tier the facility falls under and what type of design and operational requirements will be required based on the facility-specific risk factors. Although this initial screening is performed during the application process, ODEQ monitors the site for any changes that could change the risk level as described in ODEQ's Internal Management Directive: "If ODEQ at any time determines that an operation presents a greater risk than we initially determined, or isn't meeting our performance standards, the rules allow ODEQ to take actions that may include requiring a more robust operations plan or initiating enforcement action."[9]

In addition to ODEQ requirements, in the Metro region, per Metro Code, Section 5.01.050, "A Metro solid waste license is required of any person owning or controlling a facility at which the person performs …. Processing of yard debris or yard debris mixed with residential food waste."[10] The steps included in the Metro Solid Waste Facility License application and issuance process (for a new license) are as follows:

1) Prepare for and attend a pre-application conference.
2) Submit a completed Solid Waste Facility License Application form (with all required information) and fee payment.
3) Metro will review the application and conduct any necessary investigation of the application information.

[9] Oregon Department of Environmental Quality. 2009. Internal Management Directive – Composting Facility Risk Screening Guidance.
[10] Oregon Metro Code. Title V, Chapter 1, Section 50, License Requirements and Fees. https://www.oregonmetro.gov/sites/default/files/2019/09/13/complete-Metro-Code-updated-20190911.pdf.

4) Metro will initiate the public comment process.
5) Metro will make a determination on whether to "approve or deny license application and impose conditions on any approved license as the Chief Operating Office considers appropriate."[11]

The process is similar for renewals of existing licenses, changes of authorization to an existing license, or transfer of ownership or control of an existing license, although the pre-application conference is not needed in those instances.

Similar to ODEQ's performance standards, Metro also includes performance goals for compost facilities via the Metro license. Performance goals for compost facilities include:

- Avoiding undue threats to the environment.
- Avoiding conditions that may degrade public health and safety.
- Avoiding nuisance conditions including, but not limited to, litter, dust, odors, and noise.
- Maintaining complete and accurate records.

Each facility must also have a Metro-approved operations plan which, amongst other things, addresses how the facility will meet the above performance goals.

It should be noted that there is currently some variation between the language and information that is included in existing licenses and operations plans.

In addition to ODEQ and Metro, each jurisdiction within the Metro region has its own land use regulations. These are not listed in additional detail; however; they should be factored into decisions surrounding individual compost facilities.

Table 1-1 summarizes the existing ODEQ and Metro requirements for composting facilities.

Table 1-1. Summary of Existing ODEQ and Metro Requirements and Codes for Composting Facilities

ODEQ Uniform Requirements Across All Composting Facilities	ODEQ Special Requirements for Certain Composting Facilities	Metro Requirements for Compost Facilities
Performance Standards (OAR 340-096-0070)	Groundwater Protection (OAR 340-096-0120)	License Requirements and Fees (Metro Code Section 5.01.050-5.01.140)
Screening (OAR 340-096-0080)	Biogas, Liquid Digestate, and Leachate Collection Design and Management Requirements (OAR 340-096-0130)	Applications for Licenses (Metro Code Section 5.01.070) requires copies of DEQ documents
Operations Plan Approval (OAR 340-096-0090)	Pathogen Reduction (OAR 340-096-0140)	License contents (Metro Code Section 5.01.090) requires that "The facility operate in a manner that meets the following general performance goals: Environment, Health and Safety, Nuisances, Material Recovery, Reloading, and Record Keeping"

[11] Oregon Metro Code. Title V, Chapter 1, Section 80, License Issuance. https://www.oregonmetro.gov/sites/default/files/2019/09/13/complete-Metro-Code-updated-20190911.pdf.

Table 1-1. Summary of Existing ODEQ and Metro Requirements and Codes for Composting Facilities

ODEQ Uniform Requirements Across All Composting Facilities	ODEQ Special Requirements for Certain Composting Facilities	Metro Requirements for Compost Facilities
Registration (OAR 340-096-0100)	Unacceptable Odors (OAR 340-096-0150)	Inspections, Audits, and other Investigations of Solid Waste Facilities (Metro Code Section 5.01.290)
Composting Permit (OAR 340-096-0110)	N/A	N/A
Exempt Operations (OAR 340-096-0060(3)(a))	N/A	N/A

As shown in Table 1-1, there are a variety of existing ODEQ and Metro requirements for composting facilities located within the Metro region. This project compared these existing requirements to those of other regionally relevant jurisdictions through the lens of how the Topic 1A focus areas were addressed in those jurisdictions. This was done with the intent of identifying potential changes that Metro could make to reflect current best practices and ultimately to enhance Metro's regulatory enforcement processes so that they are comprehensive, uniform, and transparent for all regulated compost facilities.

1-2. Research, Findings, and Recommendations for Facility Tier Structure

This section describes the research performed, findings identified, and recommended actions for facility tiers located within regionally relevant jurisdictions.

1-2.1 Researched Jurisdictions

Internet research and follow-up interviews were conducted for regionally relevant jurisdictions. Table 1-2 shows the contacts interviewed during the research of facility tier structure.

Table 1-2. Jurisdictions Interviewed for Facility Tier Structure and Site Operation

Jurisdiction	Contact
Oregon Department of Environmental Quality (ODEQ)	Bob Barrows
State of California (CalRecycle, State Water Resources Control Board [SWRCB])	Ken Decio, CalRecycle Brianna St. Pierre and Ember Christensen, California SWRCB
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei
British Columbia, The Ministry of Environment (BCMOE) and Climate Change Strategy Environmental Standards Branch	Maureen O'Connell and Gloria Parker
Maryland Department of Environmental Protection (Maryland DEP)	Tariq Masood

In addition to the jurisdictions shown in Table 1-2, Massachusetts Department of Environmental Protection (DEP) was also researched, although no interview was conducted.

1-2.2 Facility Tier Structures of Researched Jurisdictions

Every compost facility is unique. The facility location, proximity to neighbors, feedstocks accepted (e.g. yard debris versus residential food waste or commercial food waste), volumes handled, and processing methods all contribute to the onsite and offsite facility characteristics and impacts. Implementing a tiered approach to account for these variables is one potential way to tie operating requirements to various types of facilities. To investigate the use of tiers as a potential tool, the consulting team researched how tiers are applied within the jurisdictions and associated regulatory authorities of Oregon, California, Washington, Alberta, British Columbia, Massachusetts, and Maryland. A summary of the research findings, including number of tiers, feedstock types, volume limits, and associated permitting requirements is provided in Table 1-3 and further described in the subsections that follow.

Table 1-3. Facility Tier Structures at Researched Jurisdictions

Jurisdiction and Citation	Tier	Feedstock Type	Volume Limit[a]	Permitting Requirements
ODEQ	1	Type I /Type II Type III Type III (in-vessel) Farm Silage Home Composting On Farm	<100 tons [~333 cy] per year <20 tons [~67 cy] per year <40 tons [~133 cy] per year Unlimited, assuming good performance Unlimited, assuming good performance Unlimited, assuming good performance	• Excluded/Exempt (Facility is exempt from the requirement to obtain a permit)
	2	Type I/Type II Type III Type III (in-vessel)	>100 tons [~333 cy] per year >20 tons [~67 cy] per year >40 tons [~133 cy] per year	• ODEQ screening to determine facility risk and permitting level. A low-risk facility is issued a registration permit
	3	Type 1/Type 2 Type 3 Type 3 (in-vessel)	>100 tons [~333 cy] per year >20 tons [~67 cy] per year >40 tons [~133 cy] per year	• ODEQ screening to determine facility risk and permitting level. A poses potential risk facility is issued a full composting facility permit
	Note, ODEQ Types are as follows: *Type I: yard and garden wastes, wood wastes, agricultural crop residues, wax-coated cardboard, vegetative food wastes; also, digestate from Type 1 feedstocks* *Type II: manure and bedding; also, digestate from Type 2 feedstocks* *Type III(R) (residential): source-separated mixed food waste, meat, eggs, dairy products, mortality; also, digestate from Type 3 feedstocks* *Type III(C) (commercial): source-separated mixed food waste, meat, eggs, dairy products, mortality; also, digestate from Type 3 feedstocks*			
CalRecycle	1	All Feedstocks Vermicomposting Mushroom Farming On Farm	100 cy at any one time Unlimited, assuming good performance Unlimited, assuming good performance Unlimited, assuming good performance	• Excluded/Exempt
	2	Green Waste Agricultural Biosolids at POTWs Research Operation Chip and Grind	<12,500 cy on site Unlimited, assuming good performance Unlimited, assuming good performance <5,000 cy on site or >5,000 cy on site if in vessel ≤200 tons [~667 cy] per day	• Enforcement Agency Notification
	3	Vegetative Food Waste Chip and Grind	<12,500 cy on site >200 tons [~667 cy] per day to ≤500 tons [~1,667 cy] per day	• Registration Permit
	4	All Feedstocks Green Waste Food Waste	>100 cy on site >12,500 cy on site >12,500 cy on site	• Full Solid Waste Facility Permit
Cal SWRCB	1	All Feedstocks	<5,000 cy at any one time	• Completely cover materials during storm events as needed to reduce the generation of wastewater; and Manage the application of water to reduce the generation of wastewater.
	2	Tier 1 Feedstocks	<25,000 cy on site at any one time and Tier 1 Feedstocks	• Water and Waste Water Management Plan • 25 year, 24-hour pads, ponds, conveyance systems • Quarterly inspections and leachate sampling
	3	Tier 2 Feedstocks	Tier 2 Facility: >25,000 cy on site at any one time or Tier 2 Feedstocks	• Water and Waste Water Management Plan • 25 year 24-hour pads, ponds, conveyance systems. • Pad conductivity of $1x10^{-5}$ cm/sec • Conveyance system must be constructed of $1x10^{-5}$ materials, pond must be lined ($1x10^{-6}$), a pan lysimeter is required under the pond liner, pond must be maintained above 1 mg/l of dissolved oxygen • Quarterly Inspections and leachate sampling
WDOE WAC 173-350-220, Table 220-A	1	All Feedstocks	5,000 gallons or 25 cy on site at any one time	• Excluded: No notification, reporting or testing requirements
	2	All Feedstocks	25 cy - 250 cy on site at any one time, <1,000 cy per year.	• 30-day notification period • If selling off site must: – Reduce pathogens – Sample for Table 220-B parameters – Submit annual reports
	3	Yard debris Crop residues Manure and bedding Bulking agents	25 cy - 500 cy on site at any one time, <2,500 cy per year.	• 30-day notification period • If selling off site must: – Reduce pathogens

Table 1-3. Facility Tier Structures at Researched Jurisdictions

Jurisdiction and Citation	Tier	Feedstock Type	Volume Limit[a]	Permitting Requirements
				– Sample for Table 220-B parameters – Submit annual reports
	4	Agricultural wastes Yard debris Bulking agents	25 cy – 1,000 cy on farm at any one time, up to 50 percent of organic materials on-farm can be yard debris	• 30-day notification period required if product is being "distributed offsite." • If selling off site must: – Reduce pathogens – Sample for Table 220-B parameters – Submit annual reports
	5	Agricultural wastes Manure and bedding from zoos Bulking agents	>25 cy with no upper limit if material is created from and reused on site.	• 30-day notification period required if product is being "distributed offsite." • Dairy Management Plan, or; • Farm Management Plan • If selling off site must: – Reduce pathogens – Sample for Table 220-B parameters – Submit annual reports
AEP	1	All Feedstocks	<20,000 tonnes [~73,487 cy] per year	• Code of Practice for Compost Facilities Requirements
	2	All Feedstocks	>20,000 tonnes [~73,487 cy] per year	• Certificate of Operations Requirements
British Columbia	1	Land Application Ag/On Farm Backyard Demonstration Gardens	Unlimited assuming performance Unlimited assuming performance Production of <20 m^3 [~26 cy] annually Composting <100 m^3 [~130 cy] annually	• Excluded/Exempt
	2	Biosolids/Food Waste	5,000 tonnes [~18,372 cy] annual production capacity	• Permit Required
	3	All Feedstocks	20,000 tonnes [~73,487 cy] annual production capacity	• Env Impact Study Required
Mass DEP	1	Group 2 (low C:N) Feedstocks All Feedstocks All Feedstocks	>105 tons [~350 cy]/week or 30 tons [~100 cy]/day <5,000 cy/acre <50,000 cy on site	• General Permit
	2	All Feedstocks	>105 tons [~350 cy]/week or 30 tons [~100 cy]/day	• Site Specific RCC Permit
Maryland DEP	1	Natural Wood Waste (NWW)	No Limit	• NWW Recycling Facility Permit
	2	Type 1: Yard Waste	Farm facilities exempt if using 40,000 square feet or less in support of composting operations and only use Type 1 feedstocks as well as any feedstocks generated onsite. Non-farm facilities exempt if using 5,000 square feet or less in support of composting operations and complying with the following pile height limits: 1) 9 feet for raw feedstocks 2) 12 feet for active, curing or finished compost piles 3) Except where smaller pile sizes required by local law	• Composting Facility Permit Required unless meet exception. All-weather pad required for feedstock receiving, curing and storage
	3	Type 2: Food Scraps, Non-recyclable paper, animal manure and bedding, industrial food processing materials, animal mortalities, compostable products	Exempt using 5,000 square feet or less in support of composting operations and complying with the following pile height limits: 1) 9 feet for raw feedstocks 2) 12 feet for active, curing or finished compost piles 3) Except where smaller pile sizes required by local law	• Composting Facility Permit Required. Low permeability pad required for feedstock receiving and active composting areas and all-weather pad for curing finished areas
	4	Type 3: Sewage Sludge or Biosolids, used diapers, MSW		• Refuse Disposal Permit or Sewage Sludge Utilization permit required if any Type 3 feedstocks are composted

[a] The actual limit as listed in each jurisdiction is included. For those not already in cubic yard units, a conversion factor was applied and the estimated number is shown in brackets [ ]. For mass to volume, a conversion factor of 600 pounds/cy for yard waste was used, per CalRecycle (Sources: https://www.calrecycle.ca.gov/swfacilities/cdi/tools/calculations)

cy = cubic yard

mg/l = milligram per liter

MSW = municipal solid waste

ODEQ = Oregon Department of Environmental Quality

POTW = publicly-owned treatment works

RCC = Recycling, Composting, or Conversion

1-2.2.1 Facility Tiers Research, Interview Summaries, and Sources

A summary of the tier structure information found for each of the researched jurisdictions is provided in the following subsections.

1-2.2.1.1 State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - ODEQ has three facility tiers. A summary of the tier requirements is included in Table 1-4. The first or lowest tier is an excluded or exempt tier for facilities that accept minimal amounts of Types 1, 2, and/or 3 feedstocks and that perform composting operations on farm sites and at home. The second and/or third tiers are triggered when a facility will compost more than the exempt amounts of Type 1, 2, and/or 3 feedstocks. When triggered, the higher tiers require an operator to submit to an ODEQ screening process wherein an ODEQ inspector will review the application and site, if it is already existing, and make a determination on whether the facility potentially poses a low or potential risk for surface water, groundwater, and odor impacts. The ODEQ inspector uses the Compost Facility Risk Screening Checklist to evaluate the facility.
- **Bob Barrows – Oregon Department of Environmental Quality**
  - Mr. Barrows was interviewed to seek clarification on the facility tiers and screening process. During the interview, Mr. Barrows confirmed that when a facility is required to go through the screening process, they are evaluated using the checklist and that permit requirements will reflect the findings of the screening process. Thus, permit requirements may differ by facility.

1-2.2.1.2 State of California

- **Department of Resources Recycling and Recovery (CalRecycle) and California State Water Resources Control Board (SWRCB)**
  - The state of California has established 4 progressive permitting tiers: an excluded tier, notification tier, registration tier, and permit tier. The performance standards and design requirements are the same for each tier above the excluded tier. The main differences between the notification and registration tiers are the permitting process, the reporting requirements, and the inspection frequency requirements. The full permit tier requires the operator to submit an extensive permit application including a Report of Composting Site Information (RCSI) document, which acts as the site operations plan. Through this application process, the site is issued a Solid Waste Facility Permit that includes site-specific requirements and provisions that take into account design and throughput considerations, as well as the facility location and proximity to neighbors.
  - The California State Water Resources Control Board has established 3 regulatory tiers a summary of which is given in Table 1-4. These tiers include an exempt tier (5,000 cubic yards onsite at any given time), Tier 1 (facilities with certain feedstocks above 5,000 cubic yards and less than 25,000 cubic yards), and Tier 2 (facilities that accept non-vegetative food waste, biosolids, and other like materials or facilities that have more than 25,000 cubic yards on site at any given time). The groundwater and surface water protection infrastructure requirements increase with each tier as shown in Table 1-4.
- **Ken Decio – CalRecycle**
  - Mr. Decio was interviewed for this focus area to better understand how the tier limits of 12,500 cubic yards on site at any one time were developed. Mr. Decio indicated that the state developed these regulations internally then released them to the public and stakeholders for comment. After the comment period, the permitting tiers were adjusted to meet the needs of both CalRecycle and the stakeholders who commented. These tier limits were established in 1994 and, despite several regulatory updates, CalRecycle and its stakeholders have not had reason to adjust those limits.
- **Brianna St. Pierre, Ember Christensen, Stephanie Young – California State Water Resources Control Board (SWRCB)**

- Brianna St. Pierre and Ember Christensen of the SWRCB were interviewed for this project and confirmed that the 25,000 cubic yard requirement referred to material on site at any one time.
- Ms. Young helped to develop the facility tier regulations for the SWRCB and she was interviewed to gain an understanding of why the facility tiers were set at 25,000 cubic yards on site at any one time. Ms. Young stated that rule makers developed a standard facility size of 3 acres and worked with regional composting experts to get an estimate of how many cubic yards could fit on a 3 acre parcel with minimal nuisance conditions. The rule was then proposed to the public and stakeholders, and was eventually implemented into law.

1-2.2.1.3 State of Washington

- **Washington Department of the Ecology (WDOE)**
  - The State of Washington has developed permitting and reporting requirements for 5 tiers. The first or lowest tier is an exempt or excluded tier for facilities that compost less than 25 cubic yards at any one time. The next 3 tiers have the same notification, sampling and reporting requirements. Facilities are only required to obtain a permit if they exceed the maximum limits for their facility tiers. The fifth tier is aimed primarily at on farm and on zoo composting and requires submittal of a Dairy Management Plan or a Farm Management Plan when applicable. Otherwise, the requirements are generally the same as Tiers 2-4.
- **Mary Harrington and Dawn Marie Maurer – Washington Department of Ecology**
  - Ms. Harrington stated that the facility tiers listed in WAC 173-350-220 are registration tiers. If a facility chooses to sell its product and maintains the amount of material onsite within the prescribed limits then the facility will need to comply with the testing and reporting requirements listed in regulation. If the amount of material onsite will exceed the upper limit for a tier then a full compost permit is required. For example, if a Tier 4 facility were to have more than 1,000 cubic yards of agricultural wastes, yard debris, and bulking agents onsite at any one time then that facility would need to obtain a full compost permit.

1-2.2.1.4 Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**
  - Compost facilities under 20,000 tonnes per year are regulated by AEP under The Code of Practice for Compost Facilities. Facilities that accept more than 20,000 tonnes per year of any feedstock are subject to a regulatory review and are issued an operational certificate. This operational certificate is essentially a facility specific permit. To develop this document an AEP permit writer will use a template to draft a facility specific operational certificate. A few of the common facility specific requirements are the requirement to state the number of odor units (using a field olfactometer and odor modeling) detected at the nearest receptor and assembling a Public Liaison Committee where the operator is required to meet with affected or nearby members of the public to discuss and address issues pertaining to the facility.
- **Natasha Page and Richard Adjei – Alberta Environment and Parks**
  - Natasha Page and Richard Adjei stated that new composting regulations are drafted but have not been implemented. These new regulations will eventually, when incorporated, alter what is required for each tier but the tier trigger will still be 20,000 tonnes per year.

1-2.2.1.5 Province of British Columbia, Canada

- **British Columbia Ministry of the Environment (BCMOE)**
  - British Columbia MOE has implemented 3 facility tiers. The first or lowest tier is an exempt or excluded tier that includes on farm composting, at home composting, land application and demonstration gardens. The second tier was recently lowered to 5,000 tonnes of product produced per year of food waste or biosolids compost and requires the facility operator to obtain a permit. The third tier which is triggered at 20,000 tonnes of product produced per year of any feedstock and requires the operator to complete an environmental impact study prior to obtaining a permit.

- **Maureen O'Connell and Gloria Parker- The Ministry of Environment and Climate Change Strategy Environmental Standards Branch**
  - The BCMOE has been trying to change their regulations that cover compost facilities for over a decade. In regard to tiers, they are working on changing tiers from the amount of product produced to the amount of material delivered/processed at the site. They are also proposing that these amounts are based on "Annual incoming wet weight of feedstock, as measured in wet tonnes, which is easier to measure, record and regulate, and which helps reduce the likelihood of composting facilities accepting more material than can be processed in one year."
- **The Massachusetts Department of Environmental Protection (Mass DEP)**
  - Mass DEP utilizes 2 permitting tiers. The first or lowest tier requires an operator to obtain a general permit. The second tier, triggered when a facility accepts more than 30 tons per day of any feedstock requires an operator to obtain a site-specific Recycling, Composting, or Conversion (RCC) permit.

1-2.2.1.6 State of Maryland

- **The Maryland Department of Environmental Protection (MarylandDEP)**
  - Maryland DEP utilizes a multi-tier permitting for compost facilities and also has separate permitting for composting natural wood waste as well as higher risk feedstocks including biosolids and MSW. The second and third tiers that encompass the most common compost feedstocks require a composting permit and increasing levels of pad coverage for operations, while the fourth tier requires a refuse disposal permit or sewage sludge utilization permit.

1-2.2.2 Findings for Facility Tiers

ODEQ has developed a tiered permitting process to evaluate potential facility risk. The regulations in place require all facilities (exempt, low-risk and poses potential risk) to comply with various performance standards. Through the ODEQ screening process, facilities are evaluated based on these parameters and permits are issued based on facility-specific considerations. This tiered permitting structure was compared with six other regionally relevant jurisdictions (California, Washington, Alberta, British Columbia, Massachusetts, and Maryland).

The following observations were made:

- Of the seven jurisdictions researched, there was a wide range of the number of tiers (2 to 5) within a jurisdiction and the type of tiers that each jurisdiction has for compost facilities.
- Most of these jurisdictions have different tiers for feedstock types and/or type of operation (e.g. on farm or research operation). The level of permitting effort associated with each feedstock type is inconsistent across the board.
- Another common trend was that tiers generally start with the lower risk materials (e.g. yard debris) and increase with increasing risk (food waste or biosolids); although none of the jurisdictions researched distinguishes between residential food waste and commercial food waste. In all jurisdictions except Washington, progressive tiers have increasing permit requirements.
- There is not a particular pattern in the volume or quantity of material associated with each progressive tier. Oregon and Washington have the lowest volume limit for their tiers. Alberta has the largest volume limit. The basis for choosing the feedstock volume triggers in each jurisdiction was either unknown to interview participants or negotiated through a public/stakeholder workshopping process.
- Four of the seven jurisdictions (Oregon, California, Washington, and British Columbia) researched have established an excluded or exempt tier. The volumes or tonnages at which these exempt tiers are enforced is also inconsistent, ranging from less than 25 cy on site at any one time to 100 tons per year or approximately 333 cy per year.

1-2.2.3 Recommendations for Facility Tiers

Although there was some variation between the specifics of the tiers of the jurisdictions that were researched, all of the jurisdictions use tiers in a way to provide some level of progressive controls with increasing risk. ODEQ has a tier structure that provides progressive controls with increasing risk. Additionally, ODEQ has developed a screening process, which incorporates the site screening requirements that are described in OAR Chapter 30, Division 96, to evaluate the environmental risk of a compost facility and to assign the appropriate tier and permit requirements.

Jacobs recommends using the existing ODEQ's tier structure (shown in Table 1-3) and to incorporate the findings of DEQ's initial screening process that evaluates the risk level of a specific facility into the Metro license application review and issuance process. This provides a consistent tier structure across DEQ and Metro while also providing additional opportunity to address facility specific risks in the Metro license requirements (design and operation) and performance standards.

Recommendations have been organized by focus area and tier. For simplicity, the feedstock types and tonnages of each tier are only included in Table 1-4.

Table 1-4. ODEQ Tier Structure and Proposed Metro Tiers

Tier	ODEQ Feedstock Types	Metro Feedstock Types	Tonnage Limits
Exempt Tier	Type I Type II Type III	Yard Debris Vegetative Food Waste Manure Residential Food Waste Commercial Food Waste	<100 tpy (Types I and II) <20 tpy (open) (Type III) <40 tpy (In-vessel) (Type III)
Low Risk / Registration Composting Facility Permit	Type I Type II	Yard Debris Vegetative Food Waste Manure	>100 tpy (Types I and II)
Poses Potential Risk / Individual Composting Facility Permit	Type I Type II Type III	Yard Debris Vegetative Food Waste Manure Residential Food Waste Commercial Food Waste	>20 tpy (open) (Type III) >40 tpy (In-vessel) (Type III)

Notes:

DEQ Feedstock types as defined in OAR-30-030 (https://oregon.public.law/rules/oar_340-093-0030):

Exempt Tier – Facilities that accept the tonnages specified in the exempt tier would be exempt from receiving a Metro license unless nuisance conditions arise requiring the need for such oversight.

Type I – "Source-separated yard and garden wastes, wood wastes, agricultural crop residues, wax-coated cardboard, vegetative food wastes including department approved industrially produced vegetative food waste, and other materials the department determines pose a low level of risk from hazardous substances, physical contaminants and human pathogens."

Type II – "Manure and bedding and other materials the department determines pose a low level of risk from hazardous substances and physical contaminants and a higher level of risk from human pathogens compared to type 1 [type I]."

Type III – "Dead animals, meat and source-separated mixed food waste and industrially produced non-vegetative food waste. They also include other materials the department determines pose a low level of risk from hazardous substances and a higher level of risk from physical contaminants and human pathogens compared to type 1 and 2 [type I and II] feedstocks."

Table 1-4. ODEQ Tier Structure and Proposed Metro Tiers

Tier	ODEQ Feedstock Types	Metro Feedstock Types	Tonnage Limits

tpy = tons per year

1-2.2.4 Level of Effort for Completing Changes to Facility Tiers

The level of effort required for completing changes to facility tiers will be minimal since these tiers are already being used.

1-3. Research, Findings, Recommendations, and Level of Effort for Site Operation Focus Areas

Operational standards are necessary to ensure that compost facilities operate safely, efficiently, and in a way that does not negatively impact the environment or surrounding neighbors. Jacobs researched and evaluated several focus areas to better understand the associated existing regulatory framework and challenges in Oregon and then compare them to other relevant jurisdictions. A summary of the different composting facility related regulations and tiers for all of the researched jurisdictions is included in Appendix A, Table A-1.

The focus areas discussed in this section are organized in the following order:

- Odor Control
- Dust Control
- Housekeeping
- Litter Control
- Track-out
- Vectors
- Compost Leachate, Groundwater, and Stormwater Management
- Throughput Capacity and Process Design Requirements
- Operations Equipment Exhaust

1-3.1 Outcomes of 2018 *Grimm's Fuel Company Composting Assessment*

Some of the challenges related to operational requirements and enforcement strategies were presented in the 2018 *Grimm's Fuel Company Composting Assessment*. [12] This study ultimately informed new license conditions for Grimm's which include switching to an aerated static pile (ASP) processing method by the deadlines listed in the license as well as a new operations plan that can satisfy both ODEQ and Metro requirements (as opposed to the two separate operation plans they had prior to the study). In addition, the revised license includes several parameters that differ from other existing facilities. Of particular interest are the following changes:

- Fire Prevention requirements that reference pile size.
- Requirement to develop an odor minimization plan (OMP), included in the operating plan and take corrective actions as necessary.
- A "Storm Water and Leachate" section in place of a "Water Contaminated by Solid Waste and Solid Waste Leachate" section that includes reference to an approved DEQ stormwater management plan (or equivalent).
- A new section on Performance Requirements that has subsections for: composting method, pile size, cover material, bulk density, no disturbance of materials, aeration system, capture and treatment of air over processing equipment, oxygen monitoring, compost monitoring parameters, pathogen reduction, temperature monitoring, community engagement plan, and compost operator training.
- New sub-sections under the Operating Plan section including: ASP composting system implementation timeline, procedures for composting operations, procedures for pile maintenance, procedures for oxygen monitoring, procedures for pathogen reductions, procedures for temperature monitoring, and OMP (in place of the procedures for odor prevention).
- New sub-sections under the Record Keeping and Reporting section including: records of performance requirements and records subject to Metro inspection.
- A new section on Summary of Due Dates.

[12] Green Mountain Technologies, Inc. 2018. Metro – Grimm's Fuel Company Compost Assessment. Final. June 18.

Each of these changes are further discussed, as they relate to various focus areas, under the specific sections for each focus area.

1-3.2 Odor Control

Compost facilities have a number of sources and activities that have the potential to produce odors. Odors have the potential to cause acute nuisance conditions to neighboring residents and businesses and can be experienced by neighbors both adjacent to and miles away from the facility. Best management practices (BMPs), when consistently used, can be utilized to control onsite odors. While odor has the potential to impact neighbors near and far, it can also be a difficult to measure and enforce.

1-3.2.1 Research and Interview Summaries

As discussed in the 2018 *Grimm's Fuel Company Composting Assessment,* "Grimm's compost facility has over the years accumulated significant odor complaints from neighboring residential neighborhoods and which have increased over the past 5 years."[13] Following the 2018 study, Metro included new license conditions for Grimm's. Several of the changes discussed in Section 3.1, were either a direct or indirect result of the malodor conditions that have been experienced from the site.

This project builds off the findings from the 2018 Grimm's study. Internet research and follow-up interviews were conducted for regionally relevant jurisdictions. Table 1-5 shows the contacts interviewed during the research of odor control requirements and enforcement in other regionally relevant jurisdictions.

Table 1-5. Odor Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Bryan Smith
State of California - CalRecycle and California State Water Resources Control Board (SWRCB)	Ken Decio, CalRecycle Brianna St. Pierre and Ember Christensen, SWRCB
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei
British Columbia Ministry of the Environment (BCMOE)	Maureen O'Connell and Gloria Parker

In addition to the jurisdictions shown in Table 1-5, Massachusetts Department of Environmental Protection (DEP) and Texas Commission on Environmental Quality (TCEQ) were also researched, although no interviews were conducted. Summaries for each of the researched jurisdictions are included in the following subsections.

1-3.2.1.1 State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - Odors are regulated by ODEQ as a performance standard. ODEQ regulation requires compost facilities to be constructed, designed and operated to control and minimize odor past the facility boundary. Both facilities that are classified as Low Risk and facilities that "Pose a Risk" are required to include a section in their Operations Plan that addresses odor minimization. Facilities classified as "posing an odor risk" and facilities that have attributable odor complaints may be required by ODEQ to prepare an OMP which must include a plan for managing malodorous feedstocks, complaint response procedures, and odor management BMPs. Significant odor

[13] Green Mountain Technologies, Inc. with Terre-Source LLC and Air Sciences, Inc., 2018, Grimm's Fuel Company Composting Assessment.

issues may result in a facility operator needing to create or revise the OMP and implement the new BMPs suggested in the document. This process would continue until odors are at an acceptable level.

- **Bryan Smith – Oregon Department of Environmental Quality**
  - Mr. Smith, the developer and administrator of the ODEQ Nuisance Odor Strategy (NOS), was interviewed as part of this project. The interview revealed that the NOS was developed by interviewing and studying different odor response strategies throughout the country. It was developed with the following question in mind, "how would (an) investigation hold up in court," and the final strategy is the result of a public review process. The NOS applies to all facilities that have an ODEQ permit. While OAR 340-096-0150 requires the facility to investigate every odor complaint, ODEQ will only begin an investigation if it receives 10 odor complaints from 10 different addresses within a 60-day period. ODEQ utilizes n-butanol testing pens to determine investigator sensitivity (excluding investigators who are found to be on the extreme low or high side of the range from performing call-out investigations). N-butanol jars are used to measure odor intensity in the field. ODEQ determined that use of a field olfactometer would be inappropriate in windy and rainy conditions. Because odor impacts must be experienced by actual people, not organizations such as ODEQ, complainants must be willing to testify or submit an affidavit for a judge to review. Should ODEQ have sufficient data to proceed with enforcement, a written notice will be sent to the operator providing them 20 days to comply or improve conditions. The operator may enter into a Best Work Practices Agreement to negotiate a compliance timeline and actions.

1-3.2.1.2 State of California

- **CalRecycle and California State Water Resources Control Board**
  - The state of California regulates odor primarily through CalRecycle with enforcement and inspection oversight provided in most cases by a Local Enforcement Agency (LEA). However, CalRecycle requires that every compost facility (except exempt) prepare an odor impact minimization plan (OIMP). Operations plans are required for registration and full tiers and inspection frequency increases with tier. The OIMP must include an odor monitoring and data collection protocol for on-site odor sources, a description of meteorological conditions effecting migration of odors, a complaint response and recordkeeping protocol, a description of design considerations and/or projected ranges of optimal operation to be employed in minimizing odor, and a description of operating procedures for minimizing odor. The OIMP must be reviewed annually by the operator and revisions should be submitted to the LEA. Other changes to the facility should be changed in the OIMP within 30 days. An instance in Solano County, California was found where the OIMP was revised to include housekeeping and system maintenance protocols to prevent odors from the active composting system. Due to several verified odor complaints at this facility the LEA required that the facility implement an odor monitoring program which is also detailed in the OIMP. OIMP and facility changes are triggered by odor complaints from nearby residents. In an unusual instance, California's State Water Resources Control Board requires that leachate ponds be maintained at a dissolved oxygen level above 1 mg/l. Treatment and leachate holding ponds with dissolved oxygen levels consistently above 1 mg/l typically do not experience the odors that sometimes occur when a leachate pond lacks oxygenation.

- **Ken Decio – CalRecycle**
  - Mr. Decio indicated that the state is developing an Odor Online Workbook to help train compost facility operators. CalRecycle regulates odor as a performance standard. The LEA will use the OIMP to determine if the operator is following the procedures established by the operator. Enforcement may be issued requiring the operator to either comply with the current OIMP or revise it. If an OIMP is being followed and odor issues persist, the LEA can direct the operator to prepare an Odor Best Management Practice Feasibility Report which requires analysis of odor causes and standard BMPs to determine a plan and schedule for implementation of the BMPs determined to be the best fit for the facility.

1-3.2.1.3 State of Washington

- **Washington Department of Ecology (WDOE)**
  - The State of Washington regulates compost facilities under Washington Administrative Code (WAC) 173-350-220. Odor management plans are required at facilities above Excluded / Exempt and notification tiers. WDOE implements prescriptive standards for finished compost requiring composted material porosity to be maintained and prohibits pile moisture in excess of 60 percent. WDOE odor complaint response is not standardized. Washington state air agencies require that complaints be submitted in writing and that the inspector smell the odor at the complainant location. Further, the inspector must trace the odor back to the facility. If an odor is detected, WDOE will require the facility to find the cause of the odor and to make changes to that process to mitigate the odor. Changes to the process may also require operations plan revisions.
- **Mary Harrington and Dawn Marie Maurer – Washington Department of Ecology**
  - It was revealed during the interview that the local health departments in Washington regulate odor enforcement. Odors are enforced at the facility boundary. An odor detected by an inspector can lead to enforcement action against the facility. A plan to control air contaminants such as dust and odors is required as part of the compost operating plan and permitting process. The plan should include a description of the facility's nuisance odor complaint response protocol, BMPs implemented at the facility, BMPs implemented as part of the composting operation including its various process phases, facility maintenance activities intended to prevent and control nuisance odors, and how high moisture feedstocks and potentially odorous materials will be managed to reduce nuisance odors from receipt to final storage. Training for identification and correction of nuisance odors is also required.

1-3.2.1.4 Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**
  - Compost facilities under 20,000 tonnes per year are regulated by AEP under *The Code of Practice for Compost Facilities*.[14] AEP requires that compost facilities be constructed in accordance with a design plan which defines and describes the structures, facilities and equipment used to control odors. AEP also requires that compost facility operators (both tiers) prepare and maintain an operations plan that includes a plan for the management, detection and mitigation of offensive odors. Odor modelling and dilution-to-threshold (D/T) limit typically are required at higher tier. A public liaison committee is often required at higher tier.
- **Dean Wyman – Jacobs, Formerly of the City of Edmonton and Guelph Compost Facility**
  - Mr. Wyman stated that facilities accepting more than 20,000 tonnes per year of any feedstock are required by AEP to submit to a regulatory review and are issued an operational certificate that can be likened unto a facility specific permit. To develop this document, an AEP permit writer will use a template to draft a facility specific operational certificate. Operational certificates may require an operator to state the number of odor units detected at the nearest receptor. For example, the City of Calgary Compost Facility must meet 7 odor units at the nearest receptor using either odor modelling or an olfactometer. This compliance measurement must be confirmed annually. Mr. Wyman stated that the odor compliance level is negotiated during the regulatory review. A facility that is owned by a municipality and operated by a contractor, such as the City of Calgary Compost Facility, will typically seek a low dilution to threshold limit for so that it can be included in operational contracts and to ensure minimal impact to neighbors. A privately owned and operated facility will typically seek to negotiate a high dilution to threshold limit to allow for operational flexibility. If the AEP permit writer feels the potential for impact is great based on the location and proximity to neighbors then a facility may be required to assemble a Public Liaison Committee wherein the operator is required to meet with affected or nearby members of the public to discuss and address issues pertaining to the facility.

[14] Alberta Government. n.d. Code of Practice for Compost Facilities. http://www.qp.alberta.ca/1266.cfm?page=COMPOST.cfm&leg_type=Codes&isbncln=9780779793938.

- **Natasha Page and Richard Adjei – Alberta Environment and Parks**
  - Natasha Page and Richard Adjei were interviewed as part of this project and confirmed that AEP requires that a certified operator is employed and responsible for each facility. This aides in the implementation of odor mitigation BMPs and helps with root cause analysis when odors arise. Odor issues are measured by neighbor complaints and by "sweeps" wherein AEP inspects the facility and finds odors past the facility boundary. Enforcement action would take place after several inspections confirm the presence of odors and non-compliance. At that point a warning letter would be issued and failure to comply with a warning letter could result in fines and penalties.

1-3.2.1.5 British Columbia

- **Ministry of the Environment (BCMOE) and Climate Change Strategy Environmental Standards Branch**
  - **BC**MOE requires the preparation and submittal of an Environmental Impact Study (EIS) for facilities that exceed the exempt tier either for tonnage or feedstock type. As part of this EIS, facilities are required to prepare an OMP. The EIS and OMP must be prepared by a "Qualified Professional" as defined in British Columbia's Organic Matter Recycling Regulation (OMRR).
  - According to interviews with Maureen O'Connell and Gloria Parker, The BCMOE have been trying to change their regulations for over decade through a process where regulations are proposed and then public input is given. In the proposed revisions, the odor management plan requirements would increase as the odor risk increases. "Facilities receiving a total annual mass of 15,000 tonnes or greater (wet weight) of feedstock per calendar year would require completion of an odor management plan that includes odor modelling, odor impact assessment, a monitoring and maintenance plan, and a process for tracking and addressing odor complaints, and facilities would be required to submit an annual monitoring and maintenance report to the ministry for the previous calendar year by March 31 of each year."

1-3.2.1.6 State of Massachusetts

- **The Massachusetts Department of Environmental Protection (Mass DEP)**
  - Compost operations are regulated for odor under 310 Code of Massachusetts Regulations (CMR) 16.00. As a general permit requirement, facilities are required to prepare and implement an odor control plan that is appropriate for the size and type of operation with the intent to mitigate offsite odors. The plan must identify what BMPs or other specific actions will be taken should an unacceptable odor occur beyond the property boundary. Mass DEP also requires the operator to prepare a design plan that includes controls for preventing nuisance odors. Mass DEP may also issue, as a condition of the operating permit, requirements for a contingency plan to mitigate nuisance odors should they arise.

1-3.2.1.7 State of Texas

- **The Texas Commission on Environmental Quality (TCEQ)**
  - TCEQ has developed a standardized odor complaint investigation procedure that utilizes a tool known as the FIDO Chart. FIDO stands for Frequency, Intensity, Duration, and Offensiveness. The FIDO chart provides an investigator the criteria to determine if an odor reaches a nuisance level without the need for a field olfactometer or n-nutanol testing kits. The FIDO criteria help investigators to determine if an odor reaches the level of a nuisance odor based on set parameters.
  - The TCEQ Odor Complaint Investigation Procedure states, "The purpose of all odor investigations is to determine the source of the odors and to work with that source to stop or lessen the generation of any nuisance odors, if present." This process is both fair to the source or operator and to the complainant and if an odor is determined to be a nuisance odor this process can help Metro to drive changes by working with the offending facility to stop or lessen the generation of nuisance odors.

  - Odors may be reported to the TCEQ regional office by a private citizen or a TCEQ inspector. The TCEQ regional office collects the name of the complainant, location, description, nature, and duration of the odor. Investigators are also trained to ask the complainant if they would like an investigator to visit their home to substantiate the odor complaint. TCEQ inspectors perform two steps during the investigation. First, they investigate the home or business of the impacted party. Then, they determine the source of the odor and conduct a site visit to determine if the source facility is complying with permits and regulations. If an odor is confirmed, then TCEQ will work with the facility to stop or lessen the generation of nuisance odors. This may require processing changes, operational and engineering changes, or other adjustments to mitigate the odor source. A copy of TCEQ's Odor Complaint Investigation Procedures is included in Appendix B.

1-3.2.1.8 State of Maryland

- **Maryland Department of Environmental Protection (Maryland DEP)**
  - Maryland DEP requires that facilities designated above the exempt tier submit an OMP as part of the Compost Facility Operations Plan. Maryland regulation directs the reader to the CalRecycle website for OIMP development as an example for what should be included in the OMP.

1-3.2.2 Findings, Recommendations, and Level of Effort

1-3.2.2.1 Findings

- ODEQ has developed the nuisance odor strategy that applies to all Metro facilities that have an ODEQ permit. As detailed above, ODEQ logs complaints and takes action at a certain number of odor complaints. This strategy prevents a single resident from having an injurious impact on a facility but still provides that resident with a place to log a complaint. While the strategy requires that complaints originate from different addresses to trigger an investigation each complaint is logged by ODEQ. The NOS was developed by interviewing and studying different odor response strategies throughout the country, and the intent is to ensure that nuisance odor enforcement actions are defensible in court.
- All of the jurisdictions researched and interviewed with regard to odor (OR, CA, WA, AB, BC, TX, MA, MD) require an odor management plan of some kind. These plans require that facilities consider every major activity in the operation and require that BMPs are considered for mitigation of odor. Enforcement occurs at the facility boundary in every case and should an odor issue move to an enforcement action each jurisdiction uses a similar process whereby an odor is investigated, determined to originate from the facility, changes or mitigations are required of the facility, and when necessary a change to the operations plan and/or odor control plan will be made. ODEQ only requires an odor management plan if the facility is found to pose a risk for odors. The creation and implementation of an odor management plan at every facility would aide facilities in preventing normal process odors from becoming offsite nuisance odors through performance of root cause analysis when an unpleasant odor occurs.
- An odor management plan for each facility would provide Metro inspectors with an enforcement tool that could be used to bring a facility back into compliance. As a facility experiences offsite odor issues and the source of the odors has been determined the operator and inspector can review the OMP to ensure all BMPs for that odor source have been implemented. If it is determined that all BMPs are implemented but odor is still an issue, then the operator will need to determine additional BMPs to mitigate the odors from that source. If it is determined that the OMP is not fully implemented, then the operator would be required to implement all of the BMPs in their OMP. The process of determining the source and cause of an odor and implementing BMPs should continue until the source of the odors is mitigated.
- Procedures recommended in the Grimm's report such as oxygen monitoring, minimum biocover depth, continuous aeration of material through curing, stability testing prior to removal from aeration, and pile heights are all excellent means of minimizing odors. These procedures would be appropriate for incorporation into the OMP as BMPs when necessary and as performance of odor mitigation dictates. Development of a standardized odor complaint response strategy would provide Metro inspector/investigators the tools to determine the frequency, intensity, duration and offensiveness of

an odor without the need for additional equipment. Field olfactometers and n-butanol testing kits only measure the intensity of an odor and the use of the field olfactometer is limited in windy or rainy conditions so establishing a dilution to threshold limit would be difficult to monitor accurately. Furthermore, odor compliant response and odor evaluation is subjective. While a measurement of the intensity of an odor can be determined with a degree of objectivity, that is only one contributing factor. The process of investigating the frequency, duration, intensity, offensiveness and the source of an odor should be as standardized as possible to minimize process subjectivity.

1-3.2.2.2 Recommendations

Figure 1-3 provides a summary of the findings and recommendations for odor control recommendations.

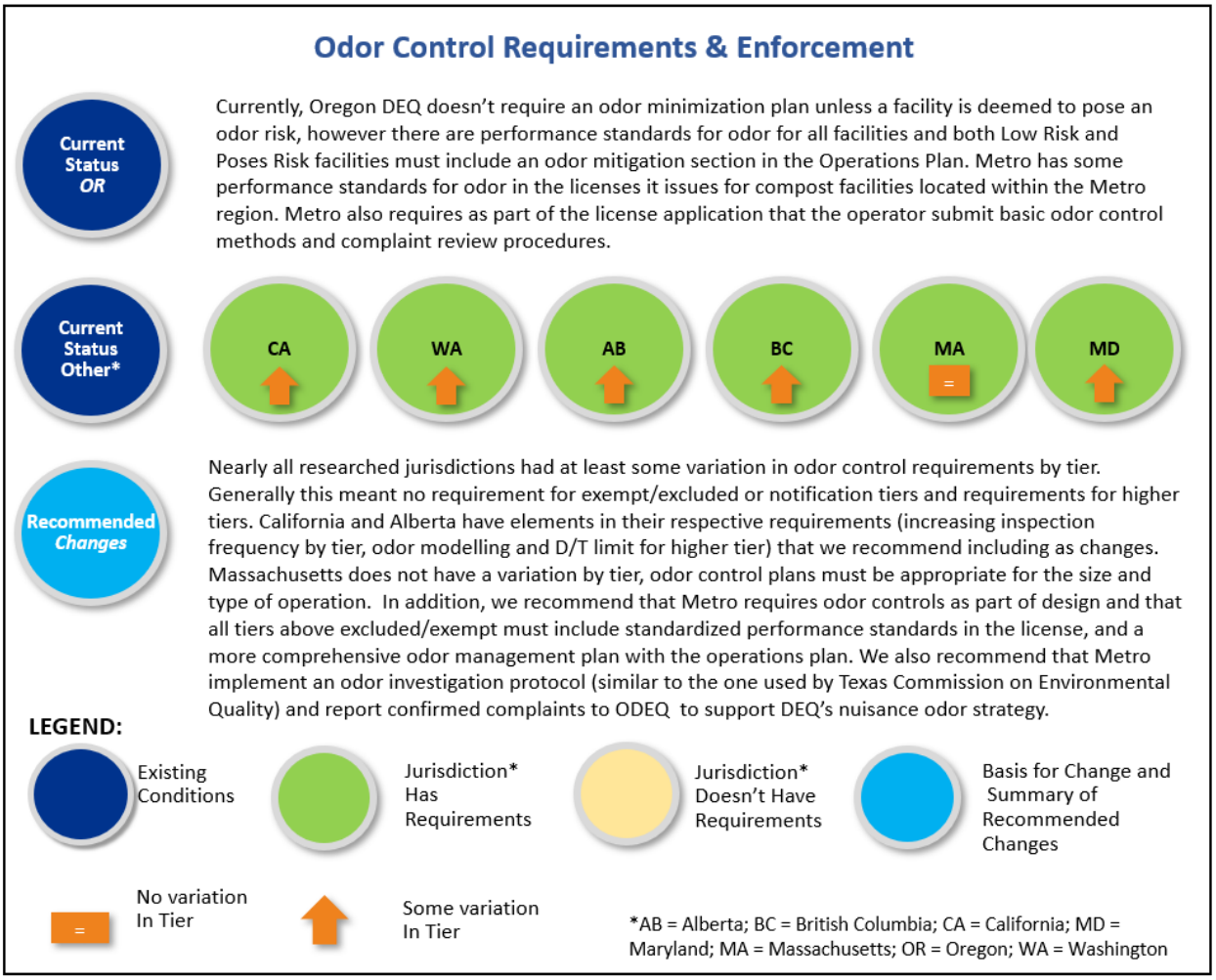

Figure 1-3. Odor Control Requirements and Enforcement

We recommend the following elements, as summarized by tier in Table 1-6, for odor control requirement and enforcement, to supplement the existing ODEQ requirements.

Table 1-6. Recommendations for Odor Control Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise

Table 1-6. Recommendations for Odor Control Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Low Risk / Registration Composting Facility Permit	• OMP required • Annual OMP review or revise to address issues	• Enforce performance standards and initiate corrective action as issues arise • Require odor controls as part of design • Standardized performance standards in the license • More comprehensive OMP • Develop and implement Metro odor investigation protocol • Report confirmed complaints to ODEQ to support NOS
Poses Potential Risk / Individual Composting Facility Permit	• OMP, odor modeling • Annual OMP review or revise to address issues	• Same as above with increased inspection frequency by tier, odor modeling

D/T = dilution-to-threshold
N/A = not applicable
NOS = Nuisance Odor Strategy
ODEQ = Oregon Department of Environmental Quality
OMP = odor minimization plan

As shown in Table 1-6, we recommend that requirements increase with increasing tier and risk level. Additional details of each of these requirements is discussed below:

- Require odor controls as a part of the design that are appropriate for the compost operation.
- Require, as was the case in the revised Grimm's license, that both low and poses potential risk facilities, as determined through the ODEQ facility permitting and screening process, develop and implement a more comprehensive OMP. The OMP provides a tool to assist the operator in minimizing, mitigating, and reporting odors and which can also be used for enforcement.
- Require the OMP to be reviewed at least annually (similar to California and British Columbia) and after an odor is confirmed to originate from the site which may trigger modifying the OMP and/or other corrective actions.
- Utilize the action triggers and corrective actions flow chart in Appendix C for facilities that are experiencing odor issues.
- Develop a standardized nuisance odor complaint response protocol like the TCEQ protocol. Use of a standardized odor complaint response protocol such as that from TCEQ gives a Metro inspector a tool to evaluate an odor based on four characteristics rather than on intensity alone. The TCEQ method does not require the purchase of additional equipment and investigations can be conducted in any weather conditions.
- Use ODEQ's NOS by forwarding complaints to the proper ODEQ office. Recognizing that it may not be appropriate to wait until an ODEQ NOS Investigation is triggered to respond to an odor complaint it is recommended that Metro consider creating or implementing a standardized odor complaint response protocol to be used by Metro inspectors and investigators. TCEQ has developed what they call the FIDO chart (detailed above) that gives an inspector the tools to determine if an odor reaches nuisance levels without the need for a field olfactometer or n-butanol kit.

- Under a separate project, develop a list of standard odor control BMPs similar to CalRecycle's Mitigation Strategy Menu. California also developed the Comprehensive Odor Response Project that explores the effects of various compost conditions and the creation of odors. This is a good resource for inspectors and regulators to be aware of and may inform BMPs.

1-3.2.2.3 Level of Effort

- Requiring that odor controls are part of the design and that an OMP will be prepared will take some additional effort by applicants (since we are recommending that both low risk and facilities that pose a risk prepare OMPs). In addition, Metro will need to review these plans.
- Creating standardized performance standards in the license will take minimal effort.
- Development of a standardized odor complaint response procedure would require a moderate to significant amount of effort even if the TCEQ system is used as a template since the protocol will need to be customized to fit the needs of Metro's facilities. However, establishing criteria for when an investigation will occur, who will perform the investigations and what procedures to follow when investigating will save time and effort in the long run if a facility develops nuisance odors that require frequent investigations.
- Utilizing and supporting the ODEQ nuisance odor strategy will result in little to no effort on the part of Metro apart from reporting complaints filed with Metro to the proper ODEQ office.
- A number of the BMPs suggested in the Grimm's report are extremely costly and could range from the hundreds of thousands of dollars into the millions for larger facilities. These mitigations should be implemented on a case by case basis when necessary and as dictated by facility performance.

1-3.3 Dust Control

Compost operations and supporting activities have the potential to generate dust. The impact of fugitive dust emissions will generally remain fairly localized to the facility boundary but depending on facility location the impact to adjacent neighbors, and in many cases nearby roadways, can be significant.

1-3.3.1 Research and Interview Summaries

Table 1-7 provides a summary of the dust control interview participants by jurisdiction.

Table 1-7. Dust Control Interview Participants

Jurisdiction	Interview Participant
Oregon Department of Environmental Quality (ODEQ)	Internet Research
State of California - CalRecycle and California State Water Resources Control Board (SWRCB)	Ken Decio, CalRecycle Brianna St. Pierre and Ember Christensen, SWRCB
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei
British Columbia Ministry of the Environment (BCMOE)	Maureen O'Connell and Gloria Parker

In addition to the jurisdictions shown in Table 1-7, Massachusetts DEP and Maryland DEP were also researched, although no interviews were conducted. Summaries for each of the researched jurisdictions are included in the following subsections.

1-3.3.1.1 State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - ODEQ regulates dust under the OAR 340-096-0090 which requires that compost facilities (not including exempt) include dust control measures in their operations plans. If dust is observed outside the facility boundary and the dust control measures deemed to be ineffective then revisions to the dust control section of the operations plan will be necessary.

1-3.3.1.2 State of California

- **CalRecycle and Feather River Air Quality Management District**
  - The State of California regulates dust primarily through CalRecycle and the regional air pollution control boards with enforcement and inspection oversight provided in most cases by an LEA and regional air board inspectors. Title 14 California Code of Regulations (CCR) Section 17867 requires that, “all handling activities shall be conducted in a manner that…minimizes human contact with, inhalation, ingestion, and transportation of dust (and) particulates…” Feather River Air Quality Management District Rule 3.16 C requires that, “a person shall take every reasonable precaution not to cause or allow the emissions of fugitive dust from being airborne beyond the property line from which the emission originates.”
- **Ken Decio – CalRecycle**
  - Ken Decio of CalRecycle was interviewed for this project and confirmed that enforcement of dust control in both cases, CalRecycle and Regional Air Boards, is at the property line. CalRecycle requires a description of dust control BMPs in the site operations plan. If dust is consistently found emitting over the property boundary then revisions to the dust control methods and additional BMPs may be required or if it is determined that site operations are not compliant with the dust control plan, then operations would need to be brought back into compliance.

1-3.3.1.3 State of Washington

- **Washington Department of Ecology (WDOE)**
  - Compost facilities in the State of Washington are regulated under WAC 173-350-040. Compost operations are required to create and implement a dust control plan to prevent migration of fugitive dust beyond the property boundary (not required for Excluded / Exempt and notification tier).
- **Mary Harrington and Dawn Marie Maurer – Washington Department of Ecology**
  - Mary Harrington and Dawn Marie Maurer of WDOE were interviewed for this project and confirmed regulatory language that dust must be controlled to prevent migration beyond the property boundary. Confirmation that dust is migrating beyond the property would warrant an investigation and it may be determined that the dust control plan is either not being followed or is ineffective. In either case it would be the responsibility of the operator to either comply with the approved plan or revise the plan to prevent future incidents of migration.

1-3.3.1.4 Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**
  - Alberta Environment and Parks (AEP) developed the *Code of Practice for Compost Facilities* to regulate facilities under 20,000 tonnes per year. Facilities that bring in excess of that amount are required to obtain a site-specific Certificate of Operations. AEP requires, as part of the *Code of Practice for Compost Facilities*, that a certified operator is employed and responsible for each facility. The *Code of Practice for Compost Facilities* requires that “the person responsible shall develop, maintain and implement an operations plan that is consistent with the compost facility design and includes…a plan for minimizing dust.”

- **Natasha Page and Richard Adjei – Alberta Environment and Parks**
  - Natasha Page and Richard Adjei were interviewed as part of this project to gain an understanding of enforcement procedures. As is the case in other jurisdictions, dust must be controlled to prevent migration beyond the property boundary. Confirmation that dust is migrating beyond the property would warrant an investigation and it may be determined that the dust control plan is either not being followed or is ineffective. In either case it would be the responsibility of the operator to either comply with the approved plan or revise the plan to prevent future incidents of migration.

1-3.3.1.5 Province of British Columbia, Canada

- **British Columbia Ministry of the Environment (BCMOE)**
  - BCMOE requires the preparation and submittal of an Air Pollution Control Plan to be submitted as part of the EIS for facilities that exceed the exempt tier either for tonnage or feedstock type. The Air Pollution Control Plan and EIS must be prepared by a "Qualified Professional" as defined in British Columbia's OMRR.

1-3.3.1.6 State of Massachusetts

- **The Massachusetts Department of Environmental Protection (Mass DEP)**
  - Regulates dust under 310 CMR 16.00. As a general permit requirement, Mass DEP requires the operator to prepare a design plan that includes environmental controls for preventing nuisance dust.

1-3.3.1.7 State of Maryland

- **The Maryland Department of Environmental Protection (Maryland DEP)**
  - Investigation into Maryland DEP solid waste regulations did not reveal a specific requirement to control dust.

1-3.3.2 Findings, Recommendations, and Level of Effort

1-3.3.2.1 Findings

- Metro already requires the inclusion of dust control procedures in the operations plan similar to each jurisdiction researched and interviewed (OR, CA, WA, AB, MA, BC) except Maryland. The Metro strategy for regulating dust is consistent with industry standard.
- Requiring a dust control plan, as Metro already does, allows the operator to manage dust emissions as a performance standard and provides the operator flexibility to manage dust based on the conditions and processes used at their site. This is consistent with industry practice.
- A dust control plan provides Metro inspectors with a tool for evaluating and enforcing compliance. If an operator is not implementing the measures detailed in their own dust control plan, then the Metro inspector can threaten or levy enforcement until the plan is fully implemented. If after implementation dust is still found emitting beyond the property boundary, the Metro inspector can require the operator to revise the plan and include measures for eliminating the cause of dust emissions.

1-3.3.2.2 Recommendations

Figure 1-4 provides a summary of the findings and recommendations for dust control recommendations.

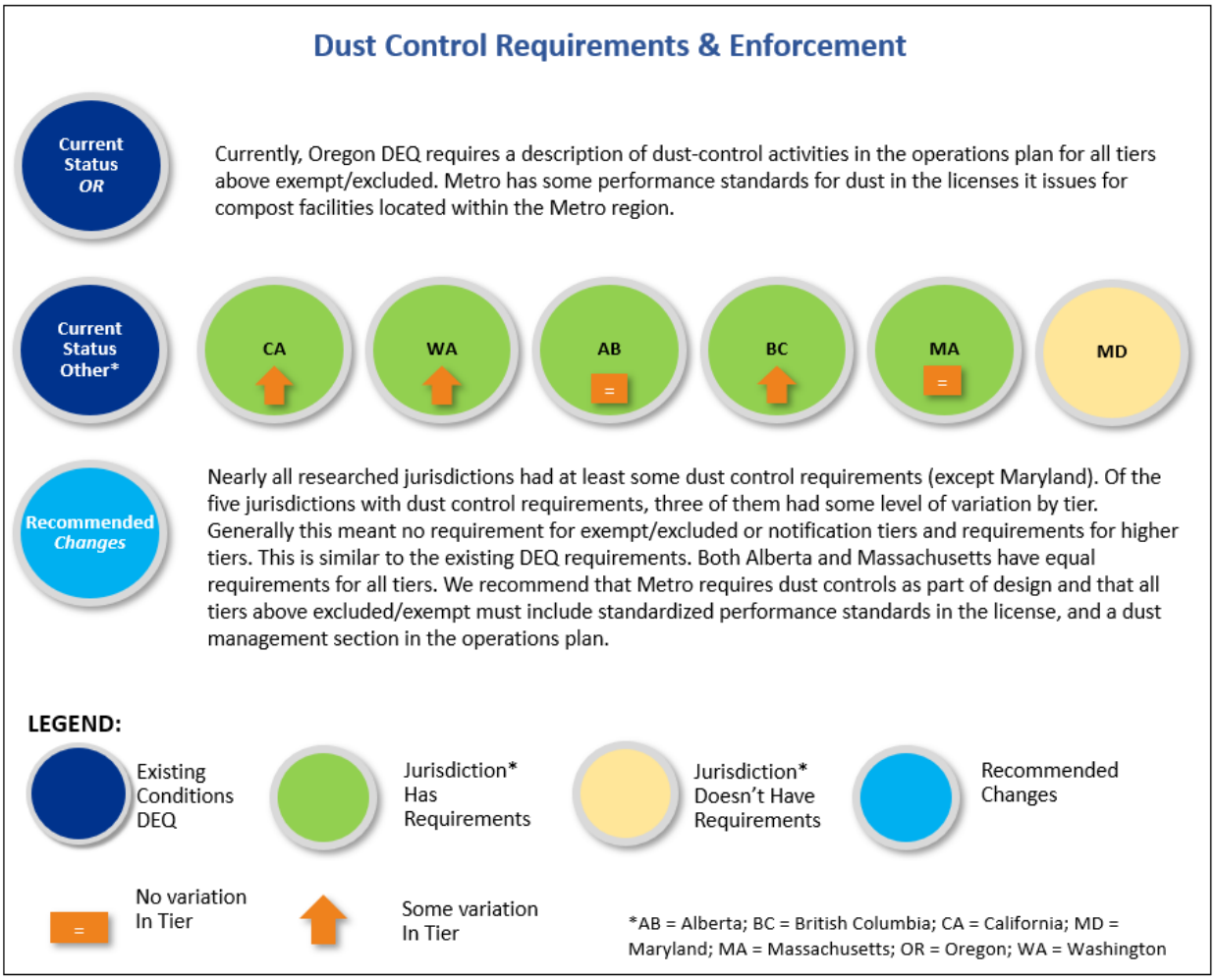

Figure 1-4. Dust Control Requirements and Enforcement

We recommend the following elements, as summarized by tier in Table 1-8, for dust control requirements and enforcement, to supplement the existing ODEQ requirements.

Table 1-8. Recommendations for Dust Control Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• No change recommended. Required in ODEQ and Metro operations plans	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit	• No change recommended. Required in ODEQ and Metro operations plans	• Enforce performance standards and initiate corrective action as issues arise • Require dust controls as part of design • Standardized performance standards in the license • Dust management section in the operations plan

Table 1-8. Recommendations for Dust Control Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Poses Potential Risk / Individual Composting Facility Permit	• No change recommended. Required in ODEQ and Metro operations plans	• Same as above

N/A = not applicable

As shown in Table 1-8 we recommend that requirements are consistent above the exempt tier. Additional details of each of these requirements is discussed below:

- Require dust controls as part of design.
- Use standardized performance standards, such as, “The licensee must operate the facility in a manner that controls and minimizes the dust generation, airborne debris and litter, and which prevents its migration beyond property boundaries,” in the license and include a dust management section in the operations plan.
- Utilize the action triggers and corrective actions flow chart in Appendix C for facilities that are experiencing dust issues.

These elements are already required in the Metro license. Maintaining the current program will provide an enforcement tool to Metro inspectors. The current code, enforcement, and program are consistent with industry based on research and interviews. No additional measures are recommended at this time.

1-3.3.2.3 Level of Effort

No additional effort required.

1-3.4 Housekeeping

Housekeeping practices are an important part of any successful compost facility. The range of housekeeping activities required are dependent on the type of facility and the associated operations. However, like many things, there are general best practices and a well-kept site typically has fewer safety hazards, is generally less likely to generate nuisance odor and dust and has fewer leachate issues. Additionally, good housekeeping will present well to the community in cases where odor or other operational issues arise, and community outreach is recommended. Requiring good housekeeping may be a way to manage other onsite issues. However, housekeeping is subjective, making consistent enforcement very difficult.

1-3.4.1 Research and Interview Summaries

Table 1-9 provides a summary of the housekeeping interview participants by jurisdiction.

Table 1-9. Housekeeping Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Internet Research
State of California - CalRecycle and California State Water Resources Control Board (SWRCB)	Ken Decio, CalRecycle Brianna St. Pierre and Ember Christensen, SWRCB
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei

In addition to the jurisdictions shown in Table 1-9, Massachusetts Department of Environmental Protection (Mass DEP), British Columbia Ministry of the Environment (BCMOE), and Maryland Department of Environmental Protection (Maryland DEP) were also researched, although no interviews were conducted. Summaries of each of the researched jurisdictions are included in the following subsections.

1-3.4.1.1 State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - OAR Section 340-096 was researched for independent instances of housekeeping and maintenance regulations and none were found. Housekeeping and maintenance requirements found were related to dust and litter control and can be characterized as BMPs for those focus areas. A description of housekeeping activities is included in nuisance control plans for non-exempt/excluded facilities.

1-3.4.1.2 State of California

- **CalRecycle and California State Water Quality Control Board**
  - Based on research of CalRecycle and SWRCB composting regulations, The State of California does not specifically regulate housekeeping and facility maintenance. BMPs are required in several sections of the RCSI (operations plan) including, dust control, litter control, odor control and stormwater management. Many BMPs such as sweeping between rows, preventing leachate ponding, cleaning accumulated litter off the litter fence, leachate pond aeration and aerator maintenance serve the dual purpose of ensuring site housekeeping and equipment maintenance is under control and that site nuisance conditions are minimized.
- **Ken Decio – CalRecycle**
  - Ken Decio of CalRecycle was interviewed for this project and confirmed that CalRecycle does not regulate housekeeping specifically. However, good housekeeping practices may be a BMP included in an odor management plan, dust control section or litter control section of an operations plan.
- **Brianna St. Pierre and Ember Christensen – California State Water Resources Control Board**
  - Ms. St. Pierre and Ms. Christensen that the California State Water Resources Control Board does not specifically regulate housekeeping. However, a Stormwater Pollution Prevention Plan will include both standard and custom BMPs, some of which may be viewed has good housekeeping practices to prevent the contamination of stormwater.

1-3.4.1.3 State of Washington

- **Washington Department of Ecology (WDOE)**
  - WAC 173-350-220(6)(a)(vi)(B) requires that facility employees are trained in facility maintenance procedures. Section (a)(B)(a)(x) requires that a plan to control air contaminants such as dust and odor include a description of the maintenance activities that will help the facility accomplish nuisance odor prevention and control. Examples listed in regulation include:
    - How the site will acquire backup equipment in case of a breakdown
    - Aeration system maintenance schedule
    - Biofilter media replacement schedule
    - Leachate pond and storage tank cleaning schedule
  - As was found in other jurisdictions, these maintenance requirements are tied to other focus areas, in this case, odor and dust control. System and equipment maintenance procedures are considered BMPs and regulation of these requirements would be tied to performance standards for preventing odor and dust migration.

- **Mary Harrington and Dawn Marie Maurer – Washington Department of Ecology**
  - Mary Harrington and Dawn Marie Maurer of WDOE were interviewed for this project and confirmed research findings that housekeeping and maintenance are not regulated on a standalone basis but that housekeeping is a necessary component of a nuisance control plan (required for facilities above the exempt and notification tiers).

1-3.4.1.4 Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**
  - Alberta Environment and Parks (AEP) developed the Code of Practice for Compost Facilities currently in affect for the regulation of compost facilities. The Code of Practice for Compost Facilities does not specifically regulate housekeeping or facility maintenance.
- **Natasha Page and Richard Adjei – Alberta Environment and Parks**
  - Natasha Page and Richard Adjei were interviewed as part of this project and confirmed that the Code of Practice for Compost Facilities does not specifically require housekeeping or maintenance requirements but that housekeeping and maintenance activities would be BMPs for other nuisance and safety conditions and should be addressed in nuisance control plans for all facilities.

1-3.4.1.5 State of Massachusetts

- **The Massachusetts Department of Environmental Protection (Mass DEP)**
  - Research performed uncovered no specific housekeeping or maintenance requirements in 310 CMR 19.00. However, a description of housekeeping activities is included in nuisance control plans.

1-3.4.1.6 Province of British Columbia, Canada

- **British Columbia Ministry of the Environment (BCMOE)**
  - Investigation into the OMRR revealed no specific housekeeping or facility maintenance requirements. However, a description of housekeeping activities is included in nuisance control plans (above the exempt tier).

1-3.4.1.7 State of Maryland

- **The Maryland Department of Environmental Protection (Maryland DEP)**
  - Investigation into Maryland DEP solid waste regulations did not reveal a specific housekeeping or facility maintenance requirements.

1-3.4.2 Findings, Recommendations, and Level of Effort

1-3.4.2.1 Findings

- Research and interviews from the jurisdictions interviewed and researched (OR, CA, WA, AB, BC, MA, MD) revealed no formal regulations for housekeeping. However, regulations for dust, vector, odor, track-out, and other nuisance conditions require the implementation of best management practices and are often included in nuisance control plans or operations plans. Many of these BMPs can be viewed as good housekeeping practices and are therefore required actions at compost facilities.

1-3.4.2.2 Recommendations

Figure 1-5 provides a summary of the findings and recommendations for housekeeping recommendations.

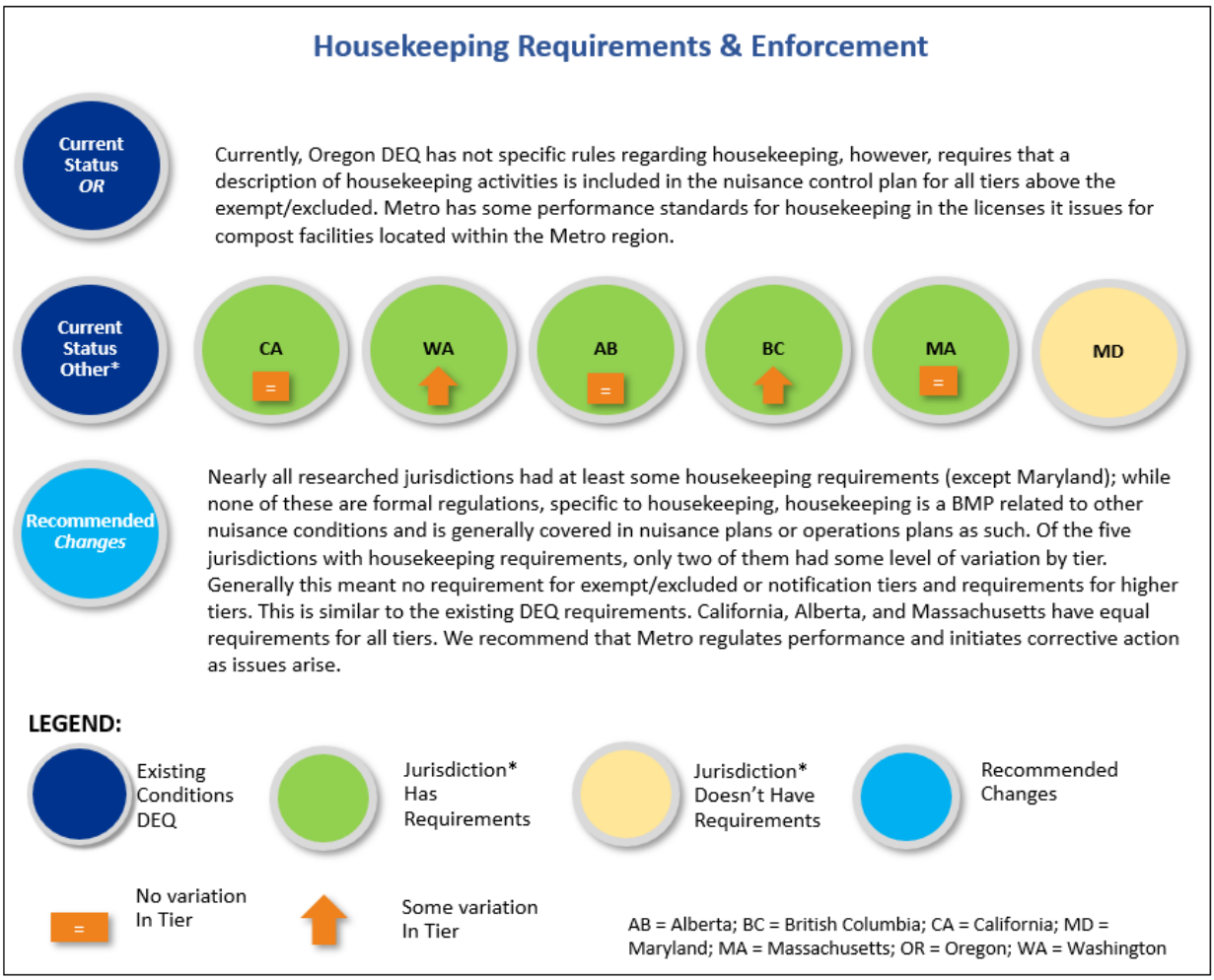

Figure 1-5. Housekeeping Requirements and Enforcement

We recommend the following elements, as summarized by tier in Table 1-10, for housekeeping requirements and enforcement, to supplement the existing ODEQ requirements.

Table 1-10. Recommendations for Housekeeping Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• Housekeeping measures/BMPs will be implemented with other nuisance control plans	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit		
Poses Potential Risk / Individual Composting Facility Permit		

BMPs = best management practices

As shown in Table 1-10, we do not recommend any variation by tier. Additional details of the requirements are discussed below:

- No specific action for housekeeping is recommended based on the research and interview findings. However, implementing housekeeping measures as part of other nuisance control plans will meet the

objective of preventing those nuisance conditions without adding additional regulation and monitoring effort.

- Enforce performance standards and initiate corrective action as issues arise, see Appendix C for suggestions on corrective actions for the related nuisance conditions of dust, vector, odor, and track-out, which can be related to housekeeping.

1-3.4.2.3 Level of Effort

No additional level of effort is required.

1-3.5 Litter Control

The impact of litter will remain fairly localized to the facility boundary but depending on facility location, the impact to adjacent neighbors, nearby roadways, and streams and rivers can be significant.

1-3.5.1 Research and Interview Summaries

Table 1-11 provides a summary of the litter interview participants by jurisdiction.

Table 1-11. Litter Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Internet Research
State of California - CalRecycle and California State Water Resources Control Board (SWRCB)	Ken Decio, CalRecycle Brianna St. Pierre and Ember Christensen, SWRCB
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei

In addition to the jurisdictions shown in Table 1-11, Massachusetts DEP and Maryland DEP were also researched, although no interviews were conducted. Summaries for each of the researched jurisdictions are included in the following subsections.

1-3.5.1.1 State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - ODEQ regulates litter under OAR Section 340-096-0090 which requires that compost facilities include litter control measures in their operations plans (for tiers above exempt). If litter is observed outside the facility boundary or uncontrolled around the site, then the operator will be required to bring their operations into compliance with the litter control plan or if the plan is deemed to be ineffective then revisions to the litter control section of the operations plan will be necessary.

1-3.5.1.2 State of California

- **CalRecycle and California State Water Quality Control Board**
  - The State of California regulates litter primarily through CalRecycle with enforcement and inspection oversight provided in most cases by an LEA. Title 14 CCR Section 17867 requires that, “all handling activities shall be conducted in a manner that minimizes…litter…”
- **Ken Decio – CalRecycle**

- Mr. Decio confirmed that enforcement is typically at the property line, however, excessive uncontrolled litter onsite can lead to issuance of an area of concern on an inspection due to the potential for offsite migration and impacts. CalRecycle requires a description of litter control BMPs in the site operations plan as part of the RCSI for tiers above exempt and notification. If litter is consistently found migrating beyond the property boundary then revisions to the litter control methods and additional BMPs may be required or if it is determined that site operations are not compliant with the litter control plan, then operations would need to be brought back into compliance.

1-3.5.1.3 State of Washington

- **Washington Department of Ecology (WDOE)**
  - WDOE regulates compost facilities under Washington Administrative Code (WAC) 173-350-040. Litter must be controlled to prevent migration beyond the property boundary. Confirmation that litter is migrating beyond the property would warrant an investigation and it may be determined that the litter controls are ineffective. It would be the responsibility of the operator to implement additional BMPs or litter control methods to prevent offsite migration of litter. A description of litter-control activities is required in the operations plans for tiers above excluded and notification.
- **Mary Harrington and Dawn Marie Maurer – Washington Department of Ecology**
  - Ms. Harrington and Ms. Maurer confirmed that litter migration beyond the boundary of the facility would warrant an investigation. The results of the investigation would either require the operator to bring the facility back into compliance with their operations plan or revise the plan if it is ineffective.

1-3.5.1.4 Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**
  - The Code of Practice for Compost Facilities currently in affect for the regulation of compost facilities and requires that a certified operator is employed and responsible for each facility. It also requires that “The person responsible shall establish and maintain litter controls to minimize the escape of wastes from the compost facility and shall retrieve waste that is washed or blown onto adjacent properties or accumulates on the compost facility and shall properly dispose of such waste.” These litter control measures are required for either tier.
- **Natasha Page and Richard Adjei – Alberta Environment and Parks**
  - Natasha Page and Richard Adjei were interviewed as part of this project to gain an understanding of enforcement procedures. As is the case in other jurisdictions, litter must be controlled to prevent migration beyond the property boundary. Confirmation that litter is migrating beyond the property would warrant an investigation and it may be determined that the litter is not being properly controlled. It would be the responsibility of the operator to implement additional BMPs or litter control methods to prevent offsite migration of litter.

1-3.5.1.5 State of Massachusetts

- **The Massachusetts Department of Environmental Protection (Mass DEP)**
  - Research conducted revealed that compost facilities are required to take measures to prevent the migration of windblown litter (for all tiers). A litter control plan does not appear to be required.

1-3.5.1.6 Province of British Columbia, Canada

- **British Columbia Ministry of the Environment (BCMOE)**
  - Investigation into the OMRR revealed no specific litter control operational requirements but that litter impacts should be considered when citing a new facility (includes facilities above exempt tier).

1-3.5.1.7 State of Maryland

- **The Maryland Department of Environmental Protection (Maryland DEP)**
  - It was found that Maryland DEP solid waste regulations require a nuisance prevention plan to be submitted as part of the Compost Facility Operations Plan (includes all but lowest tier). Litter is a topic that must be specifically addressed in the nuisance prevention plan.

1-3.5.2 Findings, Recommendations, and Level of Effort

1-3.5.2.1 Findings

- Developing and complying with a litter control plan is consistent with industry based on the research and interviews conducted (OR, CA, WA, AB, BC, MA, MD).
- Requiring the site to develop a site-specific litter control plan (as part of the operations), allows operational flexibility and allows the operator to cater the plan to their process and site conditions.
- A formal litter control section of the plan documents what efforts are required and provides Metro inspectors with a tool that makes compliance monitoring, inspections, and enforcement more effective through the use of progressive discipline.

1-3.5.2.2 Recommendations

Figure 1-6 provides a summary of the findings and recommendations for litter control recommendations.

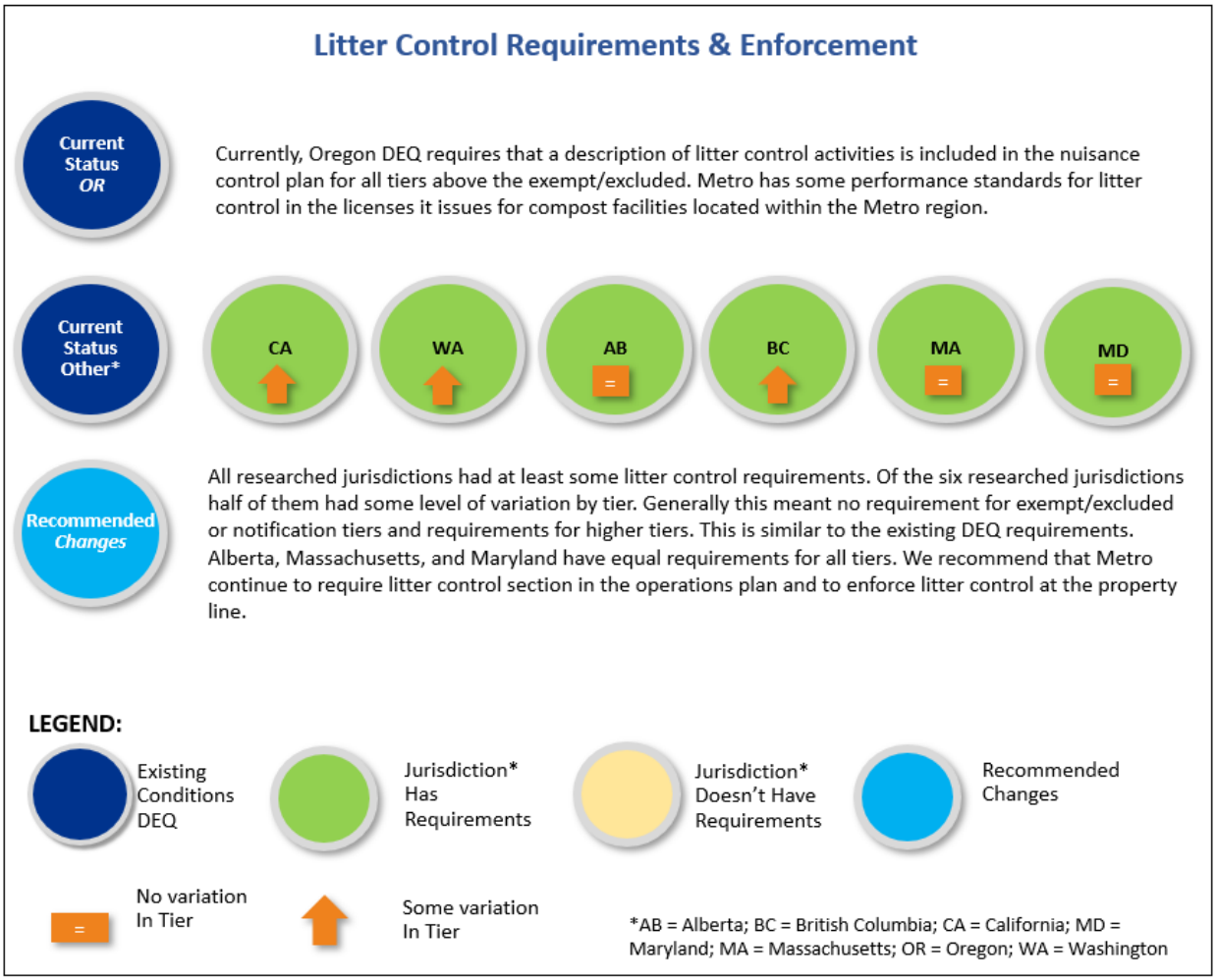

Figure 1-6. Litter Control Requirements and Enforcement

We recommend the following elements, as summarized by tier in Table 1-12, for dust control requirements and enforcement, to supplement the existing ODEQ requirements.

Table 1-12. Recommendations for Litter Control Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit	• Include litter control plan in Operations Plan	• Enforce performance standards and initiate corrective action as issues arise
Poses Potential Risk / Individual Composting Facility Permit	• Include litter control plan in Operations Plan	• Enforce performance standards and initiate corrective action as issues arise

N/A = not applicable

As shown in Table 1-12, we do not recommend any variation by tier. Additional details of the requirements are discussed below:

- Require preparation and submittal of a litter control plan in the operations plan.
- Enforce litter control at the property line using progressive enforcement procedures and initiate corrective action as issues arise. Utilize the action triggers and corrective actions flow chart in Appendix C for facilities that are experiencing litter issues.

1-3.5.2.3 Level of Effort

- No additional effort. Plan review and enforcement is already occurring.

1-3.6 Track-Out

Mud and compost fines tracked out of a compost facility (track-out) may result in the transport of solids or other contaminants into roadways and natural water ways. Track-out has a low potential for nuisance impacts to neighbors but there is a potential for environmental impacts.

1-3.6.1 Research and Interview Summaries

Table 1-13 provides a summary of the track-out interview participants by jurisdiction.

Table 1-13. Track-Out Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Internet Research
State of California - CalRecycle and California State Water Resources Control Board (SWRCB)	Ken Decio, CalRecycle Brianna St. Pierre and Ember Christensen, SWRCB
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei

In addition to the jurisdictions shown in Table 1-13, Massachusetts Department of Environmental Protection (Mass DEP), British Columbia Ministry of the Environment (BCMOE), and Maryland Department of Environmental Protection (Maryland DEP) were also researched, although no interviews were conducted. Summaries of each of the researched jurisdictions are included in the following subsections.

1-3.6.1.1 State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - ODEQ regulates track-out under the Oregon 1200Z Industrial Stormwater Permit which requires that facilities, “Minimize generation of dust, off-site tracking and discharge of soil, particulates and raw, final or waste materials.” If track-out is observed outside the facility boundary then the operator will be required to bring their operations into compliance with the Stormwater Pollution Control Plan (SWPCP). If the SWPCP is deemed ineffective then revisions to the track-out control section of the plan will be necessary. These requirements are for tiers above the exempt tier.

1-3.6.1.2 State of California

- **CalRecycle and California State Water Quality Control Board**
  - The State of California regulates track-out primarily through the California State Water Resources Control Board (SWRCB) with enforcement and inspection oversight provided in most cases by a regional board inspector. Title 27 CCR Section 20540 requires that, “Roads within the permitted facility boundary shall be designed to minimize the generation of dust and the tracking of material onto adjacent public roads. Such roads shall be kept in safe condition and maintained such that vehicle access and unloading can be conducted during inclement weather.” These requirements are for all tiers.
- **Brianna St. Pierre and Ember Christensen - California State Water Resources Control Board**
  - Brianna St. Pierre and Ember Christensen of the SWRCB were interviewed for this project and confirmed that the presence of track-out would be considered an offsite discharge. Under the NPDES Stormwater permit track-out is prohibited. The SWRCB would employ progressive enforcement as a method to bring a facility back into compliance. To return to compliance with an NPDES permit, the operator would be required to update their SWPPP to address insufficiencies with track-out BMPs.

1-3.6.1.3 State of Washington

- **Washington Department of Ecology (WDOE)**
  - WDOE regulates track-out under the NPDES program (all tiers).
- **Mary Harrington and Dawn Marie Maurer – Washington Department of Ecology**
  - During the interview Ms. Maurer stated that track-out from compost facilities is prohibited as it would represent a discharge into the waters of the state. If track-out is observed outside the facility boundary then the operator will be required to bring their operations into compliance with the SWPCP. If the SWPCP is deemed ineffective then revisions to the track-out control section of the plan will be necessary.

1-3.6.1.4 Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**
  - Based on review of the Code of Practice for Compost Facilities it appears track-out is not currently regulated in this jurisdiction. Many facilities in Canada perform composting operations under roof. This serves to minimize generation of muddy conditions and thereby reduces instances and impacts of track-out.
- **Natasha Page and Richard Adjei – Alberta Environment and Parks**

- Natasha Page and Richard Adjei were interviewed as part of this project to gain an understanding of regulations and enforcement procedures and they confirmed that track-out is not regulated by AEP.

1-3.6.1.5 State of Massachusetts

- **The Massachusetts Department of Environmental Protection (Mass DEP)**
  - Research conducted revealed that Mass DEP solid waste regulations do not include a specific requirement to minimize track-out. However, track-out minimization should be included in the Massachusetts stormwater protection program (for all tiers).

1-3.6.1.6 Province of British Columbia, Canada

- **British Columbia Ministry of the Environment (BCMOE)**
  - Track-out is not regulated in the OMRR. Other stormwater quality parameters are considered and the OMRR references the ODEQ 1200z (NPDES) permit in regulation for comparison purposes.

1-3.6.1.7 State of Maryland

- **The Maryland Department of Environmental Protection (Maryland DEP)**
  - It was found that Maryland DEP solid waste regulations requires that track-out control procedures are included in the compost facility operations plan (for tiers above the lowest tier).

1-3.6.2 Findings, Recommendations, and Level of Effort

1-3.6.2.1 Findings

- Based on the research and interviews conducted, managing track-out as part of the NPDES program is consistent with most of the jurisdictions evaluated (OR, CA, WA, MA, MD).
- The NPDES program requires that a comprehensive, site-specific, stormwater evaluation is completed annually.
- The Stormwater Pollution Control Plan documents what efforts are required and provides Metro inspectors with a tool that makes compliance monitoring, inspections, and enforcement more effective through the use of progressive discipline.
- In addition to track-out minimization practices, a Stormwater Pollution Prevention Plan, as required by the NPDES program will consider other stormwater BMPs to further protect the waters of the state.

1-3.6.2.2 Recommendations

Figure 1-7 provides a summary of the findings and recommendations for track-out minimization.

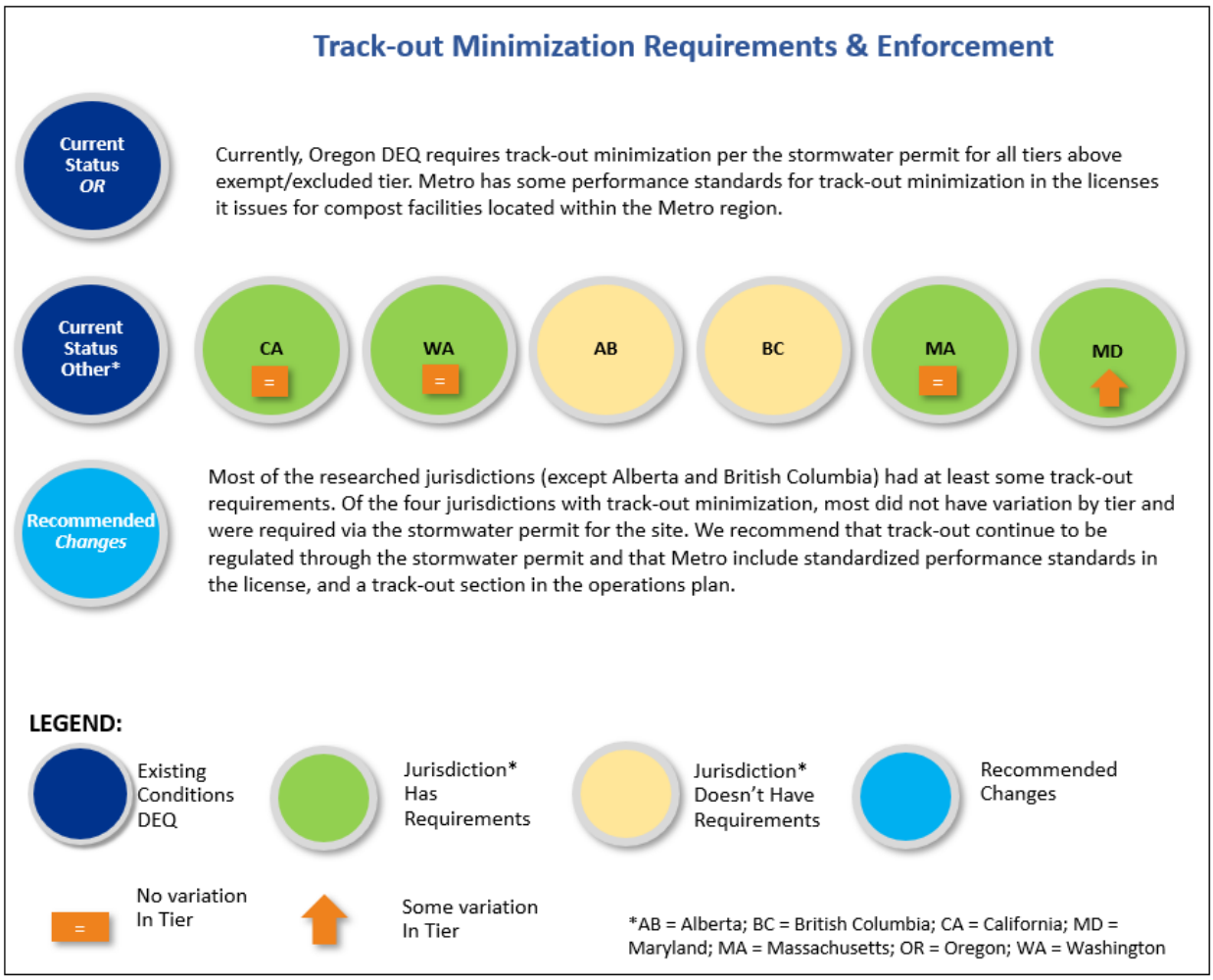

Figure 1-7. Track-out Minimization Requirements and Enforcement

We recommend the following elements, as summarized by tier in Table 1-14, for track-out minimization requirements and enforcement, to supplement the existing ODEQ requirements.

Table 1-14. Recommendations for Track-out Minimization Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit	• Include track-out minimization plan in Operations Plan	• Enforce performance standards and initiate corrective action as issues arise • Standardized performance standards and operation plan
Poses Potential Risk / Individual Composting Facility Permit	• Include track-out minimization plan in Operations Plan	• Enforce performance standards and initiate corrective action as issues arise

Table 1-14. Recommendations for Track-out Minimization Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
		• Standardized performance standards and operation plan

N/A = not applicable

As shown in Table 1-14, we do not recommend any variation by tier. Additional details of the requirements are discussed below:

- Regulate track-out through the Stormwater Pollution Control Plan as required under the NPDES program (ODEQ 1200z Permit). Require a track out control plan section in the operations plan for facilities that are not governed by an NPDES permit.
- Enforce track-out control at the property line using progressive enforcement procedures and initiate corrective action as issues arise (See Appendix C).
- Reporting to the proper ODEQ authority is also recommended when inspections reveal a deficiency.

1-3.6.2.3 Level of Effort

- Management of the NPDES program would be handled at the ODEQ level. Metro may choose to inspect and enforce items in the Stormwater Pollution Control Plan.
- Review cost for Metro is minimal. Metro can review the Stormwater Pollution Control Plan as part of the permitting process and a track-out control section or should be addressed as part of this plan. Cost of permit and plan review should be covered by the applicant.

1-3.7 Vectors

Vectors can pose nuisance and potential health impacts for people both on and off site. Proper management of the facility is required to minimize these impacts.

1-3.7.1 Research and Interview Summaries

Table 1-15 provides a summary of the vector interview participants and other sources by jurisdiction.

Table 1-15. Vector Interview Participants and Other Sources

Jurisdiction	Interview Participants and Other Sources
Oregon Department of Environmental Quality (ODEQ)	Internet Research
State of California - CalRecycle and California State Water Resources Control Board (SWRCB)	Ken Decio, CalRecycle Brianna St. Pierre and Ember Christensen, SWRCB
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei

In addition to the jurisdictions shown in Table 1-15, Massachusetts Department of Environmental Protection (Mass DEP), British Columbia Ministry of the Environment (BCMOE), and Maryland Department of Environmental Protection (Maryland DEP) were also researched, although no interviews were conducted. Summaries of each of the researched jurisdictions are included in the following subsections.

1-3.7.1.1 State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - ODEQ regulates vectors under the Oregon Administrative Rules (OAR) Section 340-096-0070 which requires that, “all composting facilities must be designed, constructed, and operated in a manner that controls or prevents propagation, harborage, or attraction of vectors, including but not limited to rats, birds, and flies.” OAR 340-096-0090 requires that the operations plan (for tiers above exempt), “describe methods the composting operation will use to comply with OAR 340-096-0070(6) to minimize the attraction of vectors such as rats, birds, flies.” If vectors are observed onsite and are deemed to be excessive by an inspector, then the operator will be required to bring their operations into compliance with the vector control portion of the operations plan. If the methods described in the plan are deemed to be ineffective then revisions to the vector control section of the operations plan will be necessary.

1-3.7.1.2 State of California

- **CalRecycle and California State Water Quality Control Board**
  - The State of California regulates vectors primarily through CalRecycle with enforcement and inspection oversight provided in most cases by a Local Enforcement Agency (LEA). Title 14 CCR Section 17867 requires that, “all handling activities shall be conducted in a manner that minimizes vectors…”
- **Ken Decio - CalRecycle**
  - Mr. Decio was interviewed for this project and confirmed that enforcement of vector control regulations is subjective and that the LEA inspector would be responsible for issuance of an area of concern or violation on an inspection due to excessive vectors such as birds, insects or rodents. CalRecycle requires a description of vector minimization in the site operations plan (for tiers above exempt). If vectors are consistently found in excessive numbers onsite the inspector will determine if the operator is in compliance with their operating plan. Non-compliance or failure to implement vector control measures will result in an inspection area of concern or violation. If an operator is found to be in compliance with their operating plan but vectors are still excessive, then a revision to the operating plan may be necessary and additional measures employed.

1-3.7.1.3 State of Washington

- **Washington Department of Ecology (WDOE)**
  - WDOE regulates compost facilities under Washington Administrative Code (WAC) 173-350-220. WAC 173-350-220(6.vii.B) requires that, “aerated static pile(s) must have a cover such as a synthetic material or a layer of finished compost to ensure that pathogen reduction temperatures are reached and vectors are controlled.”
- **Mary Harrington and Dawn Marie Maurer – Washington Department of Ecology**
  - It was confirmed during the interview that the facility must be operated to prevent the attraction of vectors. If vectors are observed onsite and are deemed to be excessive by an inspector then the operator will be required to bring their operations into compliance with the vector control portion of the operations plan (required for tiers above exempt). If the methods described in the plan are deemed to be ineffective then revisions to the vector control section of the operations plan will be necessary.

1-3.7.1.4 Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**
  - AEP requires that a certified operator is employed and responsible for each facility. The certified operator is responsible for implementing controls to prevent the propagation, harbourage or attraction of disease vectors and noxious weeds at their compost facility. Vector control measures should be addressed in the operations plan.

- **Natasha Page and Richard Adjei – Alberta Environment and Parks**
  - Natasha Page and Richard Adjei were interviewed as part of this project to gain an understanding of the implementation of regulations and enforcement procedures. As is the case in other jurisdictions, if vectors are observed onsite and are deemed to be excessive by an inspector then the operator will be required to bring their operations into compliance with the vector control portion of the operations plan. If the methods described in the plan are deemed to be ineffective then revisions to the vector control section of the operations plan will be necessary.

1-3.7.1.5 State of Massachusetts

- **The Massachusetts Department of Environmental Protection (Mass DEP)**
  - Mass DEP regulates vectors under 310 CMR 16.00. As a general permit requirement, Mass DEP requires the operator to, "(implement) a vector control plan that is appropriate for the size and type of the operation that will minimize the presence of vectors. The plan shall identify specific actions that will be taken to address complaints if unacceptable vectors occur beyond the property line of the operation." These requirements are for all tiers.

1-3.7.1.6 Province of British Columbia, Canada

- **British Columbia Ministry of the Environment (BCMOE)**
  - Investigation revealed that BCMOE requires operators to perform vector attraction reduction processes of varying effort based on the type of feedstock and product the facility plans to use and sell. These processes are detailed in OMRR Schedule 2. These are general requirements (for tiers above exempt). Site specific vector control measures should also be included in the Wildlife Management and Control Plan.

1-3.7.1.7 State of Maryland

- **The Maryland Department of Environmental Protection (Maryland DEP)**
  - It was found that Maryland DEP solid waste regulations requires that vector control procedures are included in the compost facility operations plan (for all but lowest tier).

1-3.7.2 Findings, Recommendations, and Level of Effort

1-3.7.2.1 Findings

- Developing and complying with a vector control plan is consistent with industry based on the research and interviews conducted (OR, CA, WA, AB, BC, MA, and MD).
- Requiring the site to develop a site-specific vector control plan (as part of the operations plan), allows operational flexibility and allows the operator to cater the plan to their process and site conditions.
- A formal vector control section of the plan documents what efforts are required and provides Metro inspectors with a tool that makes compliance monitoring, inspections, and enforcement more effective through the use of progressive discipline.
- Interviews and research did not reveal a standard for what constitutes a violation for vectors.

1-3.7.2.2 Recommendations

Figure 1-8 provides a summary of the findings and recommendations for vector control recommendations.

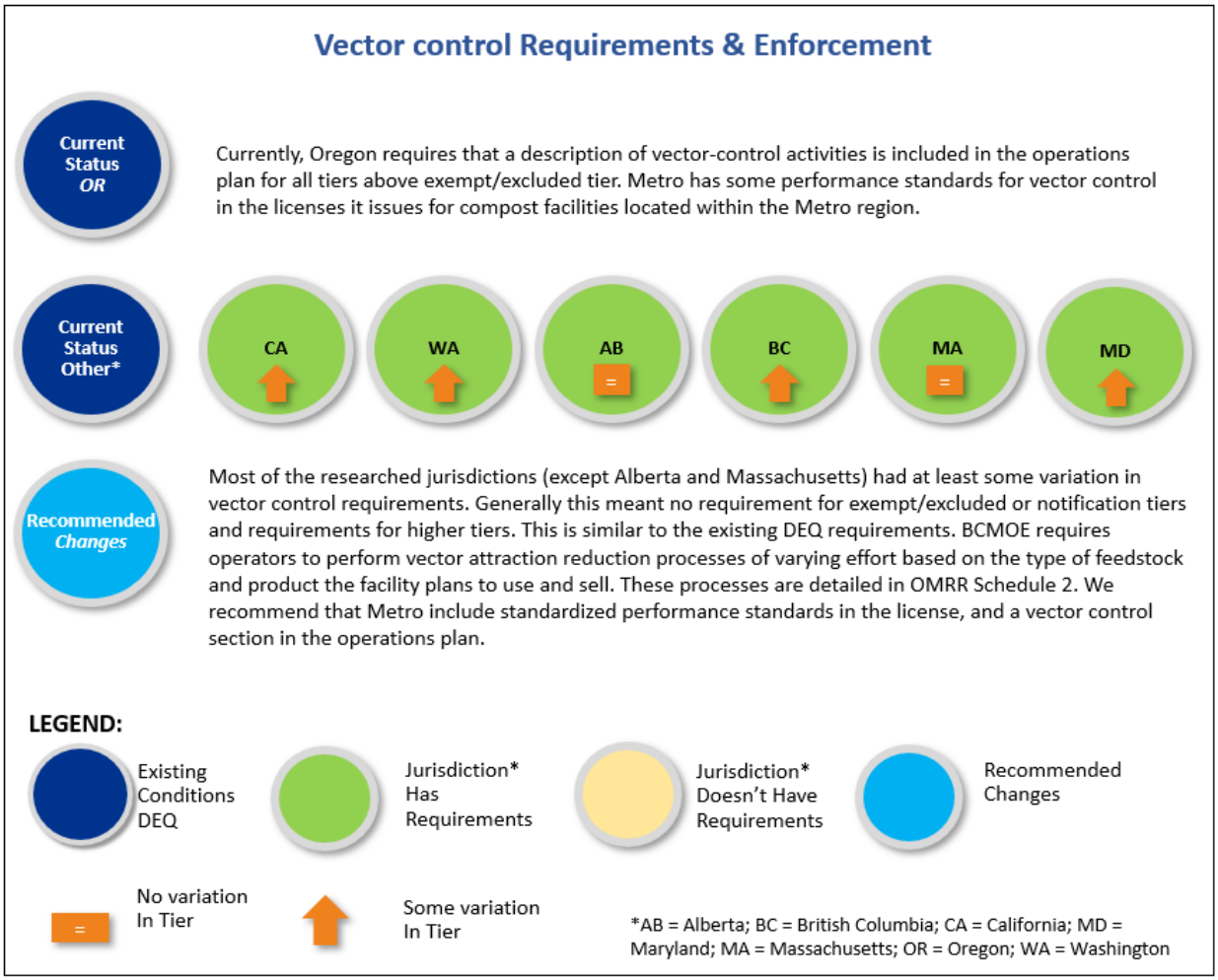

Figure 1-8. Vector Control Requirements and Enforcement

We recommend the following elements, as summarized by tier in Table 1-16, for vector control requirements and enforcement, to supplement the existing ODEQ requirements.

Table 1-16. Recommendations for Vector Control Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit	• Include vector management plan in operations plan	• Enforce performance standards and initiate corrective action as issues arise • Standardized performance standards and operation plan
Poses Potential Risk / Individual Composting Facility Permit	• Include vector management plan in operations plan	• Enforce performance standards and initiate corrective action as issues arise

Table 1-16. Recommendations for Vector Control Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
		• Standardized performance standards and operation plan

N/A = not applicable

As shown in Table 1-16, we do not recommend any variation by tier. Additional details of the requirements are discussed below:

- Use standardized performance standards.
- Require preparation and submittal of a vector control plan in the operations plan. Enforce vector control as a performance standard using progressive enforcement procedures and initiate corrective actions as incidents arise (see Appendix C).

1-3.7.2.3 Level of Effort

- Development cost and effort of a vector control plan is minimal to operator.
- Review cost for Metro is minimal. Metro can review as part of the permitting process and a vector control section or plan should be no more than 1-3 pages. Cost of permit review should be covered by the applicant.

1-3.8 Compost Leachate, Groundwater, and Stormwater Management

Compost facilities generate various water streams (contact water, stormwater, and leachate) that require varying collection and disposal. Groundwater monitoring is a relatively new practice required by a number of districts. These regulations and requirements will be reviewed to determine if similar regulations make sense for Metro facilities.

1-3.8.1 Research and Interview Summaries

Table 1-17 provides a summary of the compost leachate, groundwater, and stormwater management interview participants and other sources by jurisdiction.

Table 1-17. Compost Leachate, Groundwater, and Stormwater Management Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Randy Bailey
State of California - CalRecycle and California State Water Resources Control Board (SWRCB)	Ken Decio, CalRecycle Brianna St. Pierre and Ember Christensen, SWRCB
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei

In addition to the jurisdictions shown in Table 1-17, Massachusetts Department of Environmental Protection (Mass DEP), British Columbia Ministry of the Environment (BCMOE), and Maryland Department of Environmental Protection (Maryland DEP) were also researched, although no interviews were conducted. Summaries of each of the researched jurisdictions are included in the following subsections.

Stormwater at compost facilities in Oregon, Washington and California are regulated under the NPDES stormwater permits administered in those states. These programs are already robust and are part of an intensely managed program. The leachate management and groundwater regulations for Oregon, Washington, California, and Alberta, Canada all differ and warrant comparison.

1-3.8.1.1 State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - ODEQ requires that facilities submit to a screening process prior to permitting to determine the level of risk the facility poses to human health and the environment, specifically odors, groundwater and stormwater. Facilities deemed to pose a potential risk for surface and groundwater will be required to implement an NPDES stormwater permit, stormwater pollution control plan, and groundwater protection measures identified in Table 1-18.
- **Randy Bailey – Oregon Department of Environmental Health**
  - Mr. Bailey confirmed that leachate and groundwater management requirements are established as part of the screening and permitting process for poses potential risk facilities.

1-3.8.1.2 State of California

- **CalRecycle and California State Water Quality Control Board**
  - California State Water Resources Control Board (SWRCB) exempts facilities from permitting if they will process less than 5,000 tons per year of any feedstock. Above this threshold, facilities are required to implement the leachate and groundwater protection summarized in Table 1-18. California implements a 2 tier system Tier 1 is defined as a facility that has less than 25,000 cubic yards on site at any one time and only accepts Tier 1 feedstocks which includes agriculture, green, paper, vegetative food, anaerobic digestate derived from Tier 1 feedstocks, and residentially co-collected or self-hauled food and green materials. Tier 2 requirements need to be implemented when a facility is designed to have more than 25,000 cubic yards on site at any one time or the facility accepts more than 5,000 tons per year of Tier 2 feedstocks which include non-vegetative food, biosolids, manure, anaerobic digestate derived from allowable Tier 2 feedstocks, and a combination of Tier 1 and Tier 2 feedstocks.
- **Brianna St. Pierre and Ember Christensen - California State Water Resources Control Board**
  - Brianna St. Pierre and Ember Christensen of the SWRCB were interviewed for this project and confirmed that the 25,000 cubic yard requirement referred to material on site at any one time.

1-3.8.1.3 State of Washington

- **Washington Department of the Ecology (WDOE)**
  - WDOE requires that all facilities implement leachate controls and groundwater protections. Requirements are summarized in Table 1-18.
- **Mary Harrington and Dawn Marie Maurer – Washington Department of Ecology**
  - During the interview Ms. Maurer confirmed that compost processing pads are required to be constructed of concrete or asphalt and must meet permeability requirements and alternatives may be approved. She also confirmed that the pond must be sized to meet a 25 year/24-hour storm event and that facilities are responsible for ensuring the pond does not overflow even if a storm exceeds the design capacity. Ms. Maurer also confirmed that there are no sampling requirements if a standard liner and pad are installed. Sampling may be required in the case that an alternative is approved.

1-3.8.1.4 Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**

  - The Code of Practice for Compost Facilities applies to facilities that process under 20,000 tonnes per year. Facilities that process more than 20,000 tonnes per year are issued a site-specific Certificate of Operation. Based on review of the Code minimum requirements for compost facilities include, pad permeability, leachate controls and groundwater monitoring if certain criteria are met. These requirements are summarized in Table 1-18.

- **Natasha Page and Richard Adjei – Alberta Environment and Parks**
  - Natasha Page and Richard Adjei were interviewed as part of this project to gain an understanding of regulations and enforcement procedures and they confirmed that ponds must be sized to a 25 year/24-hour storm event. They also confirmed that clean, non-contact stormwater can leave the site clean if it tests as such. This is consistent with other jurisdictions in the United States that are regulated under an NPDES stormwater permit. It was also revealed during the interview that water should be tested for chlorine, nitrogen and pH. Further, if compost leachate was to leave the site boundary then compliance action would be likely.

1-3.8.1.5 State of Massachusetts

- **The Massachusetts Department of Environmental Protection (Mass DEP)**
  - Mass DEP requires that leachate controls are included in the facility design plan. Storm water is regulated under the NPDES program.

1-3.8.1.6 Province of British Columbia, Canada

- **British Columbia Ministry of the Environment (BCMOE)**
  - BCMOE requires operators to include leachate, groundwater and stormwater management in the facility design. The design plan must include leachate minimization, control, collection, treatment, and monitoring systems aimed at preventing ground and surface water contamination.

1-3.8.1.7 State of Maryland

- **The Maryland Department of Environmental Protection (Maryland DEP)**
  - Maryland DEP requires that all facilities implement leachate controls and groundwater protections. Requirements are summarized in Table 1-18. Stormwater regulation is subject to the Stormwater Associated with Industrial Activity General Discharge Permit."

Table 1-18 presents the different leachate and water management strategies for each jurisdiction.

Table 1-18. Comparison of Leachate and Wastewater Management Strategies in Select Jurisdictions

Area	ODEQ Strategies	Cal – SWRCB Strategies	WDOE Strategies	AEP Strategies	BCMOE Strategies
Water and Wastewater Management Plan	Leachate, stormwater and groundwater management included in operations plan	Water and Waste Water Management Plan required by the SWRCB for every facility	Leachate Management Plan	Part of design plan	
Tier Thresholds	Type 1 and 2 - <100 tpy Type 3 - <20 tpy Type 3 (in-vessel) - <40 tpy	Exempt: <5,000/yr Tier 1 Facility: <25,000 cy on site and Tier 1 Feedstocks Tier 2 Facility: >25,000 cy on site or Tier 2 Feedstocks	All facilities	<20,000 tpy	Tier 1 – Type 1 feedstocks only Tier 2 (small) – produces <10,000 cy of compost/yr of Type 1 and 2 feedstocks only Tier 2 (large) – produces >10,000 cy of compost/yr of Type 1 and 2 feedstocks only Tier 3 – Type 3 feedstocks (biosolids)
Pad Requirements	At least two (2) feet of compacted soil with a hydraulic conductivity of no more than 1x10-6 cm/sec or equivalent and damage resistant	All pads must be grade-to-drain and able to handle a 25yr/24hr storm. Pads at a tier 2 facility must have a hydraulic conductivity of no more than 1x10-5 cm/sec or equivalent	Must be concrete, asphaltic concrete or soil cement or other approved alternative	0.5 meters of clay soil with a permeability of $1X10^{-8}$, minimum 2 percent slope	Tier 1 – all weather, 1 to 6 percent slope, 2 to 4 inches from water table. Tier 2 (small) – Tier 1 requirements plus, 6-inch carbon substrate under piles, covered active piles. Tier 2 (large) – requires addition of low perm pad in active areas Tier 3 – Engineering plans and specifications must be submitted during permitting that described the measures to be taken to prevent or control groundwater and surface/stormwater pollution.
Drainage/Conveyance/ Storage Pond Requirements	System and pads must be free of ponding and must direct liquids from the compost facility to collection devices.	Conveyance systems and ponds must be able to withstand a 25yr/24hr storm event Tier 2 conveyance system must be constructed of $1x10^{-5}$ materials, pond must be lined ($1x10^{-6}$), a pan lysimeter is required under the pond liner, pond must be maintained above 1 mg/l of dissolved oxygen	All conveyance systems and ponds must be able to withstand a 25yr storm event. Ponds must be constructed with a liner >30-mil geomembrane or >60-mil if HDPE geomembrane, must maintain 18” of freeboard in the pond	Run-on and run-off controls required	Tier 1 – no requirements Tier 2 (small) – no requirements Tier 2 (large) – Contact water from feedstock and active areas must be contained and stored in a collection basin prior to reuse, transport off site or discharge. Containment must be sized to a 25 yr/24-hr storm, have a synthetic liner, $<10^{-7}$ permeability, >1 foot thick compacted clay. Tier 3 – Engineering plans and specifications must be submitted during permitting that described the measures to be taken to prevent or control groundwater and surface/stormwater pollution.
Leachate Sampling	Applicable if required by discharge permit	Quarterly inspections and leachate sampling	N/A	N/A	N/A

Table 1-18. Comparison of Leachate and Wastewater Management Strategies in Select Jurisdictions

Area	ODEQ Strategies	Cal – SWRCB Strategies	WDOE Strategies	AEP Strategies	BCMOE Strategies
		Tier 2 facility requires quarterly PL sampling as well			
Groundwater Monitoring	Applicable if requested from ODEQ as part of the permitting process	If Tier 2 requirement for a 1x10-5 pad cannot be met ground monitoring is required	N/A	If facility is not enclosed, exceeds 5000 tpy, low perm subgrade, or high water table	N/A
Citations and Sources	OAR 340-096-0070, 340-096-0090,	SWRCB General Order WQ 2015-0121-DWQ	WAC 173-350-220	Code of Practice for Compost Facilities	COMAR 26.04
Interview Participants	Randy Bailey	Brianna St. Pierre and Ember Christensen	Mary Harrington and Dawn Marie Maurer	Natasha Page and Richard Adjei	Tariq Masood

1-3.8.2 Findings, Recommendations, and Level of Effort

1-3.8.2.1 Findings

- As stated above, ODEQ performs a facility screening process as part of permitting for facilities that exceed extremely low annual thresholds assuring virtually all commercial compost facilities will be screened prior to beginning operation.
- The ODEQ groundwater protection requirements such as pad thickness and permeability requirements exceed those in California and Washington. So additional measures are not recommended based on the research findings.
- California, Washington, Maryland and jurisdictions in Canada have developed a 25 year/24-hour storm event pond design requirement. This is intended to safeguard against overflows and discharges from the facility by sizing the retention basins large enough that a normal rain event would not overwhelm the basins. As noted above however, a discharge from a properly designed pond would still result in enforcement action.
- If, through the course of Metro inspections, evidence is found that a facility deemed low risk for stormwater or groundwater is causing environmental harm then Metro needs to have a means to remedy the cause.

1-3.8.2.2 Recommendations

Figure 1-9 provides a summary of the findings and recommendations for compost leachate, groundwater, and stormwater requirements and enforcement.

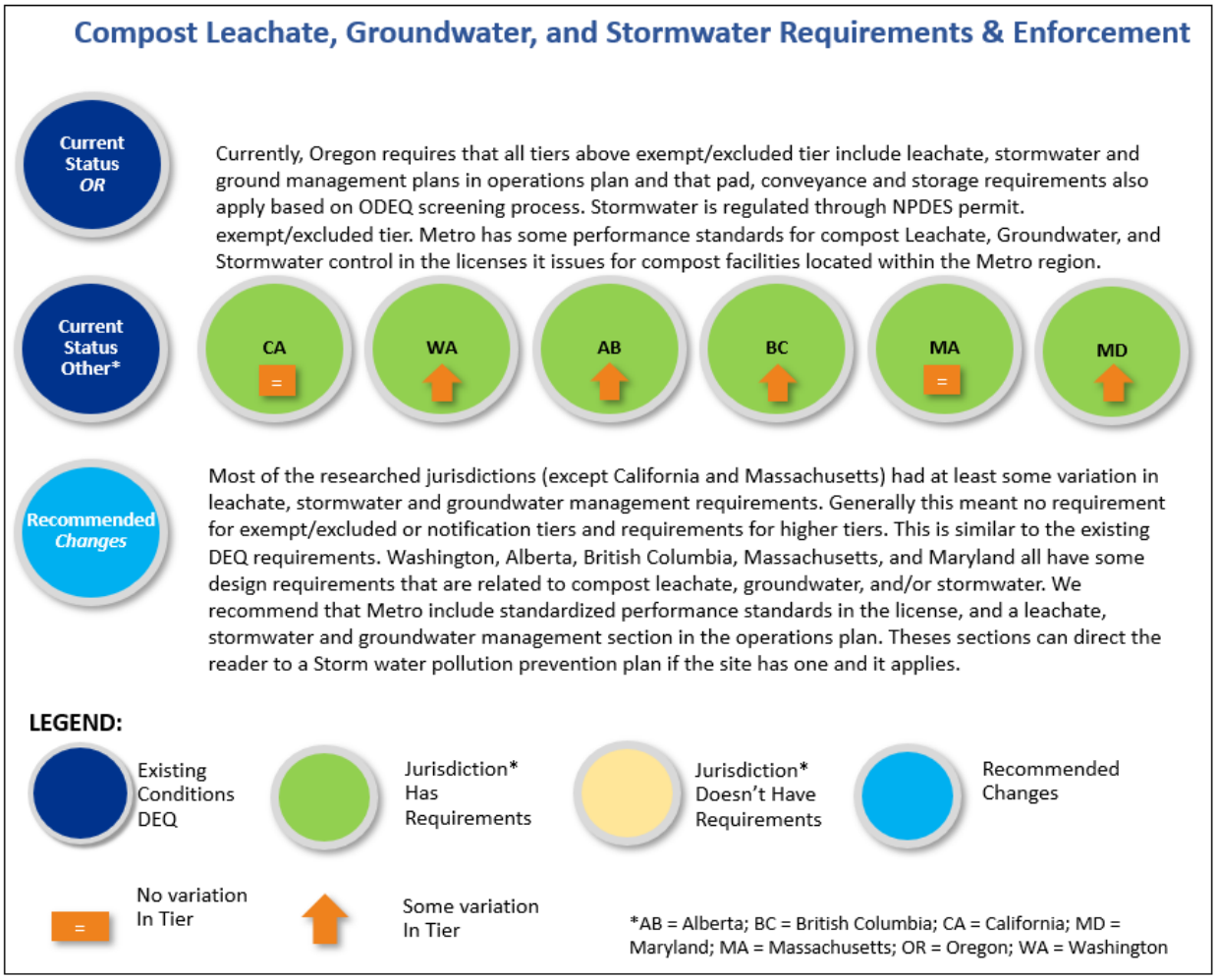

Figure 1-9. Compost Leachate, Groundwater, and Stormwater Requirements and Enforcement

We recommend the following elements, as summarized by tier in Table 1-19, for compost leachate, groundwater, and stormwater requirements and enforcement, to supplement the existing ODEQ requirements.

Table 1-19. Recommendations for Compost Leachate, Groundwater, and Stormwater Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit	• Manage facility performance	• Enforce performance standards and initiate corrective action as issues arise • Standardized performance standards and operation plan • Develop formal Metro/ODEQ reporting protocol for Water/Leachate impacts

Table 1-19. Recommendations for Compost Leachate, Groundwater, and Stormwater Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
		• Determine a minimum pond sizing requirement
Poses Potential Risk / Individual Composting Facility Permit	• Implement ODEQ ground water and storm water protection requirements	• Enforce performance standards and initiate corrective action as issues arise • Standardized performance standards and operation plan • Develop formal Metro/ODEQ reporting protocol for Water/Leachate impacts • Determine a minimum pond sizing requirement

N/A = not applicable
ODEQ = Oregon Department of Environmental Quality

As shown in Table 1-19, we do not recommend variation by tier. Additional details of the requirements are discussed below:

- Review report from the ODEQ facility permitting and screening process. Based on research, Oregon already has one of the most protective programs for water.
- Consider developing a pond sizing or design requirement.
- Develop formal reporting protocol for water/leachate impacts.

1-3.8.2.3 Level of Effort

- There will be little to no effort on the part of Metro to follow the current tier and screening process.
- Based on the research findings of this project it appears that industry standard is to build retention basins and structures to meet a 25 year/24-hour storm event. Implementing a new rule of this nature would require Metro to go through its formal rulemaking process and would likely require stakeholder workshops and a public input process.
- Compiling evidence and submitting a request to ODEQ to request a facility be re-screened has a relatively low level of effort.

1-3.9 Throughput Capacity and Process Design Requirements

Understanding a site's throughput capacity and process design can help determine what a site is capable of handling and when an upset condition has occurred.

1-3.9.1 Research and Interview Summaries

Table 1-20 provides a summary of the throughput capacity and process design requirement interview participants by jurisdiction.

Table 1-20. Throughput Capacity and Process Design Requirement Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Bob Barrows

Table 1-20. Throughput Capacity and Process Design Requirement Interview Participants

Jurisdiction	Interview Participants
State of California - CalRecycle and California State Water Resources Control Board (SWRCB)	Ken Decio, CalRecycle Brianna St. Pierre and Ember Christensen, SWRCB
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei
Maryland Department of Environmental Protection (Maryland DEP)	Tariq Masood

In addition to the jurisdictions shown in Table 1-20, Massachusetts Department of Environmental Protection (Mass DEP) and British Columbia Ministry of the Environment (BCMOE) were also researched, although no interviews were conducted. Summaries of each of the researched jurisdictions are included in the following subsections.

1-3.9.1.1 State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - ODEQ regulates design requirements under the Oregon Administrative Rules (OAR) Section 340-096. The OAR requires leachate structures are designed by an engineer and receive an engineering review prior to approval. Research did not uncover a requirement to prepare a throughput design or incoming tonnage capacity design to demonstrate the ability of the facility to handle the expected amount of feedstock neither does this limit the amount that can be brought to the facility after approval.
- **Bob Barrows – Oregon Department of Environmental Quality**
  - Mr. Barrows confirmed that developing and submitting an engineered throughput and capacity design is not currently required by ODEQ regulations.

1-3.9.1.2 State of California

- **CalRecycle**
  - Facility design in California is regulated by CalRecycle following regulations in Title 14 CCR Section 17866. These regulations require that a compost operator obtain prior to the permitting phase a design that considers design advice from competent engineering architecture, landscape design, traffic engineering, air quality control, and structural design experts, as necessary. The design will also consider the engineering principles and disciplines of the State of California for this type of facility, feedstock nature, quantity, and type, facility location, climate, adjacent land use, traffic impacts, air impacts, drainage control and ability to process the expected amount of feedstock given the size of the facility. Other factors will also include pile sizes and time in process.
- **Ken Decio – CalRecycle**
  - Enforcement of these regulations is carried out in most cases by an LEA inspector who inspects site operations and compares what is happening at the facility to the design plan. Progressive enforcement would be implemented in instances of non-compliance.

1-3.9.1.3 State of Washington

- **Washington Department of the Ecology (WDOE)**
  - WDOE requires that all facilities develop and submit a compost facility design and throughput report. This report must consider the aerobic decomposition of feedstocks and it must include

engineered calculations, plans, drawings, aeration design and emission controls. The design report must be prepared by an engineer registered with the State of Washington.

- **Dawn Marie Maurer – Washington Department of Ecology**
  - During the interview Ms. Maurer confirmed these regulations for design and throughput adding that the design must be approved prior to the commencement of composting activities. Non-compliance is handled by progressive enforcement from a failing site inspection to possible NOV issuance and further if necessary. Design plan changes may be required if compliance cannot be achieved.

1-3.9.1.4 Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**
  - AEP requires the submittal of a design plan as part of the permitting process. This design must consider operating capacity of the facility and the ability of the facility to process and store organics. The design must also consider what structures and equipment are required to for compost processing and for emissions, leachate management, and odor controls.
- **Natasha Page and Richard Adjei – Alberta Environment and Parks**
  - Natasha Page and Richard Adjei of AEP confirmed that the facility must have a maximum capacity and that must be backed up by science and engineering. Non-compliance is handled by progressive enforcement from a failing site inspection to possible NOV issuance and further if necessary. Design plan changes may be required if compliance cannot be achieved.

1-3.9.1.5 State of Massachusetts

- **The Massachusetts Department of Environmental Protection (Mass DEP)**
  - Mass DEP regulates facility design under 310 CMR 16.00. As a general permit requirement, Mass DEP requires the operator to submit a design as part of the permit application. Additionally, “All forms, plans, and other papers pertaining to design and construction of an operation to be permitted pursuant to 310 CMR 16.05, shall be completed under the supervision of a Massachusetts registered professional engineer knowledgeable about the proposed technology, design and construction and shall bear the seal, signature and discipline of said engineer. Any other form, plan or paper shall be completed by a competent professional experienced in the appropriate field.”

1-3.9.1.6 Province of British Columbia, Canada

- **British Columbia Ministry of the Environment (BCMOE)**
  - BCMOE requires the preparation and submittal of a facility design plan as part of the permitting process. The design plan must be prepared by a Qualified Professional as defined in the OMRR.

1-3.9.1.7 State of Maryland

- **The Maryland Department of Environmental Protection (Maryland DEP)**
  - Maryland DEP regulates facility design under COMAR 26.04.11. As a general permit requirement, Mass DEP requires the operator to submit a Composting Facility Operations Plan (CFOP). The two types of permits offered are “Individual Permit” And “General Permit”.
  - There are no formal limits on throughput, however certain space limits can trigger exemptions from permitting. Farm facilities exempt if using 40,000 square feet or less in support of composting operations and only use Type 1 feedstocks as well as any feedstocks generated onsite. Non-farm facilities exempt if using 5,000 square feet or less in support of composting operations.

1-3.9.2 Findings, Recommendations, and Level of Effort

1-3.9.2.1 Findings

- Submitting an engineered process design and throughput report is consistent with industry standard based on the research findings for this project (OR, CA, WA, AB, BC, MA, MD).
- An engineered process design and throughput report would allow Metro to develop maximum daily and annual tonnage limits that are reflective of the specific site conditions. These limits provide Metro inspectors with a tool for measuring compliance. By reviewing tonnage records Metro inspectors can quickly see if a facility is out of compliance with daily limits and if that facility is on pace to exceed annual limits.
- Limiting tonnage to an engineered design and throughout capacity prevents acceptance of materials above a facility's realistic processing capacity.
- The engineered process design requires facilities to state pile size parameters and processing times. This provides Metro inspectors with another tool for measuring compliance.
- Using the tools mentioned above, Metro inspectors would have the ability to implement progressive enforcement if a facility does not comply with their design and throughput report.

1-3.9.2.2 Recommendations

Figure 1-10 provides a summary of the findings and recommendations for dust control recommendations.

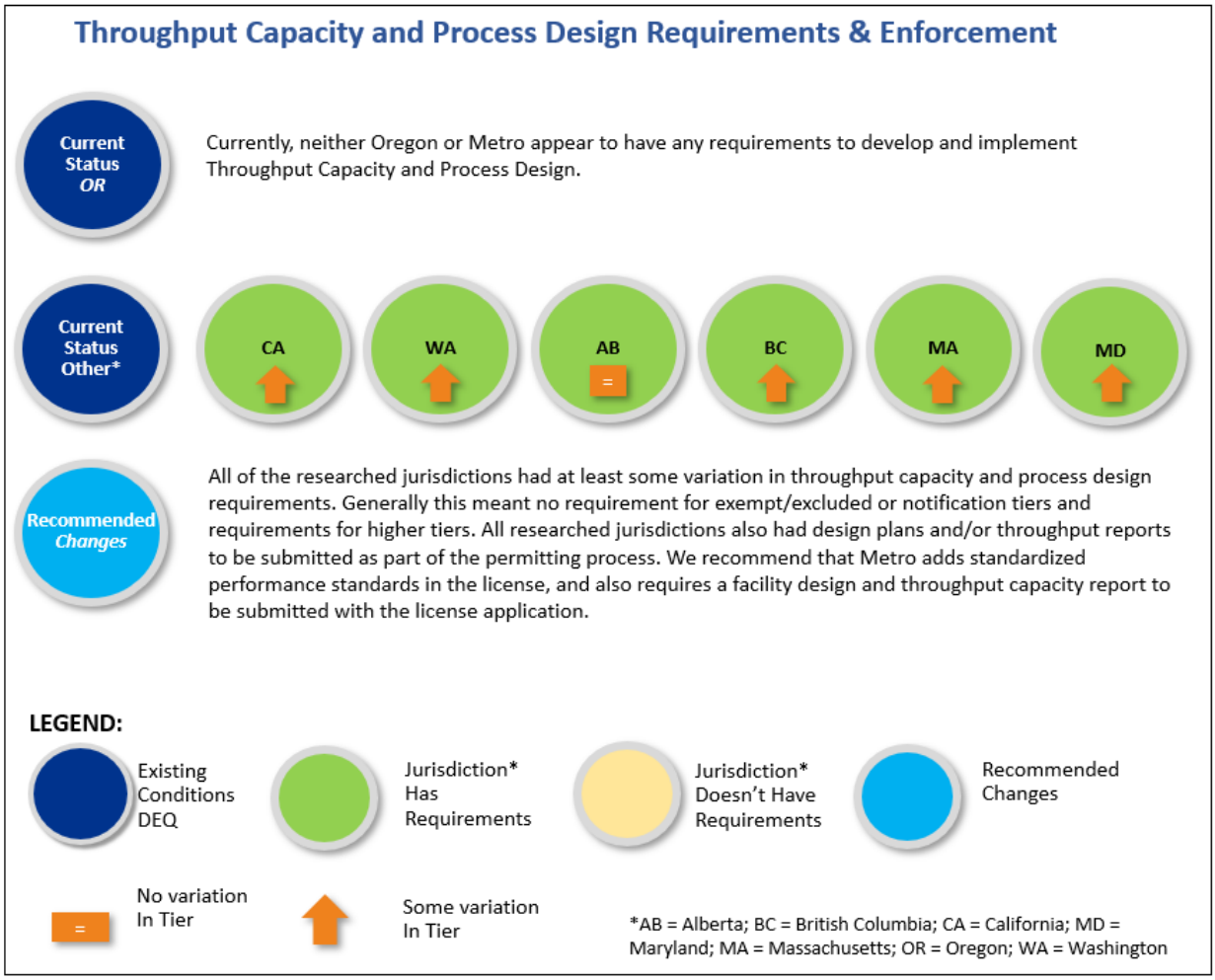

Figure 1-10. Throughput Capacity and Process Design Requirements and Enforcement

We recommend the following elements, as summarized by tier in Table 1-21, for throughput capacity and process design requirements and enforcement, to supplement the existing ODEQ requirements.

Table 1-21. Recommendations for Throughput Capacity and Process Design Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• N/A	• Enforce performance standards and initiate corrective action as issues arise
Low Risk / Registration Composting Facility Permit	• Create, submit, and implement throughput and capacity report/calculations	• Enforce performance standards and initiate corrective action as issues arise • Create facility specific tonnage or volume limits
Poses Potential Risk / Individual Composting Facility Permit	• Create, submit, and implement throughput and capacity report/calculations	• Enforce performance standards and initiate corrective action as issues arise • Create facility specific tonnage or volume limits

N/A = not applicable

As shown in Table 1-21, we do not recommend any variation by tier. Additional details of the requirements are discussed below:

- Create and implement facility design and throughput requirements for all facilities required to submit to the ODEQ screening process. This process should require input from industry experts and design and certification should be prepared by an appropriate professional engineer.

1-3.9.2.3 Level of Effort

- Implementing a new requirement of this nature would require Metro to go through its formal rulemaking type process and would likely require stakeholder workshops and a public input process. Level of effort for this recommendation would be significant as it exceeds current ODEQ requirements. Rulemaking process could take 6-12 months.
- Facilities in the Metro region would be required to spend a significant amount of effort and money to develop a facility design and throughput report. In some cases, this would also require the facility to update its operations to comply with the report causing additional effort. The compliance timeline for existing facilities should be carefully considered.

1-3.10 Operations Equipment Exhaust

Operations equipment can generate exhaust, which can have impacts on the surrounding areas.

1-3.10.1 Research and Interview Summaries

Table 1-22 provides a summary of the operations equipment exhaust interview participants and other sources by jurisdiction.

Table 1-22. Operations Equipment Exhaust Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Internet Research
State of California - CalRecycle and California State Water Resources Control Board (SWRCB)	Ken Decio, CalRecycle Brianna St. Pierre and Ember Christensen, SWRCB
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei

In addition to the jurisdictions shown in Table 1-22, Massachusetts Department of Environmental Protection (Mass DEP), British Columbia Ministry of the Environment (BCMOE), and Maryland Department of Environmental Protection (Maryland DEP) were also researched, although no interviews were conducted. Summaries of each of the researched jurisdictions are included in the following subsections.

1-3.10.1.1State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - A review of Oregon and ODEQ regulations revealed that industrial equipment exhaust emissions at compost facilities are not regulated in the state.

1-3.10.1.2State of California

- **CalRecycle and California Air Resources Board**
  - California and Washington have developed very similar programs wherein source exhaust emissions are regulated differently based on regional air quality status, equipment usage (portable or stationary), engine exhaust data, after market emission control devices and myriad other factors. Both states typically regulate equipment exhaust and air quality parameters at the regional air board/district level. State air pollution regulations for California are found in Title 17 CCR. California also promulgated regulations on fleet averages requiring that company-wide equipment fleets of portable equipment must remain below specified thresholds for large fleets. Small fleets, equipment fleets with a total horsepower under 750, are required to follow a phase out schedule. These regulations can be found in California Airborne Toxic Control Measure 93116.
- **Ken Decio – CalRecycle**
  - Mr. Decio confirmed that exhaust emissions are enforced by the California Air Resources Board and the facility's local Air District.

1-3.10.1.3State of Washington

- **Washington Department of Ecology (WDOE)**
  - California and Washington have developed very similar programs wherein source exhaust emissions are regulated differently based on regional air quality status, equipment usage (portable or stationary), engine exhaust data, after market emission control devices and myriad other factors. Both states typically regulate equipment exhaust and air quality parameters at the regional air board/district level. State air pollution regulations for Washington are found in WAC 173-400.
- **Dawn Marie Maurer – Washington Department of Ecology**
  - During the interview Ms. Maurer confirmed that equipment exhaust emission requirements were not included in solid waste regulations.

1-3.10.1.4Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**
  - Alberta Environment and Parks does not regulate the emissions from equipment as confirmed by regulation review
- **Natasha Page and Richard Adjei – Alberta Environment and Parks**
  - Natasha Page and Richard Adjei confirmed that AEP does not regulate equipment exhaust emissions. However, they did state that AEP has developed a Green House Gas credit program that rewards operators for replacing or using equipment with low greenhouse gas emissions.

1-3.10.1.5State of Massachusetts

- **The Massachusetts Department of Environmental Protection (Mass DEP)**
  - Investigation did not reveal requirements to regulate equipment exhaust in the Mass DEP solid waste regulations.

1-3.10.1.6Province of British Columbia, Canada

- **British Columbia Ministry of the Environment (BCMOE)**
  - BCMOE requires the preparation of an Air Quality Control Plan as part of the operations plan. Equipment exhaust emissions must be addressed in the plan.

1-3.10.1.7State of Maryland

- **The Maryland Department of Environmental Protection (Maryland DEP)**
  - Maryland DEP requires that operators using equipment powered by an internal combustion engine with a bhp of 500 or greater obtain a Permit to Construct. This may include aeration systems, sorting systems, screens, grinders, shredders, dryers, and bagging equipment.

1-3.10.2 Findings, Recommendations, and Level of Effort

1-3.10.2.1Findings

- Both California and Washington regulate operations equipment exhaust at the state level. Keeping this at a state level makes sense. Otherwise Metro facilities at a huge disadvantage. Metro should wait for the state to take the lead.
- Significant time, cost, and effort would be required to build an emissions evaluation program like that in California and Washington. Additional cost, manpower, time and effort would be required to manage the program properly. This cost would be significant and could be evaluated further. The cost of compliance for operators would also be significant since one of the goals of these types of programs is to force an operator to replace an old piece of equipment with a similar piece of equipment that produces fewer emissions. The cost of new equipment ranges in the hundreds of thousands of dollars. The overall cost of compliance for the operator and cost of developing and managing a program for such a small sector of the Oregon compost market would likely not be worth the emission offsets gained. Further, this program would only impact the Metro sector of the Oregon compost industry putting Metro composters at a significant financial disadvantage.
- Significant time, cost and effort would be needed to create and administer a greenhouse gas credit program like that in Alberta, Canada. While the cost and level of effort for Metro would increase, the cost to operators would be high, but would be somewhat offset by the greenhouse gas credits.

1-3.10.2.2Recommendations

Figure 1-11 provides a summary of the findings and recommendations for dust control recommendations.

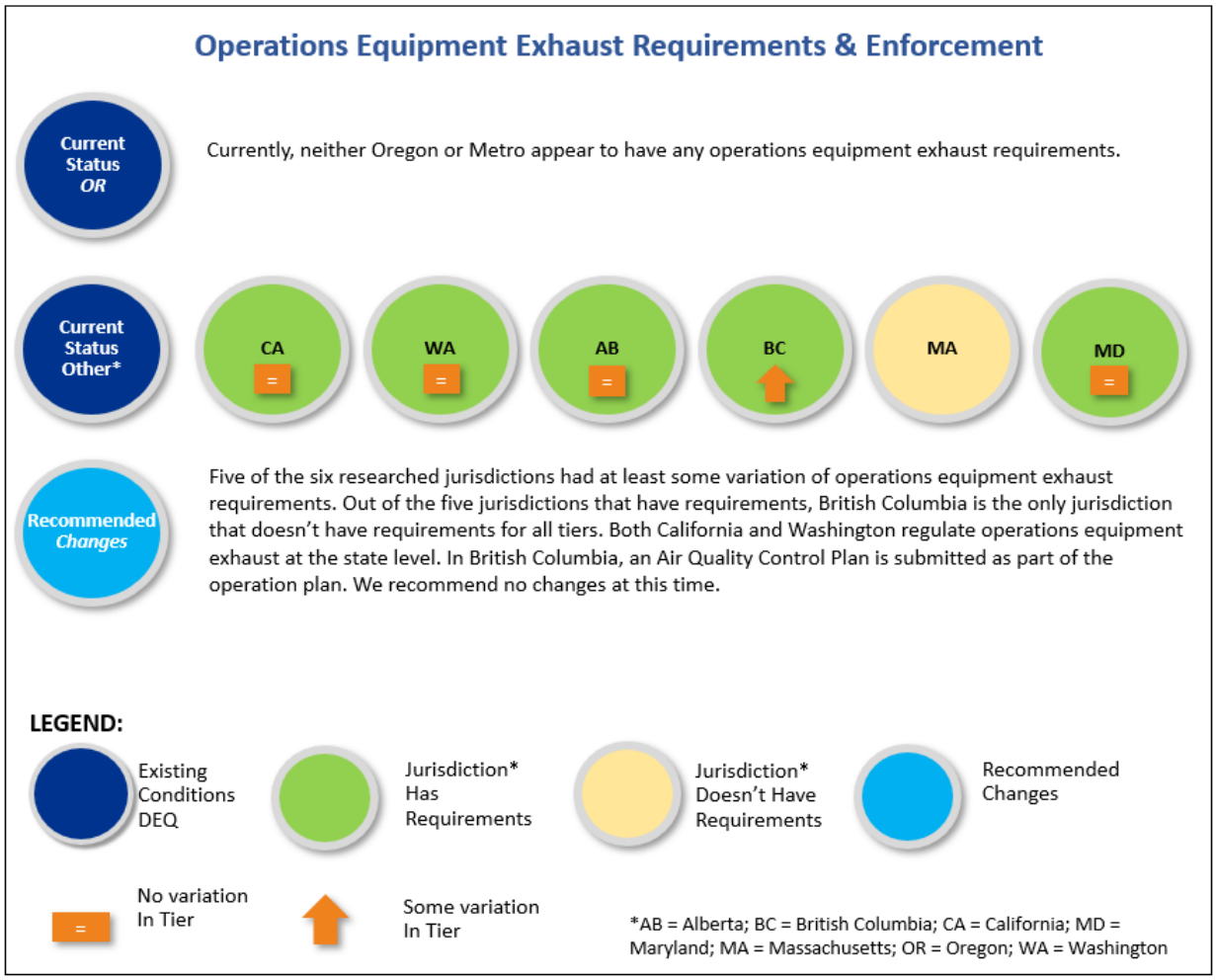

Figure 1-11. Operations Equipment Exhaust Requirements and Enforcement

We recommend the following elements, as summarized by tier in Table 1-23, for operations equipment exhaust requirements and enforcement, to supplement the existing ODEQ requirements.

Table 1-23. Recommendations for Operations Equipment Exhaust Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• No change is recommended	• No change is recommended
Low Risk / Registration Composting Facility Permit	• No change is recommended	• No change is recommended
Poses Potential Risk / Individual Composting Facility Permit	• No change is recommended	• No change is recommended

N/A = not applicable

No change or additional permitting is recommended based on the research findings.

1-3.10.2.3Level of Effort

Additional level of effort is not required.

Chapter 2. Standards for Compost Pile Mass

2-1. Introduction

2-1.1 Scope and Purpose

As discussed above, research for this project was divided into one main topic. The purpose of Topic 1B, Compost Pile Mass, is to research and evaluate options for regulating pile size at compost facilities with consideration of facility design and throughput regulations. Jacobs conducted internet research, interviewed five regionally-relevant contacts, and reviewed previously prepared reports, investigations, and other documents to gather information on existing pile size requirements. The research and findings are documented in the sections below.

2-1.2 Regulatory Context

The existing applicable ODEQ composting rules, Metro code requirements, and Oregon Fire Code (OFC) requirements are briefly summarized below to provide some context around the current requirements for pile size in the Metro region. For a summary of tier structure, general requirements and oversight mechanisms for compost facilities in the Metro region, refer to Topic 1A – Site Operation.

2-1.2.1 Oregon Administrative Rules

The Oregon Administrative Rules (OAR) do not establish specific height, width, or volume limits on compost pile sizes. However, OAR 340-096-0150, Special Rules Pertaining to Composting: Unacceptable Odors, states that Odor Minimization Plans should include "odor-minimizing measures, which may include" "Formation of windrow or other composting piles into a size and shape favorable to minimizing odors."[15] For ODEQ, the intent of this rule is to manage a pile size so as to prevent or reduce nuisance conditions such as odor.

2-1.2.2 Metro Requirements

Metro does not establish specific height, width, or volume limits on compost pile sizes. However, Metro-issued licenses include a section on fire prevention, in which "the licensee must provide fire prevention, protection, and control measures." This indirectly regulates pile size as management of compost pile sizes can prevent or reduce fires originating from compost piles within a facility.

Similarly, a section on odor within the license states that the "licensee must operate the facility in manner that prevents off-site malodors" and "must follow procedures in the operating plan for minimizing malodor at the facility." Again, this can be interpreted as indirect regulation towards pile size since one way to manage malodors is to manage compost pile size. Good management of compost piles may decrease the chances of anaerobic conditions, which in turn reduces odors.

Metro seeks to improve regulation of compost piles in order to address nuisance issues from compost facilities throughout their jurisdiction and has been gathering information to support this. In 2018, Metro contracted with Green Mountain Technologies, Inc (Green Mountain Technologies) to investigate Grimm's Fuel Company and assess its odor impacts to the community, as well as provide recommendations for improving the facility's processing capabilities. The results of Green Mountain Technologies' investigation are documented in the *Grimm's Fuel Company Compost Assessment*.[16] Grimm's Fuel Company had received numerous complaints from the community pertaining to odors and visual concerns from the height of compost piles. In particular, the assessment noted that 162 total odor-related complaints were logged during 2017 and 92 odor-related complaints over 22 days in February

[15] Oregon Administrative Rules. Chapter 340, Division 96, Rule 150, Special Rules Pertaining to Composting: Unacceptable Odors.
[16] Green Mountain Technologies, Inc. 2018. Metro – Grimm's Fuel Company Compost Assessment. Final. June 18.

2018 alone. Other notable findings were that neighbors were not only concerned with the characteristic of the odors, but were also concerned with the potential for odors to affect human health and the height and ability to see the compost piles. In the assessment, Green Mountain Technologies provided a number of recommendations to Grimm's Fuel Company and Metro, with the following recommendations related to compost pile size:

- Installation of an aerated static pile (ASP) system in order to improve processing and odor control.
- Limit compost piles to a maximum of 14 feet in height to minimize potential for combustion and to increase aeration potential.
- Implement a minimum biocover thickness of 12 inches with at least 50 percent moisture for the first 20 days of composting.

The Grimm's investigation ultimately informed new license conditions for Grimm's Fuel Company, which include switching to an ASP processing method by the deadlines listed in the license as well as a new operations plan that can satisfy both ODEQ and Metro requirements (as opposed to the two separate operations plans they had prior to the investigation). In addition, the revised license includes several parameters that differ from other existing facilities. With respect to compost pile size, the following changes were incorporated into the Grimm's Fuel Company revised license:

- Fire Prevention requirements that reference pile size.
- A new section on Performance Requirements that has subsections for: composting method, pile size, cover material, bulk density, no disturbance of materials, aeration system, capture and treatment of air over processing equipment, oxygen monitoring, compost monitoring parameters, pathogen reduction, temperature monitoring, community engagement plan, and compost operator training.
- New sub-sections under the Operating Plan section including: ASP composting system implementation timeline, procedures for composting operations, procedures for pile maintenance, procedures for oxygen monitoring, procedures for pathogen reductions, procedures for temperature monitoring, and Odor Minimization Plan (in place of the procedures for odor prevention).
- By April 30, 2019, comply with pile size limitations of 25 feet height, 150 feet width, and 250 feet length for material stockpiles.
- By July 1, 2020, comply with pile size limitations of 14 feet height for material stockpiles subject to ASP composting.

2-1.2.3 Oregon Fire Code

The OFC appears to be the only ruling in Oregon that directly regulates compost pile size, although facilities can work with local fire districts to create site-specific exemptions. The intent of such regulation is to prevent or reduce the occurrence of fires originating from compost piles, as well as to ensure isolation of fires should one develop.

The most recent OFC (2019) was adopted on November 15, 2019. With this update to the OFC, Chapter 28, Section 2808, Storage and Processing of Wood Chips, Hogged Material, Fines, Compost, Solid Biomass Feedstock and Raw Product Associated with Yard Waste, Agro-industrial and Recycling Facilities, sets forth the following requirements for compost piles applicable to compost facilities:[17]

- Section 2808.3, Size of Piles:
  - Height, not to exceed 25 feet
  - Width, not to exceed 150 feet
  - Length, not to exceed 250 feet

[17] Oregon Fire Code. 2019. Section 2808, Storage and Processing of Wood Chips, Hogged Material, Fines, Compost, Solid Biomass Feedstock and Raw Product Associated with Yard Waste, Agro-industrial and Recycling Facilities. https://www.oregon.gov/osp/programs/sfm/Pages/Fire_Codes.aspx.

- Section 2808.4, Pile Separation (referencing “approved fire apparatus roads” in Section 503.2.1):
  - Piles shall be separated by an unobstructed width of not less than 20 feet (exclusive of shoulders) and unobstructed vertical clearance of not less than 13 feet and 6 inches.

In support of pile dimensions that may exceed those set forth in Section 2808, the 2019 OFC notes that the pile size can be increased with authorization from a fire code official, based on the fire protection plan and capabilities of the installed fire protection systems and features.

It should be noted that the maximum compost pile height, width, and length allowances remain unchanged from the 2014 OFC. [18]

2-2. Research, Findings, Recommendations, and Level of Effort for Compost Pile Mass Focus Area

This section describes the research performed and findings identified for compost pile sizes located within regionally relevant jurisdictions.

2-2.1 Researched Jurisdictions

Internet research and follow-up interviews were conducted for regionally relevant jurisdictions. Table 2-1 shows the contacts interviewed and the focus areas that were discussed within each jurisdiction.

Table 2-1. Jurisdictions Interviewed for Compost Pile Mass

Jurisdiction	Contact
State of Oregon (ODEQ)	Bob Barrows
Maryland Department of Environmental Protection (DEP)	Tariq Masood
Washington Department of Ecology (DOE)	Mary Harrington and Dawn Marie Maurer
State of California Department of Resources Recycling and Recovery (CalRecycle) and Ventura County Fire Protection District	Ken Decio, CalRecycle Larry Williams, Ventura County Fire Protection District
Alberta Environment and Parks (AEP)	Natasha Page and Richard Adjei

Additionally, internet research and review of documents was conducted for the following jurisdictions and businesses:

- Grimm’s Fuel Company
- Vermont Agency of Natural Resources
- O_2 Compost
- Feather River Organics
- Yuba County Department of Environmental Health

[18] Oregon Fire Code. 2014. Section 2808, Storage and Processing of Wood Chips, Hogged Material, Fines, Compost and Raw Product Associated with Yard Waste and Recycling Facilities. http://ecodes.biz/ecodes_support/free_resources/Oregon/14_Fire/14_PDFs/Chapter%2028%20-%20Lumber%20Yards%20and%20Woodworking%20Facilities.pdf.

2-2.2 Compost Pile Size

This section presents an overview and discussion of the requirements of the jurisdictions Jacobs researched.

2-2.2.1 Research and Interview Summaries

To investigate the use of tiers as a potential tool, the consulting team researched how tiers are applied within the jurisdictions and associated regulatory authorities of and in Oregon, California, Washington, Alberta, Maryland, and Vermont.

Outside of Oregon, pile size regulations were found for several purposes. Some jurisdictions set pile size limits to allow smaller facilities such as community gardens and nonprofits to be exempt from certain permitting requirements. Another purpose for regulating pile size is to reduce the risk of composting piles igniting fires and to limit the size and intensity of any fires that could be started from these facilities. Additionally, some sources recommend pile sizing to reduce odor and other nuisance concerns.

2-2.2.1.1 State of Oregon

- **Oregon Department of Environmental Quality (ODEQ)**
  - ODEQ does not place specific pile size regulations on compost facilities, except for OAR 340-096-0150, Special Rules Pertaining to Composting: Unacceptable Odors, which states that Odor Minimization Plans should include "odor-minimizing measures, which may include" "Formation of windrow or other composting piles into a size and shape favorable to minimizing odors."[19]
  - ODEQ defers to the OFC for pile size regulations. OFC Chapter 28, Section 2808 states the following on pile size:[20]
    - Section 2808.3, Size of Piles:
      - Height, not to exceed 25 feet
      - Width, not to exceed 150 feet
      - Length, not to exceed 250 feet
    - Section 2808.4, Pile Separation (referencing "approved fire apparatus roads" in Section 503.2.1):
      - Piles shall be separated by an unobstructed width of not less than 20 feet (exclusive of shoulders) and unobstructed vertical clearance of not less than 13 feet and 6 inches

2-2.2.1.2 State of Maryland

- **Maryland Department of Environmental Protection (Maryland DEP)**
  - Mr. Masood explained that Maryland DEP asks facilities requesting permits to propose pile sizes to them and requires that they meet local fire code requirements (an internet search yields that many districts defer to the State of Maryland Fire Prevention Code, which adopts the National Fire Code stating "piles should not exceed 25 ft in height, 150 ft in width, and 250 ft in length"[21]). Maryland DEP exempts composting facilities from a compost facility permit if the facility does not use more than 5,000 square feet for composting and pile heights are less than 9 feet for raw feedstocks and 12 feet for active, curing, and finished compost piles.[22] This exemption is intended

[19] Oregon Administrative Rules. Chapter 340, Division 96, Rule 150, Special Rules Pertaining to Composting: Unacceptable Odors.

[20] Oregon Fire Code. 2019. Section 2808, Storage and Processing of Wood Chips, Hogged Material, Fines, Compost, Solid Biomass Feedstock and Raw Product Associated with Yard Waste, Agro-industrial and Recycling Facilities. https://www.oregon.gov/osp/programs/sfm/Pages/Fire_Codes.aspx.

[21] Code of Maryland Regulations. 2019. Title 29, Subtitle 6, Chapter 1, Section 8: National Fire Protection Association 1 Fire Code. http://mdrules.elaws.us/comar/29.06.01.08.

[22] Maryland Department of the Environment. 2015. Maryland's New Composting Facility Regulations: What Farmers Need to Know. December. https://mocofoodcouncil.org/wp-content/uploads/2015/08/Kaley-Laleker-and-Tariq-Masood-On-Farm-Composting.pdf.

to support smaller facilities such as farms, nonprofits, and community-level facilities. Maryland DEP has issued permits for 23 active commercial sites, eight of which are composting food scraps (a list of facilities was not provided).

- Maryland DEP only specifies pile sizes in order to determine the type of permit needed, but its regulation on pile size limits is more general. The following are excerpted from the Code of Maryland Regulations (COMAR):[23]
    - COMAR, Section 26.04.11.08: "The composting facility shall be of sufficient size to allow processing of materials as necessary to avoid nuisance conditions and shall have adequate space for material stockpiles, windrows, or piles of manageable dimensions for maintaining aerobic conditions, curing piles, staging of finished compost, and equipment."
    - COMAR, Section 26.04.11.08: "The maximum windrow or pile size and minimum windrow or pile spacing shall match the capability and requirements of the equipment used at the composting facility."
    - COMAR, Section 26.04.11.09: "Except for covered piles, a 6-inch layer of compost or carbon-rich material shall be placed over active composting piles by the end of the operating day on which they are formed and again after each time the piles are turned." This requirement is applicable to Tier 2 small facilities (receive 10,000 cubic yards or less of compost and only accept Type 1 and or 2 feedstocks) and is required to prevent odors and scavenging by vectors.

2-2.2.1.3 State of Washington

- **Washington Department of the Ecology (DOE)**
    - Like most states, Washington DOE does not directly limit pile size, but does state in their *Siting and Operating Composting Facilities in Washington State- Good Management Practices* publication that local fire codes may have their own limitations on pile sizes (possibly below heights of 14 feet) regardless of feedstock types or composting technologies. A web search of local fire codes limiting pile sizes resulted in references to the State of Washington Fire Code, which adopts the 2015 International Fire Code and enforces pile size dimensions of 25 feet in height, 150 feet width, and 250 feet length.[24]
    - To control odors, *Siting and Operating Composting Facilities in Washington State- Good Management Practices* additionally recommends piles of 10 feet high or less if managing "high volumes of smelly, wet feedstocks."[25] It is presumed that this height recommendation is made to manage odors.

2-2.2.1.4 State of California

- **California Department of Resources Recycling and Recovery (CalRecycle)**
    - CalRecycle does not limit pile size but requires that facilities meet California state fire code as well as local fire requirements. California state fire code limits piles to 250 feet long, 150 feet wide, and 25 feet tall. As part of the standard Report of Composting Site Information (operations plan), operators are required to submit a Fire Prevention Plan that includes maximum pile size recommendations reviewed by CalRecycle, the Local Enforcement Agency, and the local fire department. The operations plan must provide a description of the composting process and design capacity. Typical pile sizes are included in these descriptions as well.
    - CalRecycle's webpage on composting provides guidance on onsite and offsite composting. With respect to pile size, CalRecycle states (although does not regulate) that "with the right combination of ingredients and weather conditions, the danger of spontaneous combustion is

[23] Code of Maryland Regulations. 2019. Title 26, Subtitle 4, Section 11: Composting Facilities. http://mdrules.elaws.us/comar/26.04.11.

[24] International Code Council. 2015. International Fire Code. http://sfmd.az.gov/documents/2016/03/2015-ifc.pdf/.

[25] Department of Ecology, State of Washington. 2013. Siting and Operating Composting Facilities in Washington State, Good Management Practices, Publication No. 11-07-005. July. https://fortress.wa.gov/ecy/publications/publications/1107005.pdf.

very real if compost piles are allowed to stack much over ten feet high." This is qualified by larger size piles allowing heat to build up to approximately 170 degrees Fahrenheit, at which point a reaction could take place and result in fire.[26]

- **Ventura County Fire Protection District**
  - The interview with Mr. Larry Williams revealed that Ventura County has experienced multiple catastrophic fires that motivated their limits on pile size. As the author of the standard, Mr. Williams explained that his team researched other counties in California to understand their limits for pile size and were not able to find other counties that actively imposed restrictions on the volume or dimensions of piles. Ventura County proceeded to analyze available data on past fire events throughout the county and determine the size that they considered to be higher risk because of the high internal temperature that could result. They also looked at the size in which a pile becomes more difficult to extinguish should it catch fire. The conclusions of this research led to limiting the maximum size of piles to 1,500 cubic yards with a maximum height of 12 feet, length of 150 feet, and width of 25 feet.[27] There are also smaller size and height limits for facilities with under 200 cubic yards of material. Mr. Williams mentioned hearing that other Southern California counties may soon implement restrictions on pile sizes since they have also experienced recent fires that had compost facilities reported as the source.
  - Additionally, other related parameters are regulated such as pile-separation distances (minimum 15-foot access width between piles and 20-foot access width along perimeter and cross aisles), maximum grid of piles and rows (500 feet by 500 feet), separation from buildings and combustible vegetation (10 to 100 feet depending on area type), and tipping area size (50 feet by 50 feet, with maximum 5 feet material height). The Ventura County Fire Protection District also requires internal temperature monitoring to ensure the temperature never exceeds 160 degrees Fahrenheit for all piles over 6 feet in height.[28] Their standards were developed to mitigate the risks of fires within or spreading to or from composting operations as well as the risk to emergency responders and surrounding communities.

2-2.2.1.5 Province of Alberta, Canada

- **Alberta Environment and Parks (AEP)**
  - AEP does not directly regulate the size of compost piles, as was revealed in the interview with Ms. Natasha Page and Mr. Richard Adjei. During the interview, Ms. Page and Mr. Adjei explained that pile size is considered to be part of the facility capacity design submitted with the operations plan. They also stated that the maximum design capacity must be confirmed by science and engineering support. Design capacity and pile size requirements differ based on feedstock type and population density. Requirements for construction as well as components of the operations plan are provided in the *Standards for Composting Facilities in Alberta*[29] and the *Code of Practice for Compost Facilities*[30], although neither document cites specific compost pile sizing.

2-2.2.1.6 State of Vermont

- **Vermont Agency of Natural Resources Department of Environmental Conservation**

[26] CalRecycle. 2019. Composting. https://www.calrecycle.ca.gov/organics/landscaping/keepgreen/compost.

[27] Ventura County Fire Protection District, California. 2015. Standard 14.9.1, Composting, Mulch and Organic Processing (Ref: Ventura County Fire Code, Section 2808). February. http://www.vcfd.org/images/prevention/standards/14.9.1-Composting-Mulch-and-Organic-Processing.pdf.

[28] Ventura County Fire Protection District, California. 2015. Standard 14.9.1, Composting, Mulch and Organic Processing (Ref: Ventura County Fire Code, Section 2808). February. http://www.vcfd.org/images/prevention/standards/14.9.1-Composting-Mulch-and-Organic-Processing.pdf.

[29] Alberta Environment. 2007. Standards for Composting Facilities in Alberta. July. https://open.alberta.ca/dataset/b62eb735-0dfb-4e59-9aee-f5e73633734d/resource/b5e364a4-d1fb-498f-86a6-5a6a8ad0ec51/download/2007-standardscompostingfacilitiesalberta.pdf.

[30] Alberta Government. n.d. Code of Practice for Compost Facilities. http://www.qp.alberta.ca/1266.cfm?page=COMPOST.cfm&leg_type=Codes&isbncln=9780779793938.

- The Vermont Department of Environmental Conservation, Agency of Natural Resources does not regulate pile size. However, they do list recommendations on their website such as keeping piles to under 8 feet tall in order to avoid anaerobic conditions.[31]

2-2.2.1.7 Other Sources

- **Grimm's Fuel Company**
  - Grimm's Fuel Company is a composting facility within Metro's jurisdiction. In 2018, Metro contracted with Green Mountain Technologies, Inc (Green Mountain Technologies) to investigate Grimm's Fuel Company and assess its odor impacts to the community, as well as provide recommendations for improving the facility's processing capabilities. The results of Green Mountain Technologies' investigation are documented in *Grimm's Fuel Company Compost Assessment*.[32] Grimm's Fuel Company had received numerous complaints from the community pertaining to odors and visual concerns from the height of compost piles. In particular, the assessment noted that 162 total odor-related complaints were logged during 2017 and 92 odor-related complaints over 22 days in February 2018 alone. Other notable findings were that neighbors were not only concerned with the characteristic of the odors, but were also concerned with the potential for odors to affect their health and their ability to witness the height of the compost piles. [33]
  - The assessment mentions that "the first goal of any compost technology applied to this facility is that it must provide adequate aeration to maintain aerobic conditions" and that "to optimize aeration, minimize dispersion of odors, and minimize fire potential, [piles] will not exceed 12- to 14-feet in material height." [34]
  - Within the assessment, Green Mountain Technologies provided a number of recommendations to Grimm's Fuel Company and Metro, with the following recommendations related to compost pile size: [35]
    - Installation of an ASP system in order to improve processing and odor control
    - Limit compost piles to a maximum of 14 feet in height to minimize potential for combustion and to increase aeration potential
    - Implement a minimum biocover thickness of 12 inches with at least 50 percent moisture for the first 20 days of composting
  - As a result of the Grimm's investigation, Metro incorporated the following changes into the Grimm's Fuel Company revised license, with respect to pile sizing:
    - Fire Prevention requirements that reference pile size.
    - A new section on Performance Requirements that has subsections for: composting method, pile size, cover material, bulk density, no disturbance of materials, aeration system, capture and treatment of air over processing equipment, oxygen monitoring, compost monitoring parameters, pathogen reduction, temperature monitoring, community engagement plan, and compost operator training.
    - New sub-sections under the Operating Plan section including: ASP composting system implementation timeline, procedures for composting operations, procedures for pile maintenance, procedures for oxygen monitoring, procedures for pathogen reductions, procedures for temperature monitoring, and Odor Minimization Plan (in place of the procedures for odor prevention).

[31] Vermont Department of Environmental Conservation, Agency of Natural Resources. n.d. Compost Site Management, Monitoring Piles: Why and How. https://dec.vermont.gov/sites/dec/files/wmp/SolidWaste/Documents/ANR%20Compost%20Pile%20Monitoring%20Why%20and%20How.pdf.

[32] Green Mountain Technologies, Inc. 2018. Metro – Grimm's Fuel Company Compost Assessment. Final. June 18.

[33] Green Mountain Technologies, Inc. 2018. Metro – Grimm's Fuel Company Compost Assessment. Final. June 18.

[34] Green Mountain Technologies, Inc. 2018. Metro – Grimm's Fuel Company Compost Assessment. Final. June 18.

[35] Green Mountain Technologies, Inc. 2018. Metro – Grimm's Fuel Company Compost Assessment. Final. June 18.

  - By April 30, 2019, comply with pile size limitations of 25 feet height, 150 feet width, and 250 feet length for material stockpiles.
  - By July 1, 2020, comply with pile size limitations of 14 feet height for material stockpiles subject to ASP composting.

- **O_2 Compost**
  - O_2 Compost has presented on industry best practices for proper composting, which dictate a recommended maximum pile length of 75 to 80 feet and a maximum height of 6 to 12 feet for ASPs. No width recommendation is provided. These dimensions are cited to promote aeration, which help to "maintain aerobic conditions, mitigate impacts from objectionable odors, manage pile temperatures, reduce the loss of nutrients, expedite the rate of composting and curing, and produce superior compost products." [36]

- **Feather River Organics, Yuba County, California**
  - Information obtained through CalRecycle's Solid Waste Information System database revealed that Feather River Organics submitted pile size limits as part of the facility's fire prevention plan (Figure 2-1). Proposed pile sizes were reviewed and approved by the Yuba County Environmental Health Department, CalRecycle, and the local fire department. The pile sizes included in the *Feather River Organics Fire Prevention and Control Plan*[37] are presented in Figure 2-1, for reference. Other facilities in Solano County, San Joaquin County, and Yolo County were also identified to have followed the same procedure. Pile sizes at these facilities varied based on the composting process used and other factors but the maximum pile height proposed for active composting windrows/piles at these sites ranged from 10 to 15 feet.

Material Management Procedures								
Material	Maximum Stockpile Dimensions			Minimum Spacing		Minimum Inspection Frequency		Notes
	*Length	Width	Height	Between Piles	Perimeter	Visual Inspection	Temperature Probe	
**California Fire Code Regulations regarding Wood Chips and Compost	250'	150'	25'	Fire Dept. Access	N/A	N/A	N/A	N/A
Pre-PFRP Windrows	200'	40'	15'	10'	25'	Daily	***Weekly	See Page 3
PFRP Windrows	200'	20'	15'	10'	25'	Daily	Daily	See Page 3
Cure Piles	200'	50'	25'	10'	15'	Daily	***Weekly	See Page 3
Finished Screened Compost	200'	50'	25'	10'	15'	Daily	***Weekly	See Page 3
Overs and Processed Wood Waste	200'	50'	25'	10'	25'	Daily	Daily	See Page 3

**Fire control is not dependent on length of pile.*
***The California Fire Code, Section 3008.3, establishes these dimensions for pile size. FRO uses more conservative dimensions for material handling.*
****Sampled weekly or more often based on visual observation or during PFRP*

Figure 2-1. Pile Sizes, Excerpt from the Feather River Organics Fire Prevention Plan[38]

Table 2-2 summarizes the pile size information that was gathered as part of Topic 1B – Compost Pile Mass.

[36] O_2 Compost. 2014. Aerated Static Pile Composting. December. https://www.compostwerks.com/images/Compostwerks%2012-10-14%20Section%201%201.pdf.
[37] Feather River Organics. 2015. Fire Prevention and Control Plan, Feather River Organics. June.
[38] Feather River Organics. 2015. Fire Prevention and Control Plan, Feather River Organics. June.

Table 2-2. Specific Pile Size Information by Jurisdiction

Jurisdiction	General Requirements	Pile Height Limit	Pile Width Limit	Pile Length Limit
State of Oregon	ODEQ and Metro defer size regulation to state and local fire code.	State Fire Code: 25 feet	State Fire Code: 150 feet	State Fire Code: 250 feet
State of Maryland	Maryland DEP defers size regulation to state and local fire code, except to determine permit exemptions.	State Fire Code: 25 feet Per DEP, Tier 2 small facilities (less than 10,000 cubic yards) are exempt from permit with: • Raw feedstock: 9 feet • Active, Curing, and Finished Piles: 12 feet	State Fire Code: 150 feet	State Fire Code: 250 feet
State of Washington	Washington DOE defers size regulation to state and local fire code. Washington DOE provides recommendations on pile size.	State Fire Code: 25 feet *DOE Recommendations:* • *General: 14 feet* • *High volume of wet feedstock: 10 feet*	State Fire Code: 150 feet	State Fire Code: 250 feet
State of California	CalRecycle defers size regulation to state and local fire code, but pile size is negotiated by the operator and local enforcement agency although reasoning behind pile size determination is unknown.	State Fire Code: 25 feet May differ by location depending on local enforcement agency	State Fire Code: 150 feet May differ by location depending on local enforcement agency	State Fire Code: 250 feet May differ by location depending on local enforcement agency
	Ventura County Fire Protection District limits pile size based on aggregate amounts at the facility.	For an aggregate facility amount of 200 cubic yards or less: 6 feet For an aggregate facility amount over 200 cubic yards: 12 feet Within a tipping area: 5 feet	For an aggregate facility amount of 200 cubic yards or less: no limit For an aggregate facility amount over 200 cubic yards: 25 feet	For an aggregate facility amount of 200 cubic yards or less: no limit For an aggregate facility amount over 200 cubic yards: 150 feet

Table 2-2. Specific Pile Size Information by Jurisdiction

Jurisdiction	General Requirements	Pile Height Limit	Pile Width Limit	Pile Length Limit
Province of Alberta, Canada	AEP does not regulate pile size but requires the operations plan to include capacity design and pile size.	Not specifically listed	Not specifically listed	Not specifically listed
State of Vermont	Vermont Department of Environmental Conservation does not regulate pile size but provides recommendations to prevent anaerobic conditions.	*Recommendation: 8 feet*	Not specifically listed	Not specifically listed

Note: Italicized text indicate recommended limits; these limits are not regulated.

AEP = Alberta Environment and Parks

DEP = Department of Environmental Protection

DOE = Department of Ecology

ODEQ = Oregon Department of Environmental Quality

2-2.2.2 Findings, Recommendations, and Level of Effort

2-2.2.2.1 Findings

Research found that many jurisdictions defer to state or local fire code for regulatory limits on compost pile sizing. It did not appear that pile size limits were particularly dependent upon the composting process; that is, regulations did not distinguish between pile dimensions for different compost methods. This is likely due to the fact that many jurisdictions defer to state and local fire code for pile size dimensions, and these size regulations are driven by fire prevention rather than by nuisance concerns or compost process optimization. Jurisdictions and other sources that did suggest pile dimensions driven by nuisance concerns and/or compost process optimization generally recommended pile heights ranging from 6 to 14 feet (with O_2 Compost also recommending 75 to 80 feet in pile length). With nuisance and process concerns in mind, pile height is the size dimension most commonly specified since height increases the volume of the core, the area most susceptible to anaerobic conditions. Avoiding anaerobic conditions will help reduce odors, result in more favorable pile temperatures, and improve the quality of the compost.[39]

The Ventura County Fire Protection District in California has the most robust guidelines for limiting pile size and related metrics, including pile-separation distances (minimum 15-foot access width between piles and 20-foot access width along perimeter and cross aisles), maximum grid of piles and rows (500 feet by 500 feet), separation from buildings and combustible vegetation (10 to 100 feet depending on area type), and tipping area size (50 feet by 50 feet, with maximum 5-foot-tall piles). The Ventura County Fire Protection District also requires internal temperature monitoring to ensure the temperature never exceeds 160 degrees Fahrenheit for all piles over 6 feet in height. Their standards were developed to mitigate the risks of fires within or spreading to or from composting operations as well as the risk to emergency responders and surrounding communities.

2-2.2.2.2 Recommendations

Limits imposed by Metro would promote the safety of adjacent communities and land from the fire risk posed by oversized compost piles and stockpiled materials. Regulating pile size would also promote aerobic composting conditions, thereby minimizing odors from the active and curing stages of the compost process. Based on the research conducted, Jacobs provides the recommendations and associated level of effort in the sections below.

Figure 2-2 provides a summary of the findings and recommendations for compost pile size recommendations. Recommendations are summarized by tier in Table 2-3, for compost piling sizing requirements and enforcement, to supplement the existing ODEQ requirements.

[39] O_2 Compost. 2014. Aerated Static Pile Composting. December. https://www.compostwerks.com/images/Compostwerks%2012-10-14%20Section%201%201.pdf.

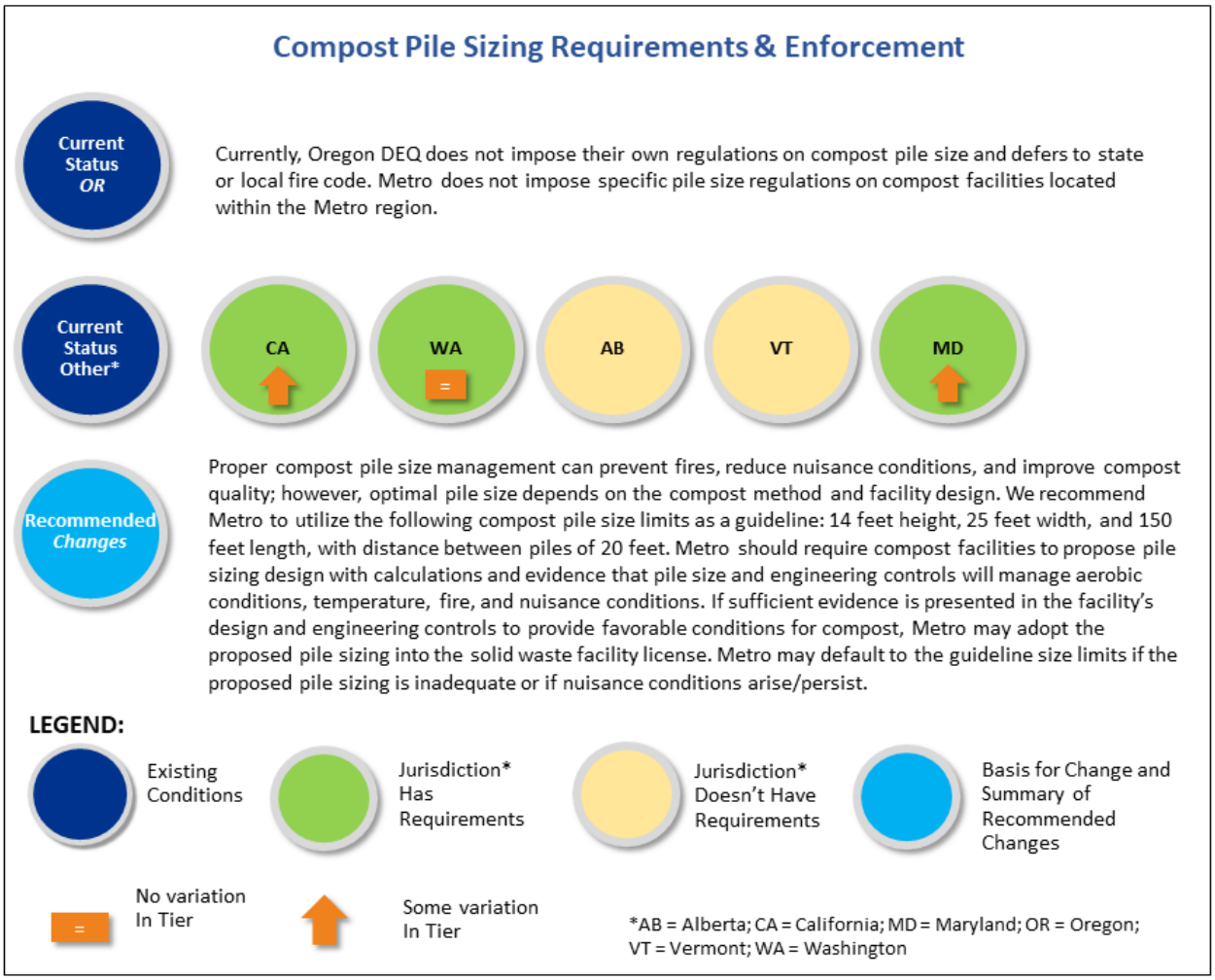

Figure 2-2. Compost Pile Size Requirements and Enforcement

Table 2-3. Recommendations for Compost Pile Size Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• Routinely monitor compost piles for evidence of fire, anaerobic conditions, and/or nuisance conditions	• Defer regulation of compost pile size to state and local fire code unless nuisance conditions develop • If nuisance conditions develop for a facility, regulate compost pile size as a "Low Risk" facility

Table 2-3. Recommendations for Compost Pile Size Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Low Risk / Registration Composting Facility Permit	• Develop and propose to Metro pile sizing design and engineering controls with evidence that support favorable aerobic conditions, temperature, fire prevention, and nuisance conditions • Comply with permit and license conditions	• Pile size must meet state and local fire code, at a minimum • Require compost facilities to propose pile sizing design and engineering controls with evidence that support favorable aerobic conditions, temperature, fire prevention, and nuisance conditions • Utilize the following compost pile sizing as a guideline: – Height – 14 feet – Width – 25 feet – Length – 150 feet – Distance between piles – 20 feet • Negotiate compost pile sizing with each facility based on compost system design and implementation of engineering controls, with the option to default to guideline sizing • Incorporate negotiated pile size limits into the license • Monitor facility for any fire or nuisance concerns related to pile size during routine inspections
Poses Potential Risk / Individual Composting Facility Permit	• Develop and propose to Metro pile sizing design and engineering controls with evidence that support favorable aerobic conditions, temperature, fire prevention, and nuisance conditions • Comply with permit and license conditions	

Requirement to Propose Pile Sizing

With respect to pile sizing, there is no “one size fits all” standard. Optimal pile sizing is dependent upon many conditions, including feedstock types, feedstock volumes, facility location, facility size, local weather, processing technology, proximity to neighbors, and other factors. For example, one facility may be able to sustain a higher pile height if it implements fire protection measures as well as odor controls, whereas another facility would not be able to sustain the same pile height because it lacks those very engineering controls.

Prior to issuance of the solid waste facility license, it is recommended that Metro require compost facilities to propose pile sizing design with calculations and evidence that pile size and engineering controls will manage aerobic conditions, temperature, fire, and nuisance conditions. Metro and the facility should negotiate pile sizing based on the design package and ongoing experience, and ultimately incorporate the final pile sizing dimensions as conditions within the license.

Negotiation is important in order to fully consider the impacts of pile sizing limits on the facility’s throughput and operations. Significant capital investment and/or operational changes at the facility may be required if Metro imposes limits that are difficult to accommodate.

This recommendation is consistent with the facility throughput recommendation in Topic 1A to “Create and implement facility design and throughput requirements for all facilities required to submit to the ODEQ screening process. This process should require input from industry experts and design and

certification should be prepared by an appropriate professional engineer." Additionally, several jurisdictions such as Maryland DEP, CalRecycle, and AEP follow a similar process of facilities proposing pile size limits for review by agencies.

Compost Pile Sizing Guidelines

Pile sizing shall be proposed by the compost facility; however Jacobs recommends to Metro the following limits as guidelines for compost pile sizing:

- Height limit – 14 feet
- Width limit – 25 feet
- Length limit – 150 feet
- Distance between piles – 20 feet

These limits are more stringent that the current OFC regulations to which ODEQ defers, except for the distance between piles – pile distance is equivalent to the OFC regulation. It should be noted that these specific pile size limits were selected because they have been implemented in regulations in other jurisdictions. Sources cited in research may recommend reduced size limits for compost piles, however they have not been written into regulations. To allow flexibility with conditions of the facility, the proposed pile limit guidelines are expected to be reasonable.

Jacobs does not recommend setting these limits as the standard for the region, but as guidelines during the pile sizing negotiation process (described in the previous section). If the proposed pile sizing is deemed to be inadequate, Metro can use these guidelines to develop more suitable pile sizing for the facility.

Basis for these sizing limits follow.

Pile Height

Based on findings from the Grimm's Fuel Company assessment, Green Mountain Technologies recommended a pile height limit of 14 feet (including biocover). This height was developed based on industry standards for ASP pile heights and is recommended in order to optimize aeration, reduce odor potential, reduce fire potential, and to limit the line-of-sight view from neighbors. [40] It should be noted that Ventura County Fire Protection District, the jurisdiction found to have the most robust guidelines during research, limits pile height to 12 feet in an effort to prevent fires. Ventura County has a somewhat different climate, but closely aligned population density to the Portland metropolitan area. The average rainfall in Portland is nearly double that of Ventura County, the average humidity is 12 percent higher, and temperature varies greatly (tending to be much colder). Consequently, material tends to dry out more quickly and more often in Ventura County. Metro facilities will likely see a short fire season, in comparison to Ventura County, which is likely susceptible to fires year-round. A pile height limit of 14 feet is more stringent than the OFC regulation of 25 feet.

Pile Width

A width limit of 25 feet is recommended, modeled after that which the Ventura County Fire District regulates. While instances of fires may not occur as often in Portland, when they do occur, piles should be sized appropriately to allow for safe fire-fighting. Piles between 25 and 30 feet wide can be more easily moved using a loader allowing the operator to isolate the material that is on fire. Piles of shorter width can also be more easily separated from other piles in the event of a fire. A pile width limit of 25 feet is more stringent than the OFC regulation of 150 feet.

[40] Green Mountain Technologies, Inc. 2018. Metro – Grimm's Fuel Company Compost Assessment. Final. June 18.

Pile Length

A length limit of 150 feet is recommended, modeled after that which the Ventura County Fire District regulates. The length of piles must also be considered for firefighting since navigating around a long pile (such as 800 feet) during a fire could pose a significant safety risk. A pile length limit of 150 feet is more stringent than the OFC regulation of 250 feet.

Distance Between Piles

A distance between piles of 20 feet is recommended, based on the OFC. The Ventura County Fire Protection District states 15 feet of distance, which would not comply with OFC. A pile-spacing requirement is important in order to prevent spread of fires to other piles.

Tier Recommendations

Following the tier structure consistent with ODEQ and as presented in Topic 1A – Site Operation, recommendations were separated into three tiers: Exempt, Low Risk/Registration Composting Facility Permit, and Poses Potential Risk/Individual Composting Facility Permit. For more information on how compost facilities are classified as Exempt, Low Risk, or Poses Potential Risk, refer to Topic 1A – Site Operation.

Table 2-3 provides a summary of recommendations per facility tier.

Exempt Tier

The Exempt tier encompasses compost facilities that are exempt from ODEQ's permitting requirements. For this tier, a lower amount of regulation is proposed:

- For operators:
  - Operators must routinely monitor compost piles for evidence of fire, anaerobic conditions, malodors, and vectors.
- For Metro:
  - Compost pile size regulation is deferred entirely to state and local fire code, unless excessive fire safety or nuisance concerns arise.
  - If fire safety or nuisance concerns develop and persist for a facility, this may indicate an opportunity for mitigation in the form of pile sizing limits. In such an event, Metro should consider regulating the compost piles as if the exempt facility were classified as a low risk facility.

Low Risk/Registration Composting Facility Permit Tier

The Low Risk tier encompasses compost facilities that require a Registration Composting Facility Permit. For this tier, the following regulation is proposed:

- For operators:
  - Develop and propose to Metro pile sizing design and engineering controls with evidence that support favorable aerobic conditions, temperature, fire prevention, and nuisance conditions.
  - Comply with permit and license conditions.
- For Metro:
  - Compost pile size must meet state and local fire code, at a minimum.
  - Prior to issuance of the solid waste facility license, require compost facilities to propose pile sizing design and engineering controls with evidence that support favorable aerobic conditions, temperature, fire prevention, and nuisance conditions. Pile sizing design must include

engineering support that piles are unlikely to spontaneously combust and that odors will be minimized.

- Use the proposed compost pile sizing (14 feet height, 25 feet width, 150 feet length, distance between piles of 20 feet) as guidelines to evaluate facilities' proposed pile sizing.
- Work with the facility to negotiate compost pile sizing in a manner that promotes a balance between facility throughput, facility operations, capital investments, feedstock projection in the region, fire and nuisance conditions, and compost quality.
- Once pile sizing for the facility is negotiated, incorporate the limits into the license and monitor the parameters of the permit during routine facility inspections.

Poses Potential Risk/Individual Composting Facility Permit Tier

The Poses Potential Risk tier encompasses compost facilities that require an Individual Composting Facility Permit. For this tier, proposed regulation is the same as for the Low Risk tier.

2-2.2.2.3 Level of Effort

The level of effort for Metro to implement these recommendations is moderate. Most of the recommendations can be worked into Metro's routine oversight, except for negotiation of the compost pile sizing with the facility. Metro could choose to develop a form template for proposed compost pile sizing and use this to standardize the process or let the facilities provide their own proposal formats. Review of any given proposal and any subsequent negotiation may take up to two months to set pile size limits in the license.

Chapter 3. Standards for Quality of Finished Compost

3-1. Introduction

3-1.1 Scope and Purpose

As discussed above, research for this project was divided into various topics. Topic 2 addresses regionally-relevant research and recommendations associated with the quality of finished compost. More specifically and as described in the Work Order for this project, how various jurisdictions have (or have not) included requirements for testing various indicators that help ensure, "the environmental and human health benefits of compost produced in the region."[41] Quality standards for the following focus areas were researched and evaluated by Jacobs on behalf of Metro:

- Metals
- Pathogens
- Testing Frequency
- Contamination
- Stability and Maturity
- Bioaerosols and Pesticides
- PFAS

Each of these focus areas were researched using a variety of methods including internet research and/or follow-up interviews with regionally-relevant contacts and review of previously prepared reports, investigations, and other documents. In addition, a handful of international standards were also reviewed to represent locations that have more advanced standards for the quality of finished compost. Additional details regarding the research performed and the resulting recommendations are discussed in the sections that follow.

3-1.2 Regulatory Context

The existing applicable ODEQ composting rules and Metro code requirements are briefly summarized below to provide some context around the current requirements for quality of finished compost in the Metro region. For a summary of tier structure, general requirements and oversight mechanisms for compost facilities in the Metro region, refer to Topic 1A – Site Operation.

3-1.2.1 Oregon Administrative Rules

As discussed in the deliverable for Topic 1A[42], Oregon Administrative Rules (OAR) Chapter 340 (Department of Environmental Quality [DEQ]), Divisions 93 (Solid Waste: General Provisions), 96 (Solid Waste: Special Rules for Selected Solid Waste Disposal Sites), and 97 (Solid Waste: Permit Fees) address the various requirements for permitting a compost facility in Oregon.[43] More specifically, OAR 340-096-0060, outlines the applicability of "Special Rules Pertaining to Composting", the performance standards that are required at all compost facilities in Oregon, and the permitting, design, and operational requirements of all non-exempt composting facilities (unless "the department determines the composting facility may adversely affect human health or the environment"). OAR 340-096-0070, describes the performance standards for addressing public health and the environment that all composting facilities (even exempt facilities) must follow. These performance standards set a base level of facility performance

[41] Metro 2019. Work Order. Compost Facility Standards Study. Revised November 2019.
[42] Jacobs. 2019. S*tandards for Site Operation – Topic 1A,* December 2019.
[43] Oregon Administrative Rules. Chapter 340, Department of Environmental Quality, https://oregon.public.law/rules/oar_chapter_340.

and provide ODEQ flexibility to exempt low-risk facilities from permitting requirements.[44] Permitted performance standards address:

- Protection of groundwater
- Proper management of stormwater, process water, leachate and liquid digestate
- Standards for pathogen reduction
- Odor minimization
- Prevention of vector propagation

Many of these performance standards were addressed in Topic 1A – Site Operation and Topic 1B – Compost Pile Mass. Topic 2 – Quality of Finished compost will specifically discuss pathogen reduction. Additionally, some of the focus areas in Topic 2 will discuss how they indirectly impact some of the other general performance standards.

Aside from the pathogen related requirements, the Oregon Administrative Rules (OAR) do not establish specific standards for the quality of finished compost.

3-1.2.2 Metro Requirements

Similar to ODEQ's performance standards, Metro Code section 5.01.090 requires that a facility operate in a manner that meets performance goals.[45] Performance goals for compost facilities include:

- Avoiding undue threats to the environment
- Avoiding conditions that may degrade public health and safety
- Avoiding nuisance conditions including, but not limited to, litter, dust, odors, and noise
- Maintaining complete and accurate records

Under the health and safety heading it is required that a facility is designed and operated to avoid conditions that may degrade public health and safety including, but not limited to, fires, vectors, pathogens and airborne debris. Research did not reveal performance standards for metals, sharps, contaminants, stability or maturity in the Metro Code. This is consistent with Oregon DEQ requirements.

Each facility must also have a Metro-approved operations plan which, amongst other things, addresses how the facility will meet the above performance goals.

It should be noted that there is currently some variation between the language and information that is included in existing licenses and operations plans.

A review of the Metro solid waste facility licenses for the five compost facilities in the region (at the time of this study) revealed that monitoring for pathogens, metals, sharps, contaminants, stability and maturity were not specifically addressed in the following four licenses: McFarlane's Bark, Inc., Sunderland Recycling Facility, S&H Cornelius, and Allwood Recyclers, Inc. However, all four of these facilities are listed in the USCC's STA Certified Compost Participants.[46] As discussed in the following subsection, STA Program, being a certified participant in this program means that these composters are voluntarily testing the quality of their finished compost using the suite of standards and methods required in the program.

The recently updated license for Grimm's Fuel Company, Inc requires in section 6.9 of the license, that the facility describe the method and frequency in which it will monitor compost for moisture content, temperature, oxygen content, retention time, and pile density in its operating plan. Section 6.9 of the license also requires that Grimm's describe in its operating plan the method and frequency in which it will monitor finished compost for nutrient balance, acidity (pH), stability, electrical conductivity, heavy metals,

[44] Oregon Department of Environmental Quality. n.d. Regulating Compost Facilities and Anaerobic Digesters. https://www.oregon.gov/deq/mm/swpermits/Pages/Composting-Regulations.aspx.

[45] Oregon Metro Code. Title V, Chapter 1, Section 90, License Contents. https://www.oregonmetro.gov/sites/default/files/2019/09/13/complete-Metro-Code-updated-20190911.pdf.

[46] USCC. 2019. STA Certified Compost Participants. December 2019. https://www.compostingcouncil.org/page/participants#OR

fecal coliform and salmonella, and carbon to nitrogen ratio. According to Mr. Will Ennis[47] with Metro these parameters were included in the Grimm's License to control and minimize odors, reduce fire risk, and increase the quality of finished product. Mr. Ennis stated that the requirements included in section 6.9 of the Grimm's license were recommended in the "Grimm's Fuel Company Composting Assessment" report dated June 18, 2018 rather than market driven. Many of the parameters required for finished compost in section 6.9 of the Grimm's license are also required as part of the US Composting Council's (USCC) Seal of Testing Assurance (STA) program, in which Grimm's was already voluntarily participating (and is on the USCC's STA Certified Compost Participants list[48]). All five compost facilities in the Metro region voluntarily participate in the STA program.

3-1.2.3 USCC STA Program

The USCC's STA program is an industry-recognized testing and assurance program that was created in 2000 to provide composters and purchasers with the information they need to determine if the compost they are producing or purchasing has the qualities they desire. As described in a USCC presentation prepared by Matt Cotton, the STA program was intended to result in the following:

- "To improve customer confidence in compost selection
- To enhance compost's position as a mainstream horticultural, agricultural and retail product
- To distinguish "compost" from other organics products"[49]

The STA program establishes uniform requirements and methodologies for testing compost. Prior to STA, there was a wide variety of test methods, units of measure, and laboratories that could be used. The STA program was developed by many of the "leading compost research scientists in the United States" and requires that participants have their compost tested for the following parameters, at sampling frequencies that are summarized below in Table 3-1, using the specific testing methods, and certified labs:[50,51]

- pH
- soluble salts
- nutrient content (total N, P_2O_5, K_2O, Ca, Mg)
- moisture content
- organic matter content
- bioassay (maturity)
- stability (respirometry)
- particle size (report only)
- pathogen (Fecal Coliform or Salmonella)
- trace metals (Part 503 regulated metals)

In addition, the STA program requires, "Any and all testing required by applicable State and/or Federal regulation (e.g., pathogens, heavy metals, pesticides, inerts, etc.) to assure public health/safety and environmental protection." [52] The required sampling frequency for STA participants is based on the annual volume of compost produced at each participating facility. The sampling frequency tiers are included in Table 3-1 below. Metro facilities voluntarily participating in the program are required to follow this guidance to maintain participation in the STA program.

[47] Personal communication with Will Ennis, Metro. June 4, 2019.

[48] USCC. 2019. STA Certified Compost Participants. December 2019. https://www.compostingcouncil.org/page/participants#OR

[49] USCC Matthew Cotton. 2006. "The US Composting Council's Seal of Testing Assurance Program: (How to Tell What Compost "is")" https://www.calrecycle.ca.gov/docs/cr/organics/erosion/workshops/2006bmpct/sacramento-cotton.pdf

[50] USCC. 2019. STA Certified Compost. December 2019. https://www.compostingcouncil.org/page/CertifiedCompostSTA

[51] USCC Matthew Cotton. 2006. "The US Composting Council's Seal of Testing Assurance Program: (How to Tell What Compost "is")" https://www.calrecycle.ca.gov/docs/cr/organics/erosion/workshops/2006bmpct/sacramento-cotton.pdf

[52] United States Composting Council. 2019. STA Certified Compost. December. https://www.compostingcouncil.org/page/CertifiedCompostSTA.

Failure to comply with STA program requirements results in revocation of STA certification and discontinued use of STA promotional materials and statements.[53]

Table 3-1. STA Sampling Frequency[54]

Compost Quantity	Sampling Frequency
1 – 6,200 tons	1 per quarter
6,201 – 17,500 tons	1 per 2 months
>17,500 tons	1 per month

3-2. Research, Findings, Recommendations, and Level of Effort for Quality of Finished Compost Focus Areas

Ensuring the quality of finished compost is an important component of promoting compost facilities that operate safely, efficiently, and in a way that does not negatively impact the environment or surrounding neighbors as well as supporting the overall market success of the finished product. Jacobs researched and evaluated several focus areas to better understand the associated existing regulatory framework and challenges in Oregon and then compare them to other relevant jurisdictions in North America and Internationally. A summary of the different composting facility related regulations and tiers for all of the researched jurisdictions is included in Appendix D.

The focus areas discussed in this section are organized in the following order:

- Metals
- Pathogens
- Testing Frequency
- Contamination
- Stability and Maturity
- Bioaerosols and Pesticides
- PFAS

3-2.1 Researched Jurisdictions

Jacobs researched requirements for finished compost that have been established by other jurisdictions. Follow-up interviews were conducted with several jurisdictions that had requirements relevant for Metro's needs. Table 3-2 shows the contacts interviewed and the focus areas that were discussed within each jurisdiction.

Table 3-2. Jurisdictions Interviewed for Quality of Finished Compost

Jurisdiction	Contact	Focus Area(s) Discussed
Oregon Department of Environmental Quality (ODEQ)	Bryan Smith Bob Barrows	Metals, Pathogens, Testing Frequency, Contamination, Stability and Maturity, Bioaerosols and Pesticides, PFAS
Metro	Will Ennis	General Quality Standards

[53] United States Composting Council. 2019. STA Certified Compost. December. https://www.compostingcouncil.org/page/CertifiedCompostSTA.

[54] United States Composting Council. 2019. STA Certified Compost. December. https://www.compostingcouncil.org/page/CertifiedCompostSTA.

Table 3-2. Jurisdictions Interviewed for Quality of Finished Compost

Jurisdiction	Contact	Focus Area(s) Discussed
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer	Metals, Pathogens, Testing Frequency, Contamination, Stability and Maturity, Bioaerosols and Pesticides
Canada	Maureen O'Connell and Gloria Parker	Metals, Pathogens, Testing Frequency, Contamination, Stability and Maturity
Maryland Department of Agriculture	Philip Davidson	Metals, Pathogens, Testing Frequency, Contamination, Stability and Maturity

Additional internet research and/or additional research was conducted for jurisdictions in Hawaii, United States Composting Council, Australia, United Kingdom, and Texas as summarized in Table 3-3.

Table 3-3. Jurisdictions Researched (Internet Research Only) for Quality of Finished Compost

Jurisdiction/Organization	Contact	Focus Area(s) Discussed
Hawaii	Internet	No information found
United States Composting Council	Internet	Metals, Pathogens, Testing Frequency, Contamination, Stability and Maturity, Bioaerosols and Pesticides
State of California (CalRecycle)	Internet	Metals, Pathogens, Testing Frequency, Contamination, Stability and Maturity, Bioaerosols and Pesticides
Australia	Internet, Additional Research with Jacobs Australian staff	Metals, Pathogens, Testing Frequency, Contamination, Stability and Maturity, Bioaerosols and Pesticides
United Kingdom	Internet, Additional Research with Jacobs United Kingdom staff	Metals, Pathogens, Testing Frequency, Contamination, Stability and Maturity
Texas Commission on Environmental Quality (TCEQ)	Internet	Metals, Pathogens, Testing Frequency, Contamination, Stability and Maturity, Bioaerosols and Pesticides

In the United States (US), federal regulations have only established standards for compost from biosolids, but many states, as further outlined in the following sections, have adopted additional standards for non-biosolids compost. In the United Kingdom (UK), Australia, and Canada, where the compost markets are more developed, there are generally more extensive regulations on finished products.

The research and interviews performed revealed that two types of standards were consistently implemented: statutory and voluntary. Statutory standards were found to be more limited in scope- usually to protecting human and animal health as well as the environment, likely because statutory standards are more difficult to change. This project focuses primarily on jurisdictions' current statutory standards. The success of compost product standards can be difficult to measure, but according to a 2002 study comparing composting regulations enacted in the UK, success can be gauged by the following three questions:

1) Are human/animal health and the environment well protected?
2) Is all the compost produced easily sold?
3) Do the users of the compost products find them satisfactory?

If the questions above can be answered positively, then the regulations should be considered successful, regardless of the specifics.

The jurisdictions researched varied in the number of classes of compost products classified. Most developed markets have two or three classes, while less developed markets only have one standard, if any at all.

3-2.2 Metals

This section presents an overview and discussion of the requirements of the jurisdictions Jacobs researched. Table 3-5, at the end of this section, contains the numerical limits on metals in finished compounds for all of these jurisdictions, for comparison.

3-2.2.1 Research and Interview Summaries

Table 3-4 shows the contacts interviewed during the research of metal related quality requirements and enforcement in other regionally relevant jurisdictions.

Table 3-4. Metals Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Bryan Smith Bob Barrows
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
British Columbia Ministry of the Environment (BCMOE)	Maureen O'Connell and Gloria Parker
Maryland Department of Agriculture	Philip Davidson

In addition to the jurisdictions shown in Table 3-4, United States Composting Council STA program, State of California (CalRecycle), Hawaii, Texas Commission on Environmental Quality (TCEQ), Australia, Canada, and the United Kingdom were also researched, although no interviews were conducted. Summaries for each of the researched jurisdictions are included in the following subsections.

3-2.2.1.1 Oregon DEQ

Mr. Bob Barrows of Oregon DEQ was interviewed on the topic of metals. Mr. Barrows specified that metal concentrations are not a required parameter in Oregon. He stated that in his opinion, there are enough controls in place to prevent problematic metal concentrations without establishing specific concentration requirements for non-biosolids compost. For example, composters are not permitted to include painted or treated wood in their feedstock. This eliminates the concern for metals in green and food waste composting. The DEQ has not yet found a reason to change this stance. Mr. Barrows also stated that many composters in the state will test for metals regardless of the regulations because they choose to participate in the United States Composting Council (USCC) Seal of Testing Assurance (STA) Program. The STA program requires testing for metals as part of the program. Mr. Barrows also indicated that metals would be a greater concern in composted biosolids, but at this point biosolids are only composted at wastewater treatment plant sites under an NPDES permit, which has specific metals concentration requirements for finished compost.

3-2.2.1.2 Washington

Facilities in Washington are subject to metals limits per Washington Administrative Code (WAC) 173-350-220.[55,56]

3-2.2.1.3 California (CalRecycle)

Metal levels are regulated by CalRecycle per CCR and testing must be performed prior to the compost products departing the facility where they are produced. A table of the maximum acceptable metal concentrations from the regulation (14 CCR § 17868.2)[57] is available in Appendix E.2.

3-2.2.1.4 Hawaii

There are currently no regulatory limits pertaining to metals for selling or marketing compost, although in the permit application for a compost facility, the facility must describe operational procedures and quality of the compost.[58] Compost made from sewage sludge must comply with federal EPA 503 regulations.

3-2.2.1.5 United States Composting Council

The USCC classifies compost products into three tiers based on feedstock types under their Model Compost Rule Template. Each tier has its own list of operating requirements for the facility to meet.[59]

Metals for biosolids compost products are limited in 40 CFR 503.13(b)(3)[60] of the compost model rules template. The table of ceiling concentrations allowed, and other relevant information is available in Appendix E.3.

Additionally, the STA Program includes metals limits as shown in Table 3-5, below.

3-2.2.1.6 Maryland

Maryland regulates finished compost under the “Soil Conditioner” requirements of its Fertilizer Law. Composting operations are regulated by the Maryland Department of the Environment, while finished product is regulated by the Maryland Department of Agriculture per Code of Maryland Regulations (COMAR), Title 15, Subtitle 18, Chapter 4.[61] The State Chemist may also request additional lab reports that are not presented in the compost regulations. Maryland also registers soil conditioners, and consequently requests an N-P-K report plus a polycyclic aromatic hydrocarbon (PAH) report. Maryland also administers a compost exam to compost facility operators prior to approving their certification. The goal behind this requirement is to prove that operators understand the process required to produce the finished product.

All products, whether they are soil conditioners or composted materials, must be registered with the Maryland State Chemist before they are sold or distributed. Operators are required to maintain complete records for two years and the Department or a designee may examine the records, inspect, or sample any compost at any time to determine if the facility is in compliance. Noncompliance may result in

[55] Washington Administrative Code. 2018. Title 173, Chapter 350, Section 220: Composting Facilities. https://apps.leg.wa.gov/WAC/default.aspx?cite=173-350-220.

[56] Department of Ecology, State of Washington. 2013. Siting and Operating Composting Facilities in Washington State, Good Management Practices, Publication No. 11-07-005. July. https://fortress.wa.gov/ecy/publications/publications/1107005.pdf.

[57] California Code of Regulations (CCR), Title 14, Division 7, Chapter 3.1, Article 7, Section 17868.2: Maximum Metal Concentrations. https://govt.westlaw.com/calregs/Document/ICCDB5ED32C5C4C1BA48BF6B09F855881?transitionType=Default&contextData=%28sc.Default%29.

[58] State of Hawaii, Department of Health. 2008. Permit Application for Solid Waste Management Facility. https://health.hawaii.gov/shwb/files/2013/06/2GENAPP-composting-all-2008.pdf.

[59] United States Composting Council. 2013. Model Compost Rule Template. Version 1.1. April 4. https://old.compostingcouncil.org/wp-content/uploads/2016/05/US-Composting-Council-Model-Compost-Rule-Template-v1-1-4-15-13.pdf.

[60] Code of Federal Regulations. 2010. Title 40, Chapter I, Subchapter O, Part 503, Subpart B, Section 503.13: Pollutant Limits. https://www.govinfo.gov/app/details/CFR-2010-title40-vol29/CFR-2010-title40-vol29-sec503-13.

[61] Code of Maryland Regulations. 2019. Title 15, Subtitle 18, Chapter 4: Compost. http://mdrules.elaws.us/comar/15.18.04.

revoking any registration or certificate of an operator or the Secretary may impose a penalty instead of refusing or canceling a registration. Penalties range from $100 to $2,000 depending on the number of violations received and the level of the offense. [62]

The full regulations can be found in: COMAR Title 15 Department of Agriculture, Subtitle 18 State Chemist, Chapter 04 Compost. Authority: Agriculture Article, Title 6, Subtitle 2, Annotated Code of Maryland.

Metals limits are found in 15 COMAR 18.04.11 of the compost quality parameters. There are stricter limits for general use compost than for limited and restricted use products. The table of ceiling concentrations allowed is available in Appendix E.8.

3-2.2.1.7 Canada

Compost is regulated in Canada by the Canadian Council of Ministers of the Environment (CCME) and the Canadian Food Inspection Agency (CFIA). There is also a voluntary national standard (Standard CAN/BNQ 0413-200, Organic Soil Conditioners—Composts[63]) by the Bureau de normalisation du Québec (BNQ), which is the central body for standardization and certification in Canada.

Metals/trace elements are regulated by both the CCME and CFIA, as well as by the BNQ standard. The CCME has two categories of compost to differentiate quality, which are based on the end use of the product (if neither category criteria are met, then the material must be used or disposed of appropriately):

- Category A is unrestricted for end use, can be used in any application (including agricultural land, residential gardens, nurseries, etc), and has the highest standard for trace element limits.[64]
- Category B is restricted for end use because it fails to meet the standards for trace elements or sharp foreign matter for Category A, but meets the criteria limits for Category B.[65]

The standards for physical and chemical characteristics for compost products are consistent between the CCME, CFIA, and BNQ, but they each recognize different numbers of classes.[66] As mentioned above, the CCME has two categories (A and B).[67] But the CFIA only recognizes one class of compost, which is based on CCME and BNQ's Class B. The BNQ has three classes consisting of A, B, and an additional category (Category AA).[68] Category AA has the same requirements as Category A, except a more stringent criteria on foreign matter. The purpose of this additional category is to provide users with a product class more suitable for bagging.

The CFIA regulates trace elements for compost products used in agricultural operations as well as a secondary mandate of minimum product labeling requirements to protect consumers within Trade Memoranda T-4-93 and T-4-120, respectively.[69,70]

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[62] Code of Maryland Regulations. 2019. Title 15, Subtitle 18, Chapter 4: Compost. http://mdrules.elaws.us/comar/15.18.04.

[63] Bureau de normalisation du Québec. 2016. CAN/BNQ 0413-200: Organic Soil Conditioners – Composts. February 29. https://www.bnq.qc.ca/en/standardization/environment/composts.html.

[64] Canadian Council of Ministers of the Environment. 2005. Guidelines for Compost Quality. https://www.ccme.ca/files/Resources/waste/organics/compostgdlns_1340_e.pdf.

[65] Canadian Council of Ministers of the Environment. 2005. Guidelines for Compost Quality. https://www.ccme.ca/files/Resources/waste/organics/compostgdlns_1340_e.pdf.

[66] Environment Canada. 2013. Technical Document on Municipal Solid Waste Organics Processing.

[67] Canadian Council of Ministers of the Environment. 2005. Guidelines for Compost Quality. https://www.ccme.ca/files/Resources/waste/organics/compostgdlns_1340_e.pdf.

[68] Bureau de normalisation du Québec. 2016. CAN/BNQ 0413-200: Organic Soil Conditioners – Composts. February 29. https://www.bnq.qc.ca/en/standardization/environment/composts.html.

[69] Canadian Food Inspection Agency. 2017. T-4-93 – Safety Guidelines for Fertilizers and Supplements. https://www.inspection.gc.ca/plant-health/fertilizers/trade-memoranda/t-4-93/eng/1305611387327/1305611547479.

[70] Canadian Food Inspection Agency. 2018. T-4-120 – Regulation of Compost under the Fertilizers Act and Regulations. https://www.inspection.gc.ca/plant-health/fertilizers/trade-memoranda/t-4-120/eng/1307910204607/1307910352783.

BNQ provides limits in their voluntary standard for trace elements that help determine the class of product for which a compost is eligible.[71]

The CCME and CFIA standards include limits of the metal content in the product as well as the maximum acceptable cumulative metal additions to the soil. The trace element limits for CCME, CFIA, and BNQ are shown in Table 16-2 of Appendix E.4.

Ms. Gloria Parker of the British Columbia Ministry of Environment (BCMOE) and Climate Change Strategy - Environmental Standards Branch was interviewed to understand regulatory changes currently in process in the jurisdiction. Ms. Parker stated that with regard to metals in Class A compost, the requirements of the jurisdiction were being revised to more closely align with the CFIA Fertilizer Act since they were previously aligned to BNQ levels. Table 3-5 presents the current BCMOE metals limits, which are consistent with BNQ levels, as well as CFIA levels.

The Ontario Ministry of the Environment (OMOE) regulates compost per the Ontario Compost Quality Standards and follows BNQ limits quite closely for Categories AA, A, and B compost. Additionally, OMOE regulates the metals concentrations in feedstocks for compost as shown in Table 3-5.[72]

3-2.2.1.8 Australia

The EPA for the Australian state of Victoria has regulations on the metal content acceptable in compost products for un-restricted end use.[73] If a product exceeds these limits, it may still be suitable for a specific use. The limits are shown in the table titled “Metal Limits” in the Australia section of Appendix E.5.

3-2.2.1.9 United Kingdom

The United Kingdom (UK) has very limited statutory regulations on compost products. The primary benchmark for compost quality is the nationally recognized compost standard: The British Institution’s Publicly Available Specification 100 (PAS 100)[74], which was launched in November 2002 in conjunction with the Waste and Resources Action Program (WRAP) and The Composting Association (TCA).

In the UK, compost products are classified in one of the following categories:

- Mulch
- Soil improver
- Turf dressing constituent
- Biofilter
- Biofuel
- Other

Other classes in which compost is a constituent include:

- Growing medium
- Turf Dressing
- Top soil

Any compost product sold into the agricultural market must disclose on the label if it has been produced using any animal byproducts or catering waste.

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[71] Bureau de normalisation du Québec. 2016. CAN/BNQ 0413-200: Organic Soil Conditioners – Composts. February 29. https://www.bnq.qc.ca/en/standardization/environment/composts.html.

[72] Ontario Ministry of the Environment. 2019. Ontario Compost Quality Standards. https://www.ontario.ca/page/ontario-compost-quality-standards#section-2.

[73] Environment Protection Authority Victoria. 2017. Designing, constructing and operating composting facilities. Publication 1588.1. June. https://ref.epa.vic.gov.au/~/media/Publications/ATTGTO5C.pdf.

[74] PAS 100:2002. Specification for composted materials.

The UK has limits for heavy metals in compost products commensurate with the other jurisdictions surveyed.

3-2.2.1.10Texas

Per Texas Administrative Code, Title 30, Part 1, Chapter 332, Subchapter G, Rule 71: Sampling and Analysis Requirements for Final Product, compost products must be sampled for the following total metals parameters that are critical to public health and environmental protection:[75]

- Arsenic
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Molybdenum
- Nickel
- Selenium
- Zinc

Testing methods for chemical and physical analysis include:[76]

(A) "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods" (SW-846);
(B) "Methods for Chemical Analysis of Water and Wastes" (EPA-600); or
(C) "Recommended Test Methods for the Examination of Composts and Composting" (Compost Council, 1995)[77].

[75] Texas Administrative Code, Title 30, Part 1, Chapter 332, Subchapter G, Rule 71: Sampling and Analysis Requirements for Final Product. https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=332&rl=71.

[76] Texas Administrative Code, Title 30, Part 1, Chapter 332, Subchapter G, Rule 71: Sampling and Analysis Requirements for Final Product. https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=332&rl=71.

[77] United States Composting Council. 1995. Recommended Test Methods for the Examination of Composts and Composting. https://www.compostingcouncil.org/page/tmecc.

Table 3-5. Summary of Metals Regulations by Jurisdiction

Constituent	USCC STA (ppm)	CalRecycle (ppm)	Washington DOE (ppm)	Texas (ppm)	Maryland (general use) (ppm)	US EPA (40 CFR 503) (ppm)	UK (ppm)	Victoria, Australia EPA (ppm)	CCME Category A (ppm)	CCME Category B (ppm)	CFIA (ppm)	BNQ Category AA and A (ppm)	BNQ Category B (ppm)	BCMOE Class A (ppm)	BCMOE Class B (ppm)	OMOE Categories AA and A (ppm)	OMOE Category B (ppm)	OMOE Category AA Feedstock (ppm)	OMOE Category A/B Feedstock (ppm)
Arsenic	41	41	20	10	41	75	-	20	13	75	75	13	75	13	75	13	75	75	170
Cadmium	39	39	10	16	39	85	0.7	1	3	20	20	3	20	3	20	3	20	20	34
Chromium	-	-	-	180	1200	-	70	100	210	-	-	210	-	100	1060	210	1060	1060	2800
Cobalt	-	-	-	-	-	-	-	-	34	150	150	34	150	34	150	34	150	150	340
Copper	1500	1500	750	1020	1500	4300	70	150	400	-	-	400	-	400	2200	100 (AA) / 400 (A)	760	760	1700
Lead	300	300	150	300	300	840	45	150	150	500	500	150	500	150	500	150	500	500	1100
Mercury	17	17	8	11	17	57	0.4	1	0.8	5	5	0.8	5	2	15	0.8	5	5	11
Molybdenum	-	-	9	75	18	75	-	-	5	20	20	5	20	5	20	5	20	20	94
Nickel	420	420	210	160	420	420	25	60	62	180	180	62	180	62	180	62	180	180	420
Selenium	100	100	18	36	36	100	-	5	2	14	14	2	14	2	14	2	14	14	34
Zinc	2800	2800	1400	2190	2800	7500	200	-	700	1850	1850	700	1850	500	1850	500 (AA) / 700 (A)	1850	1850	4200

Notes:
All values are presented in part(s) per million (ppm).
- = No information found
BCMOE = British Columbia Ministry of the Environment
BNQ = Bureau de normalisation du Québec
CCME = Canadian Council of Ministers of the Environment
CFIA = Canadian Food Inspection Agency
DOE = Department of Ecology
EPA = Environmental Protection Agency
OMOE = Ontario Ministry of the Environment
ppm = part(s) per million
STA = Seal of Testing Assurance
UK = United Kingdom
USCC = United States Composting Council

3-2.2.2 Findings, Recommendations, and Level of Effort

3-2.2.2.1 Findings

The metal content restrictions in compost products were found to be regulated by each jurisdiction that has statutory standards in place for finished products.

Mr. Bob Barrows of Oregon DEQ stated during his interview that metals testing is not required because enough front-end controls are already in place, meaning that composters are not permitted to include painted or treated wood in their compost feedstock. This essentially eliminates the concern for metals in green and food waste composting. Oregon DEQ has not found a reason to change this stance. Mr. Barrows also stated that many composters in the state end up testing for metals regardless of the regulations because they choose to participate in the United States Compost Council Seal of Testing Assurance (STA) program. The STA program requires testing for metals. Mr. Barrows also added that metals would be a greater concern in composted biosolids but at this point biosolids are only composted at wastewater treatment plant sites under an NPDES permit.

3-2.2.2.2 Recommendations

Figure 3-1 provides a summary of findings and recommendations for metals. Table 3-6 presents the recommendations by tier for metals.

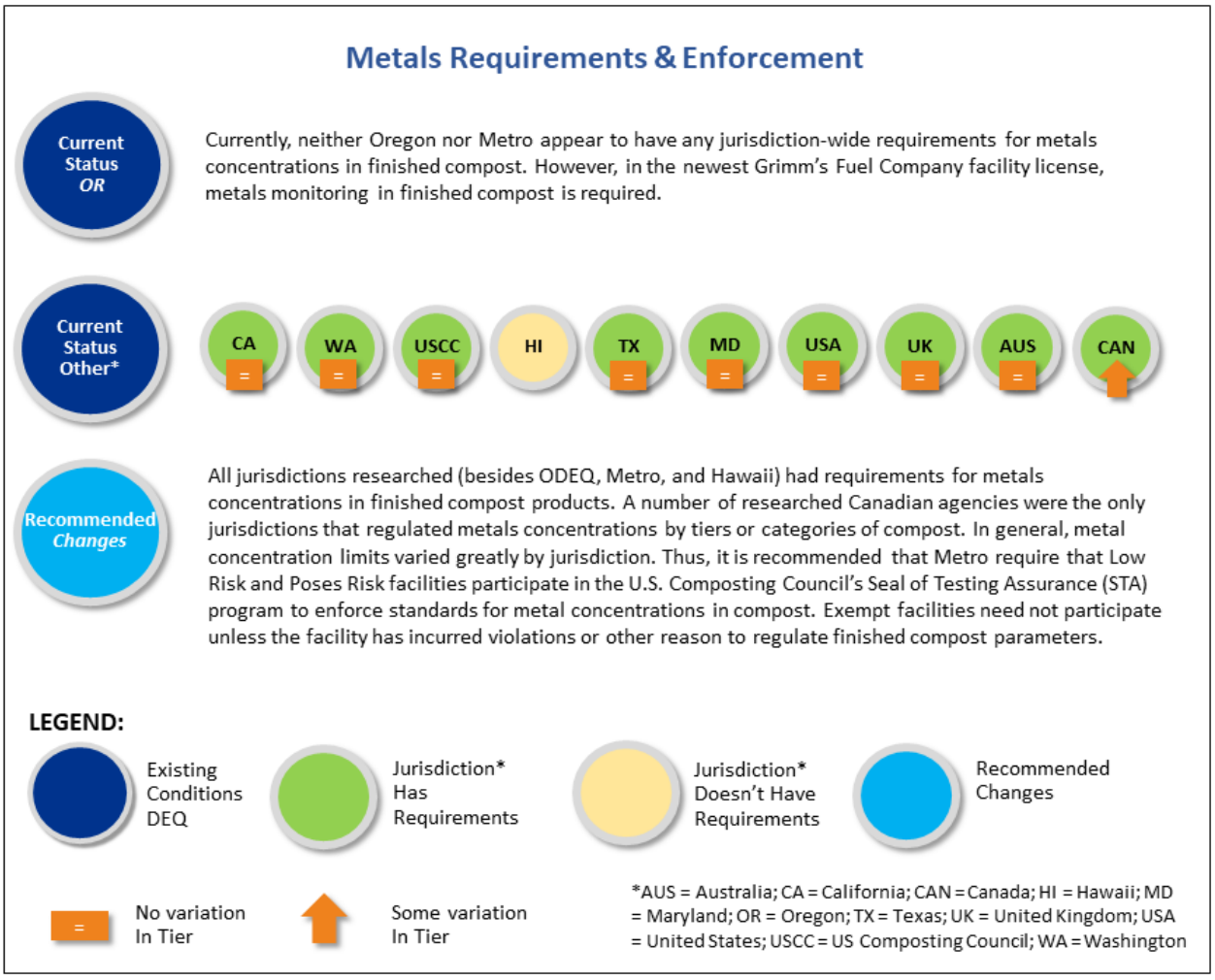

Figure 3-1. Metals Requirements and Enforcement

Table 3-6. Recommendations for Metals Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• None	• Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to testing and thresholds similar to the STA program
Low Risk / Registration Composting Facility Permit	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements	• Require facilities to participate in the STA program • Require that facilities electronically submit STA compost results to Metro • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives • Require facilities to retest and evaluate operations, if not meeting health and safety/quality requirements
Poses Potential Risk / Individual Composting Facility Permit	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements	• Require facilities to participate in the STA program • Require that facilities electronically submit STA compost results to Metro • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives • Require facilities to retest and evaluate operations, if not meeting health and safety/quality requirements

STA = Seal of Testing Assurance

As discussed in an earlier section, the five compost facilities located in the Metro region voluntarily participate in the STA program.[78] As a result of this finding, and because the Grimm's license was revised to require analyses of most STA program analyses, thus setting a precedent, Jacobs recommends that for Low Risk and Poses Potential Risk facility tiers, Metro require participation in the STA program. Participation in the STA program will provide verification and protection to Metro facilities that, at a minimum, facilities in the region are producing compost that meets EPA metals limits. Since the compliance levels for metals are inconsistent across the researched jurisdictions, Jacobs does not recommend that Metro adopt metals limits more stringent than those required by EPA without additional scientific reasoning. Instead, Jacobs recommends that Metro require electronic submittal (via the Metro License for that facility) of STA compost results so that data can be reviewed to help inform Metro. Samples should be taken according to the sampling frequency requirements of the STA program and should be submitted to Metro upon receipt of the results by the facility. Testing results that do not meet STA requirements will trigger a review of the Operations Plan and may also require operational changes for the facility. In addition, Jacobs recommends that Metro regularly review the STA program, including whenever it is modified to ensure that it aligns with Metro's testing objectives. For the Exempt facility tier, it is recommended that participation in the STA program not be required unless issues arise at the facility that warrant a need for regulation. In that case, Metro should regulate the Exempt facility as if it were a Low Risk facility.

If a facility does not meet standards for a quality parameter, the following steps should be taken:

- Retest to confirm sample results and prevent unnecessary action from a false positive.
- If the quality requirement is not met in the retest sample, the facility should review operational practices and investigate the source of the issue. If changes to operations are needed, work with Metro to determine the required changes for the Operations Plan.
- The facility will be subject to more frequent sampling equivalent to the next tier level per Table 3-1. For example, if required to sample once per quarter, composter must now sample once per two months until two rounds of passing results are achieved. If the facility is already sampling monthly, continue a monthly frequency, but work on determining source of problem and implementing operational changes, if needed.

If the retest sample still confirms an issue with quality, the compost will need to be dealt with appropriately (e.g. compost deemed not saleable). Then, the source of the problem must be determined and mitigated (e.g. look at feedstock quality and screening procedures and correct deficiencies).

The STA program includes increased testing frequency for larger compost facilities, which in effect, covers increased risk and differentiation in tier by design.

3-2.2.2.3 Level of Effort

Because compost facilities in the Metro region are already voluntarily participating in the USCC STA program, implementation of requirements for STA testing and data submittal can simply be worked into the license sections and Operation Plans, if not already. Implementation will require Metro inspectors to review the results and follow-up with the facility when poor results are found.

3-2.3 Pathogens

This section presents an overview and discussion of the requirements of the jurisdictions we researched. Table 3-8, at the end of this section, contains the numerical limits on pathogens in finished compounds for all of these jurisdictions, for comparison.

[78] United States Composting Council. 2019. *STA Certified Compost Participants*. https://www.compostingcouncil.org/page/participants#OR.

3-2.3.1 Research and Interview Summaries

Table 3-7 shows the contacts interviewed during the research of pathogen related quality requirements and enforcement in other regionally relevant jurisdictions.

Table 3-7. Pathogens Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Bryan Smith Bob Barrows
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
British Columbia Ministry of the Environment (BCMOE)	Maureen O'Connell
Maryland Department of Agriculture	Philip Davidson

In addition to the jurisdictions shown in Table 3-7, United States Composting Council STA program, State of California (CalRecycle), Hawaii, Texas Commission on Environmental Quality (TCEQ), Australia, Canada, and the United Kingdom were also researched, although no interviews were conducted. Summaries for each of the researched jurisdictions are included in the following subsections.

3-2.3.1.1 Oregon DEQ

Pathogen reduction plans are required and must address the *Code of Federal Regulations* (CFR), 40 CFR Part 503, and also describe additional pathogen reduction measures (Process to Further Reduce Pathogens [PFRP]) by either maintaining a minimum of 55°C for three days with a static pile, or in-vessel methods, or maintaining over 55°C for at least 15 days using a windrow method (minimum five turnings). There are also pathogen reduction performance standards, which limit the salmonella and fecal coliform content by product class. The operations plan for the facility must include the methods to comply with the Oregon Administrative Rules (OAR) 340-096-0140. Full sections of these regulations are available in Appendix E.1.

Mr. Bob Barrows of Oregon DEQ confirmed that the current requirements were taken from 40 CFR Part 503. Mr. Barrows was asked why Oregon DEQ established different testing parameters for Type 2 feedstocks. He stated that a facility accepting a large amount of manure would have a higher likelihood of fecal coliform bacteria in the finished product, which is why fecal coliform is a required analysis for compost facilities that accept >50% Type 2 feedstocks. Mr. Barrows stated that a composter who accepts less Type 2 feedstock would have a lower likelihood of finding fecal coliform contamination in the finished product. Mr. Barrows did not believe salmonella to be of great concern, except in cases where a composter accepts a large amount of chicken manure. Mr. Barrows felt that the current pathogen regulations for ODEQ are sufficient and working as intended.

3-2.3.1.2 Washington

Washington requires standard pathogen reduction processes to protect finished product quality. They require at least 15 days using a windrow method (minimum five turnings) and three days retention and no required turns for ASP and in-vessel processes. They also have testing requirements for either salmonella or fecal coliform.[79]

[79] Department of Ecology, State of Washington. 2013. Siting and Operating Composting Facilities in Washington State, Good Management Practices, Publication No. 11-07-005. July. https://fortress.wa.gov/ecy/publications/publications/1107005.pdf.

3-2.3.1.3 California (CalRecycle)

Pathogen concentrations are regulated by CalRecycle per 14 CCR § 17868.3 and testing must be performed prior to the compost products departing the facility where it is produced. Facilities must either maintain a minimum of 55°C for three days with a static pile or in-vessel methods or maintain over 55°C for at least 15 days using a windrow method (minimum five turnings).[80] More information on pathogen limits and testing from the regulation (14 CCR § 17868.3) is available in Appendix E.2.

3-2.3.1.4 Hawaii

Per Hawaii Administrative Rules (HAR) 11-58.1-41, there are three methods to achieve acceptable pathogen criteria:

- For the windrow composting method: Maintain aerobic conditions during the composting process. "A minimum of five turnings is required during a period of 15 consecutive dates with the temperature of the mixture being 55°C or greater within 6 to 8 inches below the surface of the pile."[81]
- For the aerated static pile composting method: "The compost pile must be insulated and a temperature of not less than 55°C or greater must be maintained throughout the compost pile for at least three consecutive days."[82]
- For the enclosed vessel composting method: "The mixture must be maintained at a temperature of not less than 55°C or greater throughout the mixture for at least three consecutive days."[83]

3-2.3.1.5 United States Composting Council

Pathogens, specifically salmonella and fecal coliform content are limited in the compost model rules template.[84]

The STA Program requirements for pathogens are listed in Table 3-8, below.

3-2.3.1.6 Maryland

Pathogens reduction processes are only required for products that are created from composting solid waste or manure (COMAR 26.04.06).

3-2.3.1.7 Canada

For the CCME, pathogens in compost must meet standards that depend on the feedstock materials. For compost that only contains yard waste feedstock, the criteria can be met either through operational parameters that include temperature/time requirements or by organism content (salmonella and fecal coliforms) limits.[85] Pathogens are limited in the BNQ by organism content and are not tied to the class of product.[86] For British Columbia, Class A products must also be treated aerobically for at least 14 days

[80] California Code of Regulations. 2019. Title 14, Division 7, Chapter 3.1, Article 7, Section 17868.3: Pathogen Reduction. https://govt.westlaw.com/calregs/Document/I8F03F229B3E54E1CA7E88BC1C028E428?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default).

[81] Hawaii Administrative Rules. Title 11, Chapter 58.1, Subchapter 4, Section 11-58.1-41: Composting facilities. https://health.hawaii.gov/shwb/files/2013/06/11-5811.pdf.

[82] Hawaii Administrative Rules. Title 11, Chapter 58.1, Subchapter 4, Section 11-58.1-41: Composting facilities. https://health.hawaii.gov/shwb/files/2013/06/11-5811.pdf.

[83] Hawaii Administrative Rules. Title 11, Chapter 58.1, Subchapter 4, Section 11-58.1-41: Composting facilities. https://health.hawaii.gov/shwb/files/2013/06/11-5811.pdf.

[84] United States Composting Council. 2013. Model Compost Rule Template. Version 1.1. April 4. https://old.compostingcouncil.org/wp-content/uploads/2016/05/US-Composting-Council-Model-Compost-Rule-Template-v1-1-4-15-13.pdf.

[85] Canadian Council of Ministers of the Environment. 2005. Guidelines for Compost Quality. https://www.ccme.ca/files/Resources/waste/organics/compostgdlns_1340_e.pdf.

[86] Bureau de normalisation du Québec. 2016. CAN/BNQ 0413-200: Organic Soil Conditioners – Composts. February 29. https://www.bnq.qc.ca/en/standardization/environment/composts.html.

with specific requirements during that time for temperature, carbon to nitrogen ratio, and pile size.[87] Alberta Environment and Parks (AEP) and OMOE adopt the maximum pathogen content standards from CCME and BNQ. Excerpts from the Guidelines for Compost Quality from the CCME, BNQ standard, and British Columbia laws that pertain to pathogens can be found in Appendix E.4.

3-2.3.1.8 Australia

Pathogens are regulated and can be met by either an established time/temperature ratio requirement or standards for set parameters if an alternative method of pasteurization is used.[88] The table titled "Pathogen Limits" in Appendix E.5 is from the Victoria Environmental Protection Agency and shows the pathogen and plant propagules reduction performance standards for alternative methods of pasteurization.

3-2.3.1.9 United Kingdom

Pathogen testing by an approved laboratory is required for two human pathogen indicator species: salmonella and enterobacteriaceae. Five samples must be taken per batch of compost and salmonella must be absent from all five samples to pass, while enterobacteriaceae must not exceed 300 colony forming units per gram in any of samples.[89]

3-2.3.1.10 Texas

Testing is required for salmonella and fecal coliform. Analysis of pathogens shall utilize "Standard Methods for the Examination of Water and Wastewater" (Water Pollution Control Federation, latest edition[90]).[91]

[87] British Columbia Ministry of the Environment. 2019. Environmental Management Act and Public Health Act, Organic Matter Recycling Regulation. http://www.bclaws.ca/civix/document/id/complete/statreg/18_2002#section12.

[88] Environment Protection Authority Victoria. 2017. Designing, constructing and operating composting facilities. Publication 1588.1. June. https://ref.epa.vic.gov.au/~/media/Publications/ATTGTO5C.pdf.

[89] The Composting Association. 2005. The Composting Industry Code of Practice. http://www.organics-recycling.org.uk/dmdocuments/Composting_Industry_Code_of_Practice.pdf.

[90] Water Pollution and Control Federation. n.d. Standard Methods for the Examination of Water and Wastewater.

[91] Texas Administrative Code, Title 30, Part 1, Chapter 332, Subchapter G, Rule 71: Sampling and Analysis Requirements for Final Product. https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=332&rl=71.

Table 3-8. Summary of Pathogen Maximums by Jurisdiction

Jurisdiction	PFRP Process	Pathogen Maximums
Oregon DEQ	In-vessel: 3 days @ 55°C; 0 turns Open Windrow: 15 days @ 55°C; 5 turns	Types 1 and 3 with <50% Type 2: Salmonella: 3 MPN/4 g or Fecal Coliform: <1,000 MPN Types 1 and 3 with >50% Type 2: Fecal Coliform: <1,000 MPN
Metro	N/A	N/A
Grimm's Report	A minimum of quarterly sampling for fecal coliform and salmonella. Every 5,000 tons must be tested for both every month and should be included in the operations plan. Any testing that exceeds that EPA maximum should be documented and reported.	Follow the EPA's requirements to ensure safe levels of pathogens for human handling. OAR 340-096-0070(4) and 340-096-0140(3)
Washington DOE	In-vessel: 3 days @ 55°C; 0 turns; Temp monitoring plan required Open Windrow: 15 days @ 55°C; 5 turns ASP: 3 days @ 55°C; 0 turns; must be covered w/synthetic or finished compost insulating material	Salmonella: 3 MPN/4 g OR Fecal Coliform: <1,000 MPN/gram
CalRecycle	In-vessel: 3 days @ 55°C; 0 turns; Temp monitoring plan required Open Windrow: 15 days @ 55°C; 5 turns ASP: 3 days @ 55°C; 0 turns; must be covered w/6"-12" of insulating material	Salmonella: 3 MPN/4 g AND Fecal Coliform: <1,000 MPN
Hawaii	Open Windrow: 15 days @ 55°C 6-8 inches below surface of pile; 5 turns ASP: 3 days @ 55°C throughout pile In-vessel: 3 days @ 55°C throughout mixture	No specific limit values found
USCC/STA	Open Windrow: 15 days @ 55°C; 5 turns ASP or In-vessel: 3 days @ 55°C; 0 turns; must have 14 additional days @ 45°C	Salmonella: 3 MPN/4 g OR Fecal Coliform: <1,000 MPN/gram
Maryland	Required for compost from municipal solid waste or manure	No Information Found

Table 3-8. Summary of Pathogen Maximums by Jurisdiction

Jurisdiction	PFRP Process	Pathogen Maximums
Canada: AEP	In-vessel: 3 days @ 55°C; 0 turns; Temp monitoring plan required Open Windrow: 15 days @ 55°C; 5 turns ASP: 3 days @ 55°C; 0 turns; must be covered w/synthetic or finished compost insulating material	Salmonella: 3 MPN/4 g AND Fecal Coliform: <1,000 MPN
Canada: CCME	In-vessel: 3 days @ 55°C; 0 turns; Temp monitoring plan required Open Windrow: 15 days @ 55°C; 5 turns ASP: 3 days @ 55°C; 0 turns; must be covered w/insulating material	Compost produced solely from yard waste must meet PFRP criteria or the following pathogen content limits: Salmonella Less than 3 MPN/4-g (dry weight) Fecal coliform Less than 1000 MPN/g (dry weight) Compost produced from all other feedstocks must meet PFRP criteria and the pathogen content limits.
Canada: CFIA	No Information Found	Salmonella: 3 MPN/4 g AND Fecal Coliform: <1,000 MPN
Canada: BNQ	No Information Found	Voluntary: Salmonella: 3 MPN/4 g AND Fecal Coliform: <1,000 MPN
Canada: OMOE	In-vessel: 3 days @ 55°C; 0 turns; Temp monitoring plan required Open Windrow: 15 days @ 55°C; 5 turns ASP: 3 days @ 55°C; 0 turns; must be covered w/insulating material	Leaf and yard waste must choose between PFRP processing or Sampling; SSO and all other feedstock composts must do both. Salmonella: 3 MPN/4 g AND Fecal Coliform: <1,000 MPN
Canada: BC	In-vessel: 3 days @ 55°C; 0 turns; Temp monitoring plan required Open Windrow: 15 days @ 55°C; 5 turns ASP: 3 days @ 55°C; 0 turns; must be covered w/insulating material	Yard waste and untreated and unprocessed wood residuals processes are only required to go through PFRP processing; SSO and all other feedstock composts must do both. Fecal Coliform: <1,000 MPN

Table 3-8. Summary of Pathogen Maximums by Jurisdiction

Jurisdiction	PFRP Process	Pathogen Maximums
Australia	No Information Found	Enteric viruses < 1 plaque-forming unit per 10 grams total (dry weight) Helminth ova < 1 per 4 grams dry solids E. coli < 100 MPN per gram (dry weight) Faecal coliforms < 1,000 MPN per gram (dry weight) Salmonella spp. Absent in 50 grams of final product (dry weight)
United Kingdom	Temperature monitoring plan required	No Information Found
Texas	No Information Found	Fecal Coliform: For Grade 1- less than 1,000 MPN per gram of solids or meets PFRP, For Grade 2- Geometric mean density less than 2,000,000 MPN per gram of solids or meets PSRP Salmonella: Less than 3 MPN per 4 grams total solid or meets PFRP

Notes:

°C = degree(s) Celsius
AEP = Alberta Environment and Parks
ASP = aerated static pile
BC = British Columbia
BNQ = Bureau de normalisation du Québec
CCME = Canadian Council of Ministers of the Environment
CFIA = Canadian Food
DEQ = Department of Environmental Quality
DOE = Department of Ecology
EPA = Environmental Protection Agency
g = gram(s)
MPN = Most Probable Number (bacteria count)
N/A = not applicable
OAR = Oregon Administrative Rules
OMOE = Ontario Ministry of the Environment
PFRP = Process To Further Reduce Pathogens
PSRP = Process To Significantly Reduce Pathogens
SSO = source-separated organics
STA = Seal of Testing Assurance
USCC = United States Composting Council

3-2.3.2 Findings, Recommendations, and Level of Effort

3-2.3.2.1 Findings

Pathogens were found to be restricted by most jurisdictions that have requirements in place through either statutory (California, Washington, Oregon) or voluntary (Australia, United Kingdom, Canada) standards. The testing protocol usually involves testing for the presence of specific micro-organisms, or the jurisdiction ensures hygienic products through a process regime with required temperatures and time limits.

3-2.3.2.2 Recommendations

Figure 3-2 provides a summary of findings and recommendations for pathogens. Table 3-9 presents the recommendations by tier for pathogens.

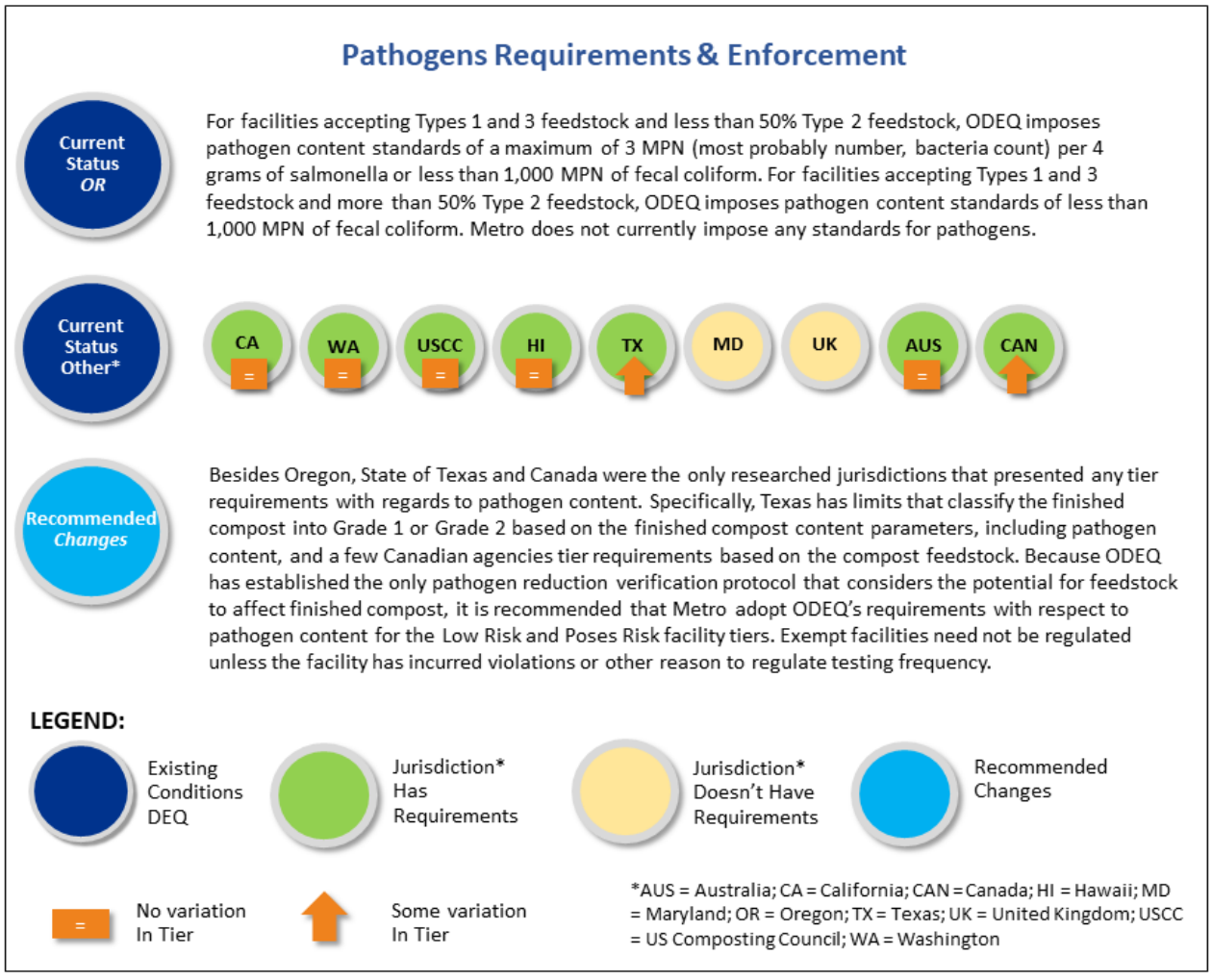

Figure 3-2. Pathogens Requirements and Enforcement

Table 3-9. Recommendations for Pathogens Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• None	• No regulation, unless issues arise at the facility (such as violations or other issues), in

Table 3-9. Recommendations for Pathogens Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
		which case Metro should consider regulating the facility per ODEQ requirements
Low Risk / Registration Composting Facility Permit	• Implement pathogen reduction measures as required by ODEQ • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost should be sent back through PFRP. Then, the source of the problem must be determined and mitigated (e.g. pile size, time and temperature of active composting and deficiencies corrected)	• Adopt ODEQ requirements for pathogen reduction • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Require facilities to retest and evaluate operations, if not meeting health and safety/quality requirements
Poses Potential Risk / Individual Composting Facility Permit	• Implement pathogen reduction measures as required by ODEQ • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost should be sent back through PFRP. Then, the source of the problem must be determined and mitigated (e.g. pile size, time and temperature of active composting and deficiencies corrected)	• Adopt ODEQ requirements for pathogen reduction • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Require facilities to retest and evaluate operations, if not meeting health and safety/quality requirements

ODEQ = Oregon Department of Environmental Quality

For the Exempt facility tier, it is recommended that no regulation be required with respect to pathogens unless issues arise at the facility that warrant a need to regulate pathogens. In that case, Metro should regulate the Exempt facility as if it were a Low Risk facility. For Low Risk, and Poses Potential Risk facility tiers, Jacobs recommends that Metro adopt specific requirements for pathogens consistent with Oregon DEQ's requirements. Oregon DEQ requires compost facilities to implement pathogen reduction measures by either maintaining a minimum of 55 degrees Celsius (°C) for three days with a static pile or in-vessel methods or maintaining over 55°C for at least 15 days using a windrow method (minimum five turnings). The requirement in the revised Grimm's license stating, "ASP composting piles must be maintained at a minimum temperature of 131 degrees Fahrenheit for a minimum of three consecutive days," is consistent with this recommendation. These requirements are consistent with other jurisdictions researched. The result of the pathogen reduction actions is verified through testing for salmonella or fecal coliform bacteria, which is also consistent with other jurisdictions researched. However, Oregon DEQ has implemented a unique sampling tier that requires facilities that accept more than 50 percent Type 2 (manure and agricultural wastes) feedstocks to sample for fecal coliform. Facilities accepting less than 50 percent Type 2 feedstocks may choose to sample for either salmonella or fecal coliform bacteria. Oregon DEQ has established the only pathogen reduction verification protocol that considers the potential for feedstock to affect finished compost, as confirmed by Mr. Bob Barrows. It should be noted that the overall recommendation to participate in the STA program for other finished product parameters does not interfere with or contradict this recommendation for pathogens.

If a facility does not meet standards for a quality parameter, the following steps should be taken:

- Retest to confirm sample results and prevent unnecessary action from a false positive.
- If the quality requirement is not met in the retest sample, the facility should review operational practices and investigate the source of the issue. If changes to operations are needed, work with Metro to determine the required changes for the Operations Plan.
- The facility will be subject to more frequent sampling equivalent to the next tier level per Table 3-1. For example, if required to sample once per quarter, composter must now sample once per two months until two rounds of passing results are achieved. If the facility is already sampling monthly, continue a monthly frequency, but work on determining source of problem and implementing operational changes, if needed.

If the retest sample still confirms an issue with quality, the compost should be sent back through PFRP. Then, the source of the problem must be determined and mitigated (e.g. pile size, time and temperature of active composting and deficiencies corrected).

The STA program includes increased testing frequency for larger compost facilities, which in effect, covers increased risk and differentiation in tier by design.

3-2.3.2.3 Level of Effort

Consistent requirements have already been written into the Grimm's Fuel Company license, thus the level of effort to implement ODEQ requirements is expected to be minimal. Additionally, all five of the existing compost facilities in the region are already participating in the STA program which includes pathogen sampling per the local regulations.

3-2.4 Testing Frequency

This section presents an overview and discussion of the requirements of the jurisdictions we researched. Table 3-11, at the end of this section, contains the numerical testing frequency requirements for finished compounds for all of these jurisdictions, for comparison.

3-2.4.1 Research and Interview Summaries

Table 3-10 shows the contacts interviewed during the research of testing frequency related quality requirements and enforcement in other regionally relevant jurisdictions.

Table 3-10. Testing Frequency Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Bryan Smith Bob Barrows
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
British Columbia Ministry of the Environment (BCMOE)	Maureen O'Connell
Maryland Department of Agriculture	Philip Davidson

In addition to the jurisdictions shown in Table 3-10, United States Composting Council STA program, State of California (CalRecycle), Hawaii, Texas Commission on Environmental Quality (TCEQ), Australia, Canada, and the United Kingdom were also researched, although no interviews were conducted. Summaries for each of the researched jurisdictions are included in the following subsections.

3-2.4.1.1 Oregon DEQ

Sampling methods must be described in the operations plan and vary in frequency between one sample every three months, to one sample every year- depending on both the type of feedstock and size of the operation. As an example, a basic summary of the requirements is outlined below for pathogen testing:

- Less than 2,500 tpy (Types 1 and 2) shall test once annually.
- Greater than 2,500 tpy (Types 1 and 2) shall test one sample per 5,000 tons or once every three months, and greater than 2,500 tpy (Type 3) shall test one sample every four months.
- Greater than 2,500 tpy (Type 3) shall test one sample per 5,000 tons or monthly.

Full testing requirements can be found in OAR 340-096-140.

3-2.4.1.2 Washington

Washington requires testing one sample per year for sites less than 5,000 yards per year. They increase the frequency to one sample per 5,000 cubic yards for sites with over 5,000 yards per year.[92] The samples must be “Representative” per USCC Test Method for the Examination of Composting and Compost (TMECC) Method 02.01-A through E.[93]

3-2.4.1.3 California (CalRecycle)

Testing frequency and method are regulated based on the amount of biosolids in the compost feedstock and are discussed in Section 14 CCR § 17868.1 of the code.[94] More information on the sampling method from the code is available in Appendix E.2. Table 3-12 summarizes the sampling frequencies required by biosolids content.

3-2.4.1.4 Hawaii

Per Hawaii Administrative Rules (HAR) 11-58.1-41, the facility must describe operational procedures and quality of the compost, including when sampling and testing will occur. Temperature monitoring must be conducted daily. [95]

3-2.4.1.5 United States Composting Council

Testing of stability, pathogens and metals must be tested according to the frequency table, which ranges from one test per quarter to one test per month depending on the amount of material. If the compost does not contain biosolids, then half the frequency of testing is acceptable.[96] The Testing Frequency table is available in Appendix E.3.

3-2.4.1.6 Maryland

Per COMAR Section 15.18.04.04, for facilities only accepting agricultural and yard waste, compost should be tested every 20,000 tons or every quarter, whichever is more frequent. If the compost test results always pass during the first year of operations, then the operator may test only once per year (pending test results remain within the limits). For facilities accepting other feedstocks, the operator should develop

[92] Department of Ecology, State of Washington. 2013. Siting and Operating Composting Facilities in Washington State, Good Management Practices, Publication No. 11-07-005. July. https://fortress.wa.gov/ecy/publications/publications/1107005.pdf.

[93] United States Composting Council. 1995. Recommended Test Methods for the Examination of Composts and Composting. https://www.compostingcouncil.org/page/tmecc.

[94] California Code of Regulations. 2019. Title 14, Division 7, Chapter 3.1, Article 7, Section 17868.1: Sampling Requirements. https://govt.westlaw.com/calregs/Document/I5F2A6DB653CC4A07BBCE6753964FF91B?transitionType=Default&contextData=%28sc.Default%29.

[95] Hawaii Administrative Rules. Title 11, Chapter 58.1, Subchapter 4, Section 11-58.1-41: Composting facilities. https://health.hawaii.gov/shwb/files/2013/06/11-5811.pdf.

[96] United States Composting Council. 2013. Model Compost Rule Template. Version 1.1. April 4. https://old.compostingcouncil.org/wp-content/uploads/2016/05/US-Composting-Council-Model-Compost-Rule-Template-v1-1-4-15-13.pdf.

a quality assurance plan approved by the Department that describes monitoring, sampling, and testing of both the process and product during the first 15 months of operation for any new facility.[97] The information gathered during the initial operations phase will inform the monitoring and sampling schedule moving forward. The testing includes metals, pH, polychlorinated biphenyls (PCBs), human-made inerts greater than 4 millimeters, and film plastic.[98]

3-2.4.1.7 Canada

Temperature monitoring must be performed daily until the requirements have been met, then weekly until curing is complete. If the temperature monitoring reveals that the minimum temperature/time requirements are not being met, then the material must be recycled into the process at the preprocessing stage or disposed of as waste.

Select conditions should trigger increased testing, such as results over 80 percent of the concentration limit for metals, or a change in feedstock characteristics is expected. The increased sampling should be frequent enough to show the operator is ensuring the quality of the compost product and the appropriate tier is assigned.

Ms. O'Connell for BCMOE revealed that BCMOE intends to update the sampling frequency for pathogen analysis to require a 10-point composite sample be taken every 500 metric tons of finished product for fecal coliform and every 1,500 metric tons of finished product for salmonella.

3-2.4.1.8 Australia

Compost products must be initially tested to verify they meet the required standard: AS 4454: 2012. After the product testing establishes that the product consistently meets this standard, the frequency of testing can be adjusted to support the ongoing management and quality assurance requirements of the facility. If any significant changes are to be made to the feedstocks, the product testing should be increased.[99]

3-2.4.1.9 United Kingdom

The PAS 100 regulations state a minimum monitoring frequency.[100] The table titled Minimum Monitoring Frequency in Appendix E.6 shows the minimum testing frequency recommended.

3-2.4.1.10 Texas

Sampling frequencies are established in the Texas Administrative Code and differ for registered, permitted and other facilities.[101] Excerpts of these testing frequencies from the Texas Administrative Code are in Appendix E.7.

Table 3-11. Summary of Testing Frequency Regulations by Jurisdiction

Jurisdiction	Testing Frequency Requirements
Oregon DEQ	Sampling methods must be described in the operations plan. Pathogen testing must occur per the following: <2500 tpy (Types 1 and 2): 1 sample annually

[97] Code of Maryland Regulations. 2019. Title 15, Subtitle 18, Chapter 15.18.04, Section 4: Composting Facility Operator Requirements. http://mdrules.elaws.us/comar/15.18.04.04.

[98] Code of Maryland Regulations. 2019. Title 15, Subtitle 18, Chapter 15.18.04, Section 11: Table 1. Compost Quality Parameters. http://mdrules.elaws.us/comar/15.18.04.11.

[99] Environment Protection Authority Victoria. 2017. Designing, constructing and operating composting facilities. Publication 1588.1. June. https://ref.epa.vic.gov.au/~/media/Publications/ATTGTO5C.pdf.

[100] PAS 100:2002. Specification for composted materials.

[101] Texas Administrative Code, Title 30, Part 1, Chapter 332, Subchapter G, Rule 71: Sampling and Analysis Requirements for Final Product. https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=332&rl=71.

Table 3-11. Summary of Testing Frequency Regulations by Jurisdiction

Jurisdiction	Testing Frequency Requirements	
	>2500 tpy (Types 1 and 2): 1 sample per 5000 tons feedstock used or 1 sample every three months <2500 tpy (Type 3): 1 sample every four months >2500 tpy (Type 3): 1 sample per 5000 tons feedstock used or 1 sample monthly	
Metro	N/A	
Grimm's	A minimum of quarterly sampling for the following: Fecal coliform and salmonella Stability pH C:N ratio Electrical conductivity Metals (if required)	
Washington DOE	<5,000 ypy: 1 sample/year >5,000 ypy: 1 sample/ 5,000 cy of finished material "Representative" USCC TMECC Method 02.01-A through E Composite sampling	
CalRecycle	12:1 composite sample <1,000 ypy: exempt <5,000 ypy: 1 sample/year >5,000 ypy: 1 sample/ 5,000 cy of finished material	
Hawaii	No specific value limits found	
USCC/STA	Compost Quantity Produced	Frequency
	1 – 2500 tons	<1 per quarter
	2501 – 6200 tons	1 per quarter
	6201 – 17500 tons	1 per 2 months
	>17501 tons	1 per month
	*May test at half the frequency above for nonbiosolids compost. Stratified 15:1 sampling.	
Maryland	For facilities only accepting agricultural and yard waste, compost should be tested every 20,000 tons or every quarter, whichever is more frequent. If the compost test results always pass during the first year of operations, then the operator may test only once per year (pending test results remain within the limits). For facilities accepting other feedstocks, the operator should develop a quality assurance plan approved by the Department that describes monitoring, sampling, and testing of both the process and product during the first 15 months of operation for any new facility. The information gathered during the initial operations phase will inform the monitoring and sampling schedule moving forward. The testing includes metals, pH, PCBs, human-made inerts greater than 4 millimeters, and film plastic.	
Canada: AEP	No Information Found	
Canada: CCME	10:1 composite for 5,000 m^3 20:1 composite for 5,000-10,000 m^3	

Table 3-11. Summary of Testing Frequency Regulations by Jurisdiction

Jurisdiction	Testing Frequency Requirements
	40:1 composite for >10,000 m^3 Composite increments should be 2 liters
Canada: CFIA	No Information Found
Canada: BNQ	No Information Found
Australia	Compost products must be initially tested to verify they meet the required standard
United Kingdom	The PAS 100 regulations state a minimum monitoring frequency for temperature and moisture based on the method of composting utilized: Temperature – measured every working day during sanitization; measured once per week during stabilization Moisture – measured once at the end for in-vessel or once at the start for outdoor windrows during sanitization; measured once per week during stabilization
Texas	No Information Found

Notes:
C = carbon
m^3 = cubic meters
N = nitrogen
PAS = Publicly Available Specification
PCBs = polychlorinated biphenyls
tpy = ton(s) per year
ypy = yard(s) per year

Table 3-12. Summary of Biosolids Sample Frequencies for CalRecycle

Amount of Biosolids Compost Feedstock	Sampling Frequency
0-290 tons per day	Annually
290-1,500 tons per day	Quarterly
1,500-15,000 tons per day	Bi-Monthly
>15,000 tons per day	Monthly

Source: 14 CCR § 17868.1

3-2.4.2 Findings, Recommendations, and Level of Effort

3-2.4.2.1 Findings

Testing frequency and type of quality assurance tests for compost products differ greatly between jurisdictions and are often affected by tonnage. Requirements typically fall in the range of one test per month to one test per year. Some jurisdictions aim to keep testing at a minimum to reduce the cost of analysis, while others deem frequent testing necessary to protect both the facility and the end use buyer. Regardless of the testing frequency required, other internal tests must be carried out voluntarily by facilities in order to ascertain any meaningful data about the actual quality of the products sold on a day-to-day basis. These tests can include simple metrics such as weight by volume, water content, salinity, pH, and contamination.

3-2.4.2.2 Recommendations

Figure 3-3 provides a summary of findings and recommendations for testing frequency. Table 3-13 presents the recommendations by tier for testing frequency.

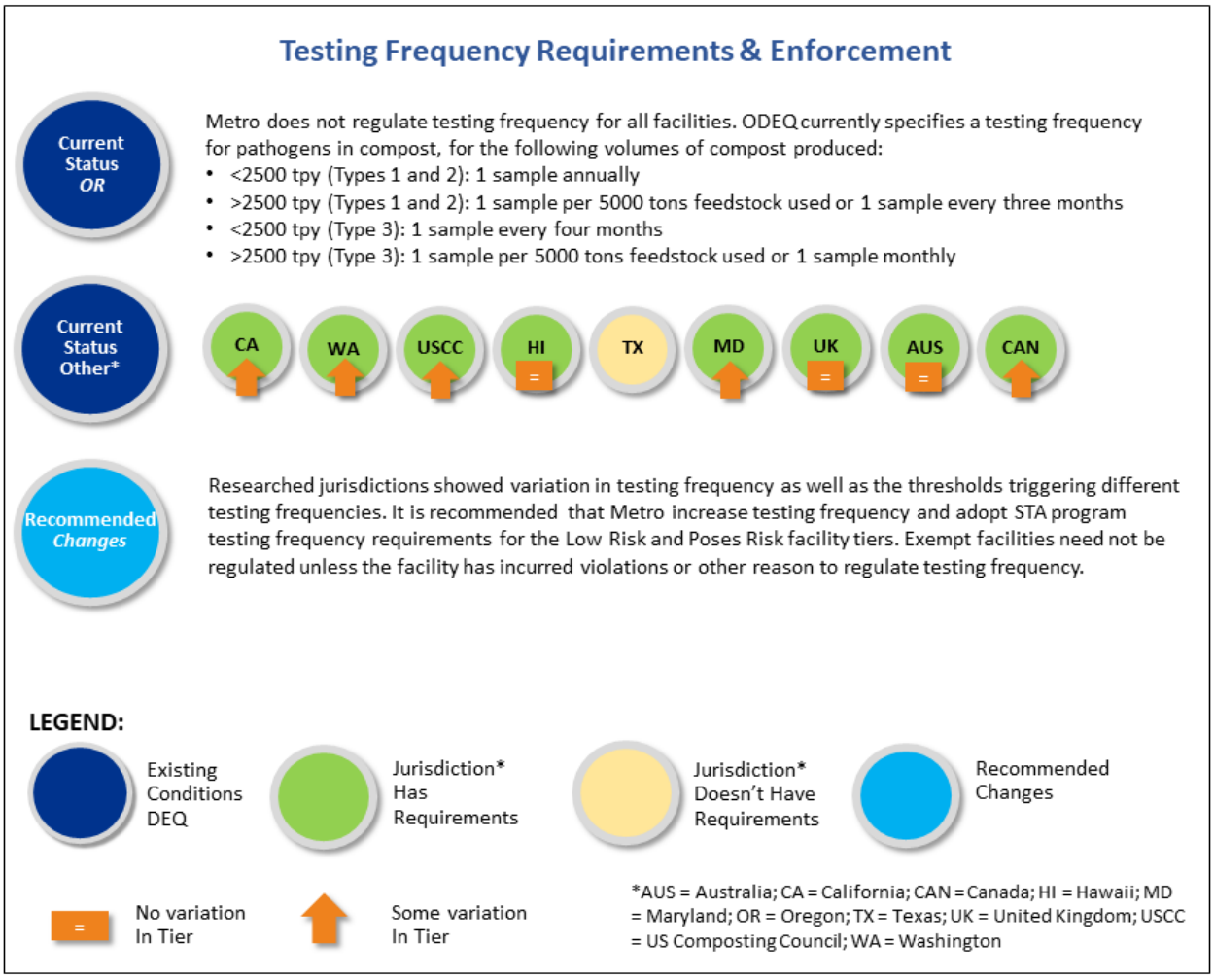

Figure 3-3. Testing Frequency Requirements and Enforcement

Table 3-13. Recommendations for Testing Frequency Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• None	• Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to testing frequency similar to the STA program
Low Risk / Registration Composting Facility Permit	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing	• Require facilities to participate in the STA program • Require increase in testing frequency and that the

Table 3-13. Recommendations for Testing Frequency Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
	data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements	Operations Plan and/or operational practices be reviewed and/or modified if not meeting other quality parameter requirements • Require that facilities electronically submit STA testing results to Metro • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives
Poses Potential Risk / Individual Composting Facility Permit	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements	• Require facilities to participate in the STA program • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting other quality parameter requirements • Require that facilities electronically submit STA testing results to Metro • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives

STA = Seal of Testing Assurance

For Low Risk and Poses Potential Risk facility tiers, it is recommended that Metro align sampling frequency requirements to the requirements of the STA program. The sampling frequency for Oregon DEQ requires that samples are taken less frequently than other jurisdictions like Washington, California, and British Columbia (since 5,000 tons of finished compost corresponds to approximately 10,000 cubic yards), but the analysis requirements in those jurisdictions are also more stringent than the requirements of Oregon DEQ. Samples should be taken according to the sampling frequency requirements of the STA program and should be submitted to Metro upon receipt of the results by the facility. Since the Metro facilities already participate in the STA program, the cost burden of performing the additional sampling is already realized. As previously mentioned, Jacobs recommends that Metro regularly review the STA program, including whenever it is modified to ensure that it aligns with Metro's testing objectives. For the Exempt facility tier, it is recommended that participation in the STA program not be required unless issues arise at the facility that warrant a need for regulation. In that case, Metro should regulate the Exempt facility as if it were a Low Risk facility.

Additionally, if facilities cannot meet any quality parameters, sampling will increase, at a minimum, to the frequency of the next tier level per Table 3-1 until the issue can be mitigated as shown by two consecutive sampling events. This is further described in other quality parameter sections.

The STA program includes increased testing frequency for larger compost facilities, which in effect, covers increased risk and differentiation in tier by design.

3-2.4.2.3 Level of Effort

Since Metro facilities already participate in the STA program, the level of effort to implement this requirement is minimal.

3-2.5 Contaminants

This section presents an overview and discussion of the requirements of the jurisdictions we researched. Contaminants in this section refer to human-made inerts or other physical contaminants such as plastic, glass, sharps, and stones. Chemical contaminants such as bioaerosols and pesticides are addressed in the Bioaerosols and Pesticides section of this chapter. Table 3-15, at the end of this section, contains the numerical limits on contaminants in finished compounds for all these jurisdictions, for comparison.

3-2.5.1 Research and Interview Summaries

Table 3-14 shows the contacts interviewed during the research of physical contaminant related quality requirements and enforcement in other regionally relevant jurisdictions.

Table 3-14. Contaminants Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Bryan Smith Bob Barrows
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
British Columbia Ministry of the Environment (BCMOE)	Maureen O'Connell
Maryland Department of Agriculture	Philip Davidson

In addition to the jurisdictions shown in Table 3-14, United States Composting Council STA program, State of California (CalRecycle), Hawaii, Texas Commission on Environmental Quality (TCEQ), Australia, Canada, and the United Kingdom were also researched, although no interviews were conducted. Summaries for each of the researched jurisdictions are included in the following subsections.

3-2.5.1.1 Oregon DEQ

Mr. Bob Barrows of Oregon DEQ was asked about contamination requirements for finished compost and to his knowledge there are no requirements at the Oregon DEQ level. Mr. Barrows mentioned that Oregon has established an unofficial "food only" policy statewide, but there are no plans to complete any rulemaking regarding this topic since it is already working without the formality in place. Mr. Barrows stated that many composters are happy with the "food only" policy. Mr. Barrows also stated that unlike Oregon DEQ, Metro has an official food only policy. These policies serve to prevent contamination in the finished compost because one cannot often tell the difference between compostable flatware and other plastic utensils. This policy excludes "compostable" packaging materials and has been met with some challenge from the USCC. In a position statement released April 22, 2019 the USCC stated "While some Oregon compost manufacturers face unique challenges that lead them to a "food only" policy in the near term, we believe that over the long haul we can work together across the "value chain" to develop creative solutions to every obstacle limiting the growth of our industry." [102] According to Mr. Barrows, many composters in the State of Oregon already sample and analyze their compost in accordance with the STA program. This program includes analyses for evaluating contaminants in the finished product.

[102] United States Composting Council. 2019. USCC Response to Oregon Composters. https://www.compostingcouncil.org/general/custom.asp?page=BlogUSCC-ResponseToOregonComposters.

3-2.5.1.2 Washington

Per WAC 173-350-220, contamination is limited to 1% of physical contaminants by weight, inclusive of 0.25% film plastic by weight, and no sharps.[103, 104]

3-2.5.1.3 California (CalRecycle)

Per 14 CCR § 17868.3.1, "compost shall not contain more than 0.5% by dry weight of physical contaminants greater than 4 millimeters; no more than 20% by dry weight of this 0.5% shall be film plastic greater than 4 millimeters."[105]

3-2.5.1.4 Hawaii

Per Hawaii Administrative Rules (HAR) 11-58.1-41, the facility must describe operational procedures and quality of the compost, including how the compost should be "free of injurious components or particles".[106]

3-2.5.1.5 United States Composting Council

USCC does not have requirements for physical contaminants; however, USCC recommends TMECC 03.08-A as a test method with results presented as a percentage by dry weight. These parameters can be included in USCC STA reporting for informational purposes.[107]

3-2.5.1.6 Maryland

Per COMAR 15.18.04.05, there are different limits based on the type of compost. For General Use Compost (described as able to pass through a 12-millimeter screen, stabilized, with no objectionable odors), compost must contain less than 2% dry weight of human-made inerts > 4mm and less than 2% dry weight film plastic > 4mm. Limited Use Compost (described as able to pass through an 18-millimeter screen, stabilized, with no objectionable odors) has the same requirements, except may contain up to 4% dry weight human-made inerts.[108]

3-2.5.1.7 Canada

The CCME, CFIA, and BNQ are harmonized in this area and limit the foreign matter and sharp foreign matter in compost products by size as well as maximum concentration within product, with ascending strictness for higher class products (Category AA= highest standards, then Category A, and Category B= lower standards). A table from the BNQ standards for Quality Criteria, including contaminants, is available in Section 3.6 of Appendix E.4.[109] The standards for contaminants are consistent between the CCME,[110] CFIA, and BNQ for categories A and B. The BNQ's Category AA has the same requirements as Category A, except more stringent criteria on foreign matter.

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[103] Washington Administrative Code. 2018. Title 173, Chapter 350, Section 220: Composting Facilities. https://apps.leg.wa.gov/WAC/default.aspx?cite=173-350-220.

[104] Department of Ecology, State of Washington. 2013. Siting and Operating Composting Facilities in Washington State, Good Management Practices, Publication No. 11-07-005. July. https://fortress.wa.gov/ecy/publications/publications/1107005.pdf.

[105] California Code of Regulations. 2019. Title 14, Division 7, Chapter 3.1, Article 7, Section 17868.3.1: Physical Contamination Limits. https://govt.westlaw.com/calregs/Document/I978C116BD2DF4472ACEADBAE443C29D1?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)&bhcp=1.

[106] Hawaii Administrative Rules. Title 11, Chapter 58.1, Subchapter 4, Section 11-58.1-41: Composting facilities. https://health.hawaii.gov/shwb/files/2013/06/11-5811.pdf.

[107] United States Composting Council. 2006. The US Composting Council's Seal of Testing Assurance Program: (How to Tell What Compost "is"). https://www.calrecycle.ca.gov/docs/cr/organics/erosion/workshops/2006bmpct/sacramento-cotton.pdf.

[108] Code of Maryland Regulations. 2019. Title 15, Subtitle 18, Chapter 15.18.04, Section 15.18.04.05: Compost Classification. http://mdrules.elaws.us/comar/15.18.04.05.

[109] Bureau de normalisation du Québec. 2016. CAN/BNQ 0413-200: Organic Soil Conditioners – Composts. February 29. https://www.bnq.qc.ca/en/standardization/environment/composts.html.

[110] Canadian Council of Ministers of the Environment. 2005. Guidelines for Compost Quality. https://www.ccme.ca/files/Resources/waste/organics/compostgdlns_1340_e.pdf.

Based on the interview with Maureen O'Connell, the BCMOE intends to lower the limit of foreign matter content from 1.0 percent to 0.5 percent for retail grade and managed organic matter. This is being done to support compost quality. BCMOE also intends to revise the regulations to introduce a limit for plastic of less than or equal to 0.25 percent dry weight.

The Ontario Ministry of the Environment (OMOE) regulates compost per the Ontario Compost Quality Standards and has requirements for foreign matter and sharp foreign matter as shown in Table 3-15.[111]

3-2.5.1.8 Australia

The Victoria EPA states that most contamination should be removed during the preprocessing stage since it is more difficult to remove from the finished product. The table titled "Physical Contaminant Limits" in Appendix E.5 outlines physical contamination limits, as specified in AS 4454: 2012.[112]

3-2.5.1.9 United Kingdom

Only voluntary standards exist for contaminant testing. For physical contaminants such as glass, metal, plastic, and other non-stone fragments less than 2 millimeters, the limit is 0.5% mass/mass total for an "air dry" sample, of which up to 0.25% can be plastic. A limit of 8% mass/mass of stones greater than 4 mm is allowed. An average number of 0 weed seeds and propagules is allowed per liter of compost. [113]

3-2.5.1.10 Texas

Per Texas Administrative Code, Title 30, Part 1, Chapter 332, Subchapter G, Rule 72, Compost products in Texas are classified into the following three grades:[114]

- Grade 1 Compost: contains no foreign matter that can cause injury to human or animals, does not have foreign matter cumulatively exceeding 1.5% on a dry weight basis on a 4mm screen, meets pathogen reduction, salinity and pH requirements for grade 1 compost in the code
- Grade 2 Compost: contains no foreign matter that can cause injury to human or animals, does not have foreign matter cumulatively exceeding 1.5% on a dry weight basis on a 4mm screen, meets pathogen reduction, salinity and pH requirements for grade 2 compost in the code
- (3) Waste Grade Compost: exceeds any of the maximum allowable concentrations for grade 2 compost or does not meet the requirements of grade 1 or 2 compost

Analytical data quality shall be established by EPA standard laboratory practices to ensure precision and accuracy.

Contaminant testing is required on a weight percent of foreign matter, dry weight basis. Analysis for foreign matter shall utilize "Recommended Test Methods for the Examination of Composts and Composting" (Composting Council, 1995)[115]. [116]

[111] Ontario Ministry of the Environment. 2019. Ontario Compost Quality Standards. https://www.ontario.ca/page/ontario-compost-quality-standards#section-2.

[112] Environment Protection Authority Victoria. 2017. Designing, constructing and operating composting facilities. Publication 1588.1. June. https://ref.epa.vic.gov.au/~/media/Publications/ATTGTO5C.pdf.

[113] BioCycle. 2006. United Kingdom, Setting the Standards for Compost. June. http://www.alexassoc.net/articles/Compost%20Labeling%20%26%20Certification/Biocycle%20STA-PAS%20article%206-06.pdf.

[114] Texas Administrative Code, Title 30, Part 1, Chapter 332, Subchapter G, Rule 72: Final Product Grades. https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=332&rl=72.

[115] United States Composting Council. 1995. Recommended Test Methods for the Examination of Composts and Composting. https://www.compostingcouncil.org/page/tmecc.

[116] Texas Administrative Code, Title 30, Part 1, Chapter 332, Subchapter G, Rule 72: Final Product Grades. https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=332&rl=72.

Table 3-15. Summary of Contamination Regulations by Jurisdiction

Jurisdiction	Contaminants			
Oregon DEQ	Based on product marketability			
Metro	No Information Found			
Grimm's	No Information Found			
Washington DOE	≤ 1 percent by weight total, not to exceed 0.25 percent film plastic by weight, no sharps			
CalRecycle	<0.5% contaminants by dry weight >4 mm , <20% of 0.5% shall be film plastic >4 mm			
Hawaii	Compost should be "free of injurious components or particles"			
USCC/STA	Recommended testing method is TMECC 03.08-A, reported in percentage by dry weight			
Maryland	For General Use Compost: Less than 2% dry weight of human-made inerts > 4mm, less than 2% dry weight film plastic > 4mm. Limited Use Compost has the same requirements, except may contain up to 4% dry weight human-made inerts.			
Canada: AEP	No Information Found			
Canada: CCME	***A***		***B***	
	Foreign Matter			
	≤1 piece >25 mm in any dimension/500 mL		≤2 pieces >25 mm in any dimension/500 mL	
	Sharps			
	0 pieces >3 mm/500 mL		<3 pieces /500 mL; 12.5 mm max	
Canada: CFIA	No Information Found			
Canada: BNQ	Class AA: ≤0.01% DW; no sharp contaminants <3mm Class A: ≤0.5% DW;			
Canada: OMOE	***Maximum Concentration of Foreign Matter in Compost***			
	Parameter	***Category AA***	***Category A***	***Category B***
	Foreign matter	Total foreign matter greater than 3 mm <1.0%, DW, and plastic <0.5%; no pieces >25 mm/500 mL.	Total foreign matter greater than 3 mm <1.0%, DW, and plastic <0.5%; no pieces 25 mm/500 mL.	Total foreign matter greater than 3 mm <2.0%, DW, and plastic <0.5%; no pieces >25 mm/500 mL.
	Sharp foreign matter	Compost shall contain no material of a size or shape that can reasonably cause human or animal injury.	Compost shall contain no material of a size or shape that can reasonably cause human or animal injury.	Compost shall have a maximum of 3 pieces of sharp foreign matter per 500 mL; and the maximum dimension of any sharp foreign matter shall be 12.5 mm.
Canada: BC	Foreign Matter ≤1% DW, No sharp objects such as glass or metal shard in a size and shape that can cause injury.			

Table 3-15. Summary of Contamination Regulations by Jurisdiction

Jurisdiction	Contaminants
Australia	Glass, metal and rigid plastics: Less than or equal to 0.5% DW Plastics: Less than or equal to 0.05% DW
United Kingdom	Only voluntary standards exist: Glass, metal, plastic and non-stone fragments >2mm: 0.5% mass/mass air dry sample, with up to 0.25% mass/mass of plastic Stones >4mm: 8% mass/mass Weed seeds and propagules: average of 0 seeds and propagules per liter of compost
Texas	No Information Found

Notes:

DW = dry weight

mL = milliliter

mm = millimeter

3-2.5.2 Findings, Recommendations, and Level of Effort

3-2.5.2.1 Findings

Approaches to contaminant standards vary widely by location and usually include more than one threshold based on the number of compost classes that exist. The US EPA's standard allows for a greater content of impurities in the form or stones than glass or plastic since it is designed to regulate sludge products. In more developed markets, the presence of weeds was also regulated (United Kingdom, Canada).

While different than most contamination concerns, the control of apple maggots in compost product has been a huge problem in Washington state. Food waste cannot be trucked from Seattle into the composting plants in apple-growing areas. Jacobs is not currently aware of any local concerns such as this in Oregon, but local issues for invasive and destructive pests should be monitored as they may lead to additional restrictions and quarantines.

3-2.5.2.2 Recommendations

Figure 3-4 provides a summary of findings and recommendations for contaminants. Table 3-16 presents the recommendations by tier for contaminants.

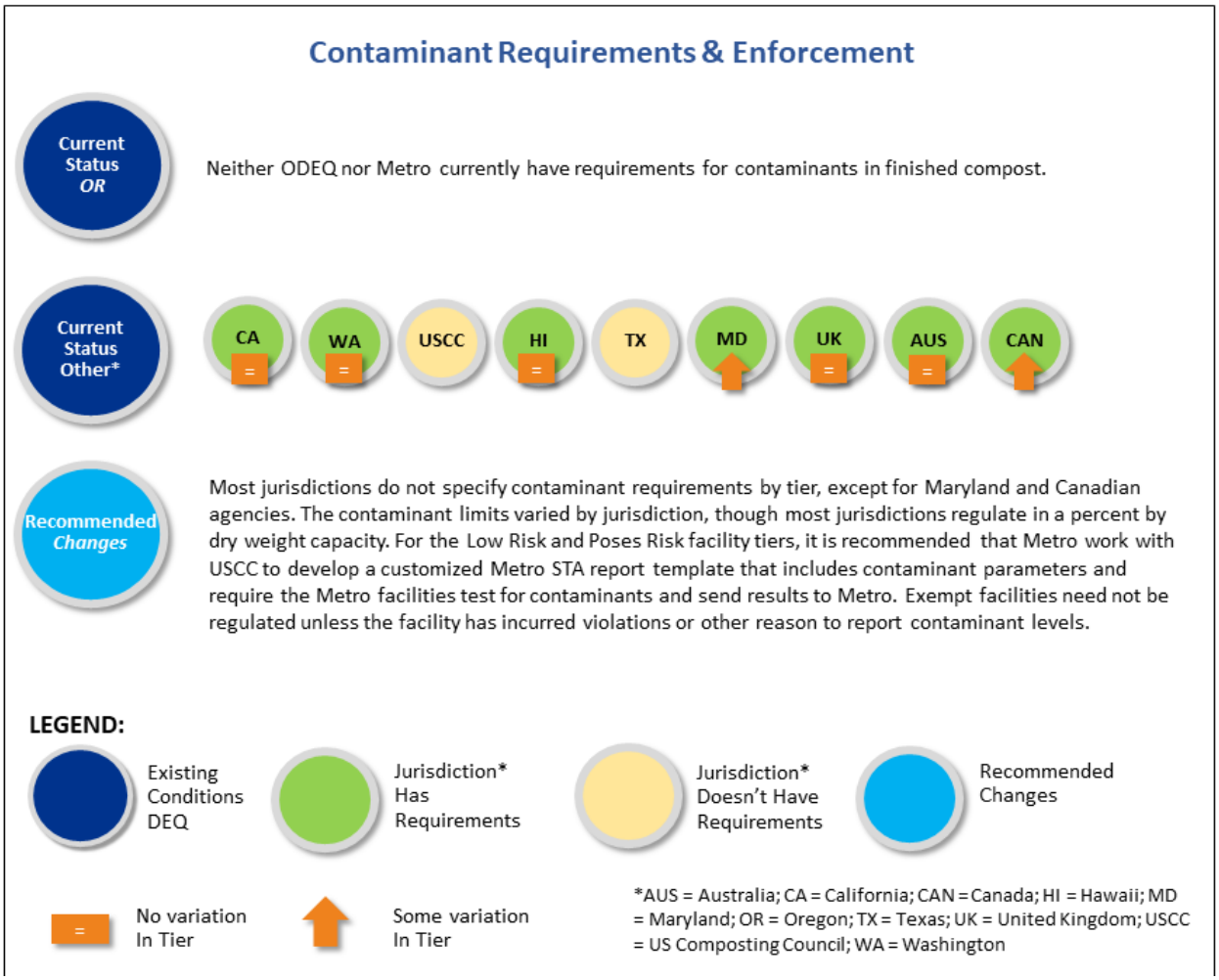

Figure 3-4. Contaminant Requirements and Enforcement

Table 3-16. Recommendations for Contaminant Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• None	• Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to contaminant testing and reporting
Low Risk / Registration Composting Facility Permit	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements	• Require facilities to participate in the STA program. Complaints about quality will trigger increased sampling and potentially process changes until the problem can be identified and addressed • Require increase in testing frequency and that the Operations Plan and/or

Table 3-16. Recommendations for Contaminant Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
	• If the retest sample still confirms an issue with quality, the compost will need to be dealt with appropriately (e.g. compost deemed not saleable). Then, the source of the problem must be determined and mitigated (e.g. look at feedstock quality and screening procedures and correct deficiencies)	operational practices be reviewed and/or modified if not meeting STA requirements • Work with USCC to create a customized Metro report format that includes physical contamination results per TMECC 03.08-A • Require that facilities electronically submit STA testing results to Metro to learn about amount of plastic, metal, glass, stones, and sharps present (percent by dry weight) • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives • Require facilities to retest and evaluate operations, if not meeting Metro's requirements
Poses Potential Risk / Individual Composting Facility Permit	• Participate in the STA program by following the recommended testing frequency dictated by the STA program and send testing data to Metro after receipt of the data • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost will need to be dealt with appropriately (e.g. compost deemed not saleable). Then, the source of the problem must be determined and mitigated (e.g. look at feedstock quality and screening procedures and correct deficiencies)	• Require facilities to participate in the STA program. Complaints about quality will trigger increased sampling and potentially process changes until the problem can be identified and addressed • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Work with USCC to create a customized Metro report format that includes physical contamination results per TMECC 03.08-A • Require that facilities electronically submit STA testing results to Metro to learn about amount of plastic, metal, glass, stones, and sharps present (percent by dry weight) • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives

Table 3-16. Recommendations for Contaminant Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
		• Require facilities to retest and evaluate operations, if not meeting Metro's requirements

STA = Seal of Testing Assurance

Jacobs recommends that Metro require facilities in the region to participate in the STA program to address concerns with contaminants. Samples should be taken according to the sampling frequency requirements of the STA program. STA program recommends TMECC 03.08-A to test for plastic, metal, glass, stones, and sharps. Results are presented in a percent by dry weight format. Although a contaminant limit is not established as part of the program, contaminant information can be presented in the report. This report, when provided to end-use customers, will inform their buying decision as a finished compost with too much contamination in the report may be refused. Additionally, these reports are frequently provided to local enforcement agencies for review.

Metro should also consider the number of quality complaints from end-users on a facility's compost. Complaints about quality will trigger increased sampling and potentially process changes until the problem can be identified and addressed. Sampling will increase, at a minimum, to the frequency of the next tier level per Table 3-1 until the issue can be mitigated as shown by two consecutive sampling events.

If a facility does not meet standards for a quality parameter, the following steps should be taken:

- Retest to confirm sample results and prevent unnecessary action from a false positive.
- If the quality requirement is not met in the retest sample, the facility should review operational practices and investigate the source of the issue. If changes to operations are needed, work with Metro to determine the required changes for the Operations Plan.
- The facility will be subject to more frequent sampling equivalent to the next tier level per Table 3-1. For example, if required to sample once per quarter, composter must now sample once per two months until two rounds of passing results are achieved. If the facility is already sampling monthly, continue a monthly frequency, but work on determining source of problem and implementing operational changes, if needed.

If the retest sample still confirms an issue with quality, the compost will need to be dealt with appropriately (e.g. compost deemed not saleable). Then, the source of the problem must be determined and mitigated (e.g. look at feedstock quality and screening procedures and correct deficiencies).

Jacobs also recommends that Metro work with USCC to develop a customized report format for Metro facilities and require facilities to send electronic submittal of STA compost results so that data can be reviewed. Sample results should be sent to Metro when they are received by the facility. The jurisdictional research performed revealed that the contaminant requirements across the jurisdictions were not consistent enough to make a quantitative recommendation for limits. However, a review of the data provided to Metro will help to inform Metro if limits for contaminants are necessary and at what level they should be established, at a minimum no contaminant materials should be of a size or shape that could potentially harm humans, animals, or the environment. As with the other recommendations that include the STA requirements, Jacobs recommends that Metro regularly review the STA program, including whenever it is modified to ensure that it aligns with Metro's testing objectives.

The STA program includes increased testing frequency for larger compost facilities, which in effect, covers increased risk and differentiation in tier by design.

3-2.5.2.3 Level of Effort

Because Metro facilities are already participating in the STA program, level of effort is reduced for these recommendations. Working with USCC to develop a customized STA report template for Metro facilities will entail some time and effort; however, USCC customizes report templates for other jurisdictions so the effort is not envisioned to be significant.

3-2.6 Stability and Maturity

This section presents an overview and discussion of the requirements of the jurisdictions researched. Table 3-18, at the end of this section, contains the numerical limits on stability and maturity in finished compounds for all these jurisdictions, for comparison.

3-2.6.1 Research and Interview Summaries

Table 3-17 shows the contacts interviewed during the research of stability and maturity related quality requirements and enforcement in other regionally relevant jurisdictions.

Table 3-17. Stability and Maturity Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Bryan Smith Bob Barrows
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer
British Columbia Ministry of the Environment (BCMOE)	Maureen O'Connell
Maryland Department of Agriculture	Philip Davidson

In addition to the jurisdictions shown in Table 3-17, United States Composting Council STA program, State of California (CalRecycle), Hawaii, Texas Commission on Environmental Quality (TCEQ), Australia, Canada, and the United Kingdom were also researched, although no interviews were conducted. Summaries for each of the researched jurisdictions are included in the following subsections.

3-2.6.1.1 Oregon DEQ

No information on this topic was found.

3-2.6.1.2 Washington

No information on this topic was found.

3-2.6.1.3 California (CalRecycle)

No information on this topic was found.

3-2.6.1.4 United States Composting Council

Stability and maturity testing are required through the STA program[117]. Stability must be tested using the methods found in the TMECC 5.08 Respirometry[118]. Maturity is indicated by bioassay using the methods

[117] United States Composting Council. 2019. STA Certified Compost. https://www.compostingcouncil.org/page/CertifiedCompostSTA.
[118] United States Composting Council. 2002. Test Methods for the Examination of Composting and Compost 05.08 Respirometry.

found in TMECC 05.05-A for seedling emergence and seedling vigor[119]. It should be noted that the STA program does not set limits for stability and maturity but the analysis of compost for these parameters will yield a reportable result that customers can use to inform their buying decision.

3-2.6.1.5 Hawaii

Per Hawaii Administrative Rules (HAR) 11-58.1-41, the facility must describe operational procedures and quality of the compost, including how the compost shall become "biologically and chemically stable… and capable of sustaining plant growth". [120]

3-2.6.1.6 Maryland

Both general and limited use compost products must be stabilized. To be considered stable, compost must have ceased active biological decomposition, which is tested against this parameter: temperature of a 4-foot-high, 6-foot-diameter pile of compost may not rise more than 20°C above ambient temperature when the pile is left undisturbed for 72 hours at the composting facility.[121]

3-2.6.1.7 Canada

The CCME and BNQ have adopted the same standards for product stability and maturity.[122][123] Under both programs, compost must be stable and mature at the time of sale. Compost product must meet one of three standards to be considered stable and mature. The requirement for compost to be stable at the time of sale must be met regardless of product class. The standards are as follows. Only one of these standards must be met for the material to be considered stable:

- The temperature of the compost is not more than 8°C above ambient temperature.
- The respiration rate is no more than 400 milligrams of oxygen per kilogram of organic matter per hour.
- The carbon dioxide production rate is no more than 4 milligrams of carbon dioxide per gram of organic matter per day.

Ms. Maureen O'Connell of the British Columbia Ministry of Environment and Climate Change Strategy - Environmental Standards Branch was interviewed regarding this topic and stated that BCMOE plans to revise the regulations to clarify the definitions of curing, and finished compost/product. The BCMOE plans to align these definitions with other national standards and regulations.

3-2.6.1.8 Australia

Maturity is determined using a maturity index. Maturity is determined by assessing the complimentary characteristics of biological stability (Group A) and plant growth response (Group B)[124].

Maturity can be tested using relatively simple and affordable on-site tests for release of a product for sale. Quantitative analytical methods are typically used during research and product development phases. Both tests can also be performed at a laboratory to assess compliance with the maturity index requirements.

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[119] United States Composting Council. 2002. Test Methods for the Examination of Composting and Compost 05.05-A Maturity.

[120] Hawaii Administrative Rules. Title 11, Chapter 58.1, Subchapter 4, Section 11-58.1-41: Composting facilities. https://health.hawaii.gov/shwb/files/2013/06/11-5811.pdf.

[121] Code of Maryland Regulations. 2013. Title 15, Subtitle 18, Chapter 4: Compost. http://mdrules.elaws.us/comar/15.18.04.05.

[122] Canadian Council of Ministers of the Environment. 2005. Guidelines for Compost Quality. https://www.ccme.ca/files/Resources/waste/organics/compostgdlns_1340_e.pdf.

[22] Bureau de normalisation du Québec. 2016. CAN/BNQ 0413-200: Organic Soil Conditioners – Composts. February 29. https://www.bnq.qc.ca/en/standardization/environment/composts.html.

[124] Environmental Protection Agency Victoria, Australia. 2019. Information Sheet No. 3-8, Producing Quality Compost. http://catchmentsolutions.com.au/files/2014/11/IS3-08.pdf.

There are three classes of products regulated by the Victoria EPA based on a range of factors designed to protect human and animal health, the environment and filling the needs of end-users.[125] The definitions of these classes are listed as follows in order of increasing value:

- Pasteurized product: An organic product that has undergone pasteurization as defined in section 7.1.1 but is relatively immature and lacking biological stability.
- Compost: An organic product that has undergone controlled aerobic and thermophilic biological transformation through the composting process to achieve pasteurization and reduce phytotoxic compounds and has achieved a specified level of maturity for compost for three tests, including at least one from Group A and one from Group B (as stated in AS 4454: 2012 Appendix N).
- Mature compost: An organic product that has undergone controlled aerobic and thermophilic biological transformation through the composting process to achieve pasteurization and exhibits lower levels of phytotoxicity and a higher degree of biological stability as indicated by the product meeting the levels specified in four tests including two from Group A and two from Group B (as stated in AS 4454: 2012 Appendix N).

3-2.6.1.9 United Kingdom

There are no requirements for stability of compost. The degree of stability recommended is based on the end use of the product, with more sensitive end uses requiring higher stability. While there is no set method of testing for stability, the UK Composting Industry Code provides a table of respiration rates (the rate at which compost releases carbon dioxide) and recommended composting times to achieve an acceptable level of maturity (see the table titled “Stability Testing” in the Appendix E.6).[126]

3-2.6.1.10 Texas

Stability analysis is based on the reduction of organic matter calculation method and is required for the first 18 months of operation, the completion of the maturity testing protocol, or the facility quality assurance and quality control plan, whichever comes first. Going forward, the method recommended in the protocol and approved by the Texas Natural Resource Conservation Commission (TNRCC) should be utilized.[127] The calculation is performed by measuring the volatile solids content at two points in the composting process: first when the feedstocks are added, and second when the product is sampled at completion for total metals and PCBs. Excerpts of these testing methods from the Texas Administrative Code are in the Appendix E.7.

Table 3-18. Summary of Stability and Maturity Requirements by Jurisdiction

Jurisdiction	Stability/Maturity
Oregon DEQ	No Information Found
Metro	No Information Found
Grimm’s	Stability testing required every quarter at a minimum. SolvitaTM test kits are recommended for this testing.
Washington DOE	No Information Found
CalRecycle	No Information Found

[125] Environment Protection Authority Victoria. 2017. Designing, constructing and operating composting facilities. Publication 1588.1. June. https://ref.epa.vic.gov.au/~/media/Publications/ATTGTO5C.pdf.

[126] The Composting Association. 2005. The Composting Industry Code of Practice. http://www.organics-recycling.org.uk/dmdocuments/Composting_Industry_Code_of_Practice.pdf.

[127] State of Texas. 2019. Sampling and Analysis Requirements for Final Product. https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=332&rl=71.

Table 3-18. Summary of Stability and Maturity Requirements by Jurisdiction

Jurisdiction	Stability/Maturity
Hawaii	The facility must describe operational procedures and quality of the compost, including how the compost shall become "biologically and chemically stable… and capable of sustaining plant growth"
USCC/STA	Stability testing is required and must be reported in TMECC 5.08 Respirometry.
Maryland	Both general and limited use compost products must be stabilized. To be considered stable, compost must have ceased active biological decomposition, which is tested against these parameters: Temperature of a 4-foot-high, 6-foot-diameter pile of compost may not rise more than 20°C above ambient temperature when the pile is left undisturbed for 72 hours at the composting facility.
Canada	To be considered mature and stable, compost must be cured for a minimum of 21 days, and meet one of the following requirements: • Respiration rate less than or equal to 400 mg O2/kg VS (or OM) per hour • CO2 evolution rate less than or equal to 4 mg C-CO2/kg OM per day Temperature rise above ambient less than 8°C
Australia	There are three classes of products regulated by the Victoria EPA: Pasteurized: low level of stability and maturity. Compost: Passing 3 stability and maturity tests Mature Compost: Passing 4 stability and maturity tests
United Kingdom	There are no requirements for stability of compost, however, temporal guidelines are provided in regulation for achieving the varying levels of maturity.
Texas	Stability analysis is based on the reduction of organic matter calculation method and is required for the first 18 months of operation, the completion of the maturity testing protocol, or the facility quality assurance and quality control plan, whichever comes first.

3-2.6.2 Findings, Recommendations, and Level of Effort

3-2.6.2.1 Findings

Neither Oregon nor Metro appear to have any jurisdiction-wide requirements for stability and maturity in finished compost. However, in the newest Grimm's Fuel Company facility license, stability monitoring in finished compost is required.

California, Washington, and the United Kingdom have not developed stability or maturity requirements for finished compost. The United Kingdom does have guidelines for achieving maturity.

Hawaii requires that facilities describe in the operations plan, how the quality of the compost will be achieved with respect to biological and chemical stability, including capability to sustain plant growth.

Maryland and Canada require that compost meet stability and maturity requirements prior to sale regardless of material classification.

Texas and Australia have developed jurisdictional stability and maturity requirements that determine product classification.

3-2.6.2.2 Recommendations

Figure 3-5 provides a summary of the findings and recommendations for stability and maturity. As shown in Table 3-19, we recommend that requirements increase with increasing tier and risk level.

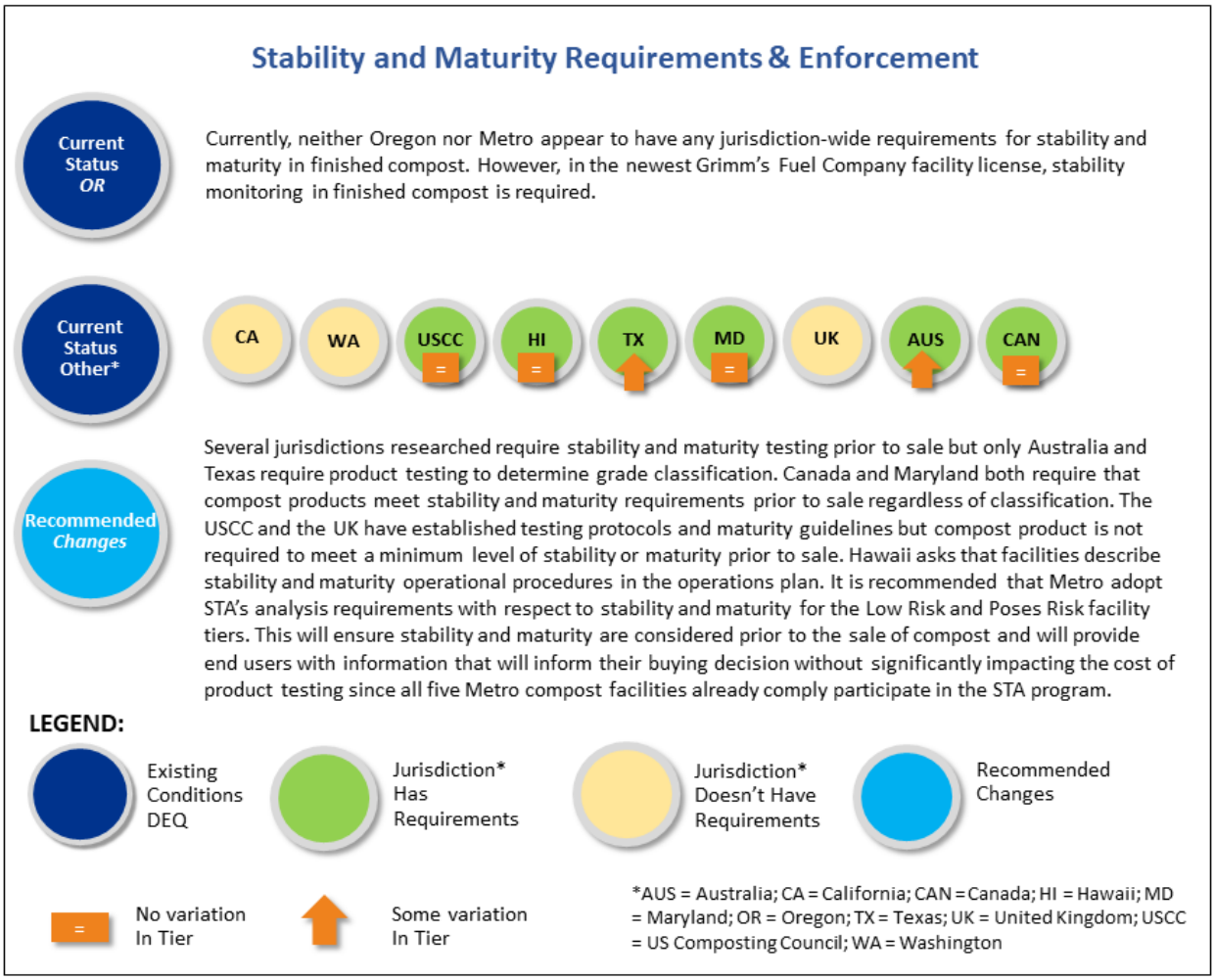

Figure 3-5. Stability and Maturity Requirements and Enforcement

Table 3-19. Recommendations for Stability and Maturity Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• None	• Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to testing and thresholds similar to the STA program
Low Risk / Registration Composting Facility Permit	• Perform regular periodic sampling and analysis for stability	• Update facility licenses to require stability sampling and analysis

Table 3-19. Recommendations for Stability and Maturity Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
	and maturity as required by the STA program • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost should be sent back through PFRP. Then, the source of the problem must be determined and mitigated (e.g. pile size, time and temperature of active composting and deficiencies corrected)	• Verify sampling is occurring by reviewing STA reports provided by the operator • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Require facilities to retest and evaluate operations, if not meeting requirements
Poses Potential Risk / Individual Composting Facility Permit	• Perform regular periodic sampling and analysis for stability and maturity as required by the STA program • Retest and evaluate operations, if not meeting quality requirements • If the retest sample still confirms an issue with quality, the compost should be sent back through PFRP. Then, the source of the problem must be determined and mitigated (e.g. pile size, time and temperature of active composting and deficiencies corrected)	• Update facility licenses to require stability sampling and analysis • Verify sampling is occurring by reviewing STA reports provided by the operator • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements • Require facilities to retest and evaluate operations, if not meeting requirements

PFRP = Process To Further Reduce Pathogens
STA = Seal of Testing Assurance

Additional details of each of these requirements is discussed below:

- Require facilities above the exempt tier to perform regular periodic sampling and analysis for stability and maturity as required by the USCC STA program. If an exempt facility exhibits issues, Metro can choose to regulate them as a Low Risk facility.
- Update facility licenses, as was done with the revised Grimm's license to require sampling and analysis for stability. Include requirements for analysis of maturity as well.
- Verify the analysis of stability and maturity by reviewing the STA reports provided to Metro by the operator.

If a facility does not meet standards for a quality parameter, the following steps should be taken:

- Retest to confirm sample results and prevent unnecessary action from a false positive.
- If the quality requirement is not met in the retest sample, the facility should review operational practices and investigate the source of the issue. If changes to operations are needed, work with Metro to determine the required changes for the Operations Plan.
- The facility will be subject to more frequent sampling equivalent to the next tier level per Table 3-1. For example, if required to sample once per quarter, composter must now sample once per two months until two rounds of passing results are achieved. If the facility is already sampling monthly,

continue a monthly frequency, but work on determining source of problem and implementing operational changes, if needed.

If the retest sample still confirms an issue with quality, the compost should be sent back through PFRP. Then, the source of the problem must be determined and mitigated (e.g. pile size, time and temperature of active composting and deficiencies corrected).

The STA program includes increased testing frequency for larger compost facilities, which in effect, covers increased risk and differentiation in tier by design.

3-2.6.2.3 Level of Effort

Requiring facilities to pass or classify material based on stability and maturity testing, like Canada, Maryland, Australia, or Texas, has the potential to put Metro facilities at a competitive disadvantage to other facilities in the state. Conversely, providing quality compost has the advantage of boosting customer confidence. This will be considered in more depth as part of Topic 3.

Requiring sampling and analysis of stability and maturity in finished compost as required by the USCC STA program will result in no additional effort on the part of the five Metro facility operators as they already voluntarily participate in the program.

Metro can minimize the level of effort in revising the licenses to include the recommended stability and maturity analysis requirements by making the change at the time of the next global revision for each facility. Because facilities are already participating voluntarily the additional effort of revising the licenses specifically for this requirement is not worth the effort.

3-2.7 Bioaerosols and Pesticides

This section presents an overview and discussion of the requirements of the jurisdictions that Jacobs researched. Pesticides and herbicides encompass a wide variety of constituents. None of the researched jurisdictions ban or limit the sale of compost based on the presence of pesticides or herbicides. However, two jurisdictions, Oregon and Washington, have implemented source control regulations to minimize the amount of a specific pesticide, clopyralid, in finished compost due in large part to its resilience in compost.

Bioaerosols encompass a wide spectrum as well. Airborne particles or toxins from a biological source (bacteria, fungi, virus, protozoa, algae, pollen…) are all considered bioaerosols. Of the jurisdictions researched only the United Kingdom has bioaerosol control requirements. Similar to dust, bioaerosols may be released during activities such as such as grinding, shredding, compost pile turning, or compost screening.[128]

3-2.7.1 Research and Interview Summaries

Table 3-20 shows the contacts interviewed during the research of bioaerosol and pesticide related quality requirements and enforcement in other regionally relevant jurisdictions.

Table 3-20. Bioaerosols and Pesticide Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Bryan Smith Bob Barrows
Washington Department of the Ecology (WDOE)	Mary Harrington and Dawn Marie Maurer

[128] Frontiers in Cellular and Infection Microbiology. 2014. Bioaerosols from compost facilities – a review. Natalie Wery. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3983499/.

In addition to the jurisdictions shown in Table 3-20, USCC STA program, State of California (CalRecycle), Hawaii, Texas Commission on Environmental Quality (TCEQ), Australia, Canada, and the United Kingdom were also researched, although no interviews were conducted. Summaries for each of the researched jurisdictions are included in the following subsections.

3-2.7.1.1 Oregon DEQ

Based on the findings of our research Oregon DEQ does not regulate pesticides or bioaerosols in finished compost. However, the Oregon Department of Agriculture limits the use of clopyralid to agricultural, forest, right-of-way, golf course and cemetery sites. The Department also prohibited the use of grass clippings or other materials from a treated site for use in compost.[129] This type of source control has been effective in Washington where clopyralid use was also limited.

3-2.7.1.2 Metro

No information on this topic was found.

3-2.7.1.3 Grimm's Report

No information on this topic was found.

3-2.7.1.4 Washington

Based on the findings of our research Washington DOE does not regulate pesticides or bioaerosols in finished compost. The Washington State Department of Agriculture (WSDA) enacted an emergency ban in March 2002, which barred the use of clopyralid, an herbicide that had damaged lawns and turfs using compost containing this contaminant in the state.[130]

Clopyralid appears to break down very slowly during the composting process unlike other herbicides and pesticides that tend to breakdown during the composting process. As a result, clopyralid tends to find its way into finished compost products and can damage plants. Approximately 18 months after the ban clopyralid levels in compost had declined by almost 90 percent.[131]

3-2.7.1.5 California (CalRecycle)

California limits the use of specific pesticides to prevent their presence in finished compost products, To address pesticide and herbicide issues CalRecycle cooperates with the California Department of Pesticide Regulations (DPR), California Department of Food Agriculture (CDFA), U.S. Department of Agriculture's (USDA) National Organic Program (NOP), farmers, and composters. The state has targeted carboxylic acid herbicides (aminocyclopyrachlor, aminopyralid, and clopyralid) and pyrethroids present in the industry due to their effect on non-target plant species.[132]

3-2.7.1.6 United States Composting Council

No information on this topic was found.

3-2.7.1.7 Hawaii

No information on this topic was found.

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[129] Oregon Department of Agriculture. 2019. 603-057-0378. https://secure.sos.state.or.us/oard/viewSingleRule.action;JSESSIONID_OARD=CXYhn8CVLxsklj1vlpIItSsPFC6VHnH-vjT96QYCffTyVvxxeu4M!-2071884724?ruleVrsnRsn=158901.

[130] Washington State University. Clopyralid in Compost. 2005. Clopyralid in Compost. https://s3.wp.wsu.edu/uploads/sites/411/2014/12/Paper_Clopyralid_QandA_v10.pdf.

[131] Washington State University. Clopyralid in Compost. 2005. Clopyralid in Compost. https://s3.wp.wsu.edu/uploads/sites/411/2014/12/Paper_Clopyralid_QandA_v10.pdf.

[132] CalRecycle. 2019. Pesticide/Herbicide Residues in Compost. https://www.calrecycle.ca.gov/Organics/Threats/Pesticides/.

3-2.7.1.8 Maryland

No information on this topic was found.

3-2.7.1.9 Canada

No information on this topic was found.

3-2.7.1.10 Australia

No information on this topic was found.

3-2.7.1.11 United Kingdom

The UK's voluntary Composting Industry Code of Practice[133] states that site staff should monitor fugitive emissions from compost using monitoring equipment as well as visually and olfactory. Bioaerosol monitoring is only needed if a trigger level is exceeded during testing. Trigger levels for bioaerosols are established during background monitoring. The code recommends managing dust and bioaerosols by planning for where and when they are most likely to occur.

Site Locations for Likely Occurrence:

- Loading areas
- Composting and compost storage areas
- Areas for screening, shredding and bagging
- Yards and roads

Conditions for Likely Occurrence:

- Grinding or shredding
- Windrow turning
- Material loading
- Windy, dry days
- Moving materials, especially when dry

Recommendations for controlling bioaerosols and dust include indoor operations (using personal protective equipment for staff), using cover materials, restricting operations during windy and dry conditions, and appropriate moisture applications.

3-2.7.1.12 Texas

No information on this topic was found.

3-2.7.2 Findings, Recommendations, and Level of Effort

3-2.7.2.1 Findings

Oregon Department of Agriculture and Washington State Department of Agriculture have implemented source controls for the resilient herbicide clopyralid. These source controls have been effective at reducing the concentration of clopyralid in finished compost.

[133] The Composting Association. 2005. The Composting Industry Code of Practice. http://www.organics-recycling.org.uk/dmdocuments/Composting_Industry_Code_of_Practice.pdf

CalRecycle works with several California state organizations to address pesticide issues and to develop resources for composters regarding pesticide and herbicide controls in compost.

No jurisdiction researched requires testing of finished compost for pesticides or herbicides.

The UK has developed the voluntary Composting Industry Code of Practice[134] that recommends the establishment of background bioaerosol triggers. This is the only jurisdiction with any such recommendation for bioaerosols.

The techniques used for control of dust emissions are also effective at controlling bioaerosol emissions.

3-2.7.2.2 Recommendations

Figure 3-6 provides a summary of the findings and recommendations for bioaerosols and pesticides. As shown in Table 3-21, we recommend that requirements increase with increasing tier and risk level.

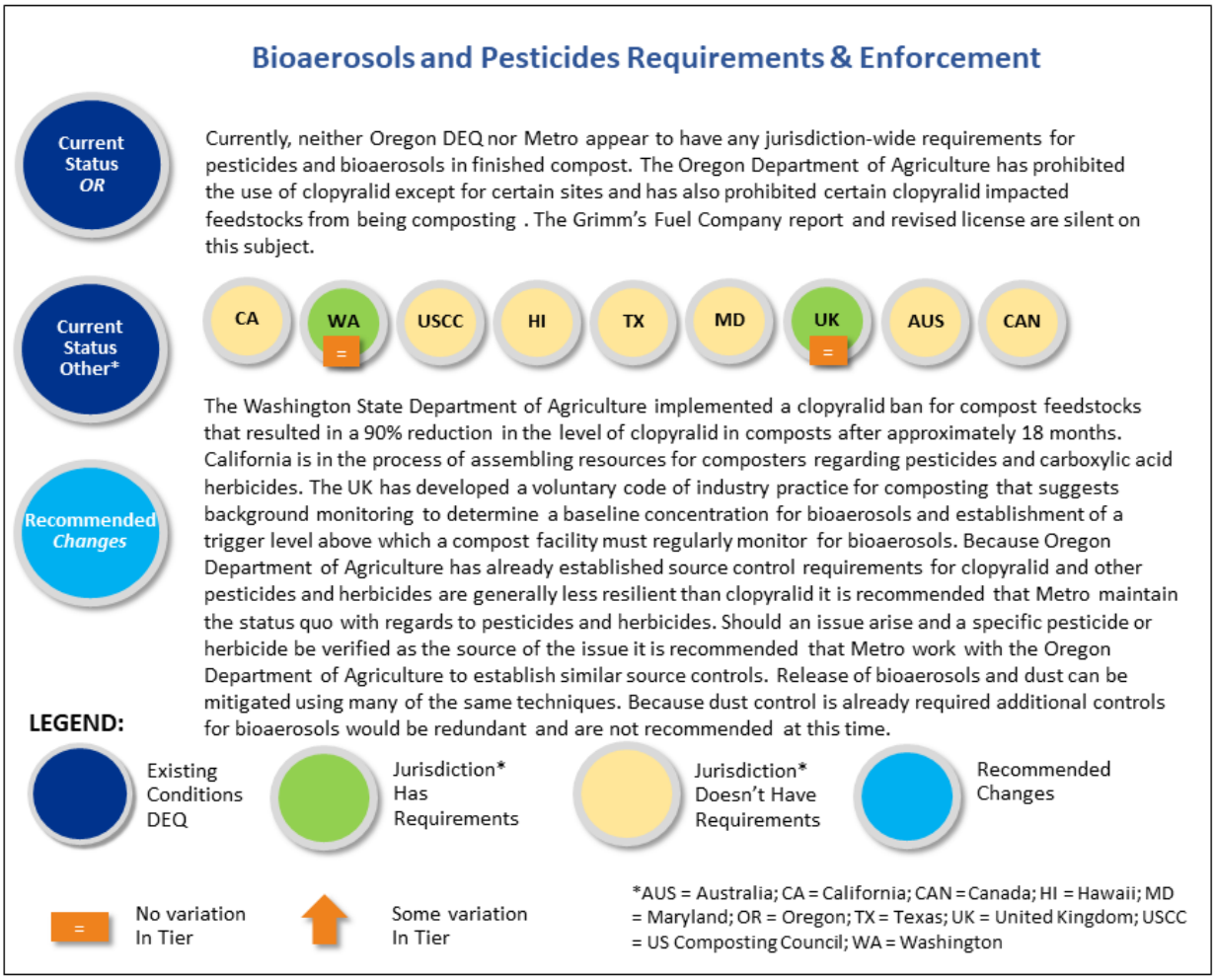

Figure 3-6. Bioaerosols and Pesticides Requirements and Enforcement

[134] The Composting Association. 2005. The Composting Industry Code of Practice. http://www.organics-recycling.org.uk/dmdocuments/Composting_Industry_Code_of_Practice.pdf

Table 3-21. Recommendations for Bioaerosols and Pesticides Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• None	• Do not impose requirements, unless issues arise at the facility (such as violations, other persistent issues), in which case Metro may consider subjecting the facility to regulation as a Low Risk facility
Low Risk / Registration Composting Facility Permit	• Control dust emissions thereby minimizing bioaerosol emissions	• If a verified pesticide or herbicide issue arises, work with the Oregon Department of Agriculture to develop source control requirements • Require facilities to control dust emissions, thereby also controlling bioaerosol emissions • Verify during inspections that dust emissions are controlled
Poses Potential Risk / Individual Composting Facility Permit	• Control dust emissions thereby minimizing bioaerosol emissions	• If a verified pesticide or herbicide issue arises, work with the Oregon Department of Agriculture to develop source control requirements • Require facilities to control dust emissions, thereby also controlling bioaerosol emissions • Verify during inspections that dust emissions are controlled

Additional details of each of these requirements is discussed below:

- Work with the Oregon Department of Agriculture to establish source control requirements similar to those created for clopyralid if a verified pesticide/herbicide issue arises at Metro facilities.
- Require facilities above the exempt tier to control dust emissions thereby also controlling bioaerosol emissions. If there is an issue or other cause for action at exempt facilities, Metro can consider subjecting exempt facilities to the requirements of a Low Risk facility.
- Verify that Metro operators are controlling dust emissions according to their dust control plans. This will in turn minimize the emission of bioaerosols.

3-2.7.2.3 Level of Effort

Controlling dust emission at compost facilities in the Metro Region is already an established practice. These dust control practices should also be effective at minimizing bioaerosol emissions. Little to no additional effort is required to control bioaerosol emissions at both the facility and Metro inspector levels.

In the event that a pesticide or herbicide is verified to cause issues in finished compost similar to clopyralid, Metro would need to expend a moderate level of effort to work with the Oregon Department of Agriculture to develop source control requirements. Follow-up sampling may be necessary to verify the new requirements are effective. This course of action is recommended to take advantage of Oregon

Department of Agriculture's experience with these issues while still creating requirements that work for Metro. This approach is similar to the approach taken by CalRecycle. Further, a pesticide/herbicide issue in the Metro region is likely to be an issue in other parts of the state. This approach would also place the burden of enforcement on the Oregon Department of Agriculture rather than Metro.

3-2.8 Per- and Polyfluoroalkyl Substances

This section presents an overview and discussion of the topic of Per-and Polyfluoroalkyl Substances, which is a new and growing concern in the industry.

3-2.8.1 Research and Interview Summaries

Table 3-22 shows the contacts interviewed during the research of Per-and Polyfluoroalkyl Substance related quality requirements and enforcement in other regionally relevant jurisdictions.

Table 3-22. PFAS Interview Participants

Jurisdiction	Interview Participants
Oregon Department of Environmental Quality (ODEQ)	Bryan Smith Bob Barrows

In addition to the jurisdictions shown in Table 3-22, United States Composting Council STA program, State of California (CalRecycle), Hawaii, Texas Commission on Environmental Quality (TCEQ), Alaska, Michigan, North Carolina, Australia, Canada, and the United Kingdom were also researched, although no interviews were conducted. Summaries for each of the researched jurisdictions follow.

Per-and polyfluoroalkyl substances (PFAS) are a large family of organic compounds, including more than 3,000 artificial fluorinated organic chemicals used since the 1940s. PFAS have unique surfactant properties that make them repel both water and oil. Because of these properties, they have been used extensively in surface coatings and protectant formulations for consumer products including paper and cardboard packaging products, carpets, leather products, clothing, construction materials, non-stick coatings, and food packaging. As such, they have been identified in landfills, landfill leachate, municipal wastewater, biosolids from waste water treatment plants, and compost made from these various materials.

PFAS are resistant to degradation, both chemically and biologically, highly soluble, and mobile in the environment. This leads to environmental accumulation of these substances in groundwater, drinking water sources, and WWTP effluent, which can lead to exposure in humans and biota. Half-lives in humans have been reported in the range of 2 to 5 years and Perfluorooctanoic acid (PFOA) has been found in almost all human blood samples collected worldwide. Toxicology studies conducted in multiple species, including monkeys, rats, and mice, have reported health effects, including high cholesterol, pregnancy-induced hypertension, liver and kidney toxicity, immune effects, and potential cancers (liver, testicular, and pancreatic). Perfluorooctanesulfonic acid (PFOS) has been shown to bioaccumulate and biomagnify in fish and fish-eating birds. Recently, PFAS has also been identified in milk and consumer crops from farms with biosolids and paper solids-amended soils.

Handling of compost is the most likely route of exposure and therefore presents the greatest potential risk. The US EPA has established a soil-based Regional Screening Level (RSL) for PFAS[135] included in Table 3-23 below, considering a combination of dermal exposure and ingestion. The Regional Screening Level for perfluorobutanesulfonic acid (PFBS) is published by US EPA (Non-cancer, Child (15 kg), Hazard Quotient = 1). Values for PFOA and PFOS are calculated by the EPA RSL calculator using EPA RfDs ($2x10^{-5}$ mg/kg/day), Hazard Quotient (HQ) of 1, and residential exposure assumptions (24 hr/day 7 days/week, 350 days/year exposure). The exposure factors are default values that are used unless there is site-specific rationale/justification for changing the exposure factors. Thus, the RSL values are worst

[135] Interstate Technology Regional Council. 2019. Table 4-2. UPDATES Residential soil standards and guidance values for PFAS. https://pfas-1.itrcweb.org/wp-content/uploads/2019/12/ITRCPFASFactSheetSect4Tables_Nov2019.xlsx.

case and may be overly conservative for typical residential or commercial use and contact but are considered a “reasonable maximum exposure scenario” per the EPA and cover the scenario of individuals contacting the material on a daily basis.

Several states and provinces such as Alaska, Michigan, North Carolina, Texas and British Columbia have established soil values for the protection human health, independent of the Federal US EPA RSLs. The different values represent different interpretation of variables used in the calculations such as the target risk levels, inclusion of additional exposure factors, and assuming a relative source contribution other than 100% (RSLs use 100%). Table 3-23 includes the levels established in parts per million.

Table 3-23. State and Provincial Regulations and Screening Levels for PFAS[136]

Soil Levels for Human Health	PFOA (mg/kg or ppm)	PFOS (mg/kg or ppm)	PFBS (mg/kg or ppm)
United States – RSL	1.26	1.26	1300
British Columbia – (agricultural, residential, commercial)[a]	-	1 (agricultural), 2.5 (residential), 7.5 (commercial)	300 (agricultural), 650 (residential), 4500 (commercial)
Alaska	1.3	1.3	-
Michigan	6	3.2	-
North Carolina	-	-	250
Texas*	0.5	1.5	80

[a] Promulgated Enforceable Value
mg/kg = milligram(s) per kilogram
RSL = regional screening level
PFAS = per-and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctanesulfonic acid
ppm = part(s) per million

Another potential exposure route is PFAS uptake from crops and plants grown in compost amended soils. There is increasing evidence of correlation between PFAS concentrations in soil treated with biosolids, composted biosolids, and compost products and uptake in plants and crops grown in this soil. Uptake of PFAS in fruits, vegetables and other crops grown in biosolids and compost amended soil can present an exposure pathway to humans. Recent studies have linked PFAS contaminated soils to biosolid and compost-based fertilizers. In turn these studies have identified detections of PFAS in crop produce, meat, eggs, and dairy. One of the first investigations that connected contaminated soil amendments to contaminated dairy was conducted at the Stone Farm in Maine.[137] When the site history was evaluated in conjunction with the sample results, it was determined that the high PFAS concentrations found in soil and hay, likely originated from soil amendments used at the site between 1983 and 2004. Cattle grazing on the PFAS contaminated land were exposed to PFAS concentrations through the hay, which lead to high concentrations of PFAS in dairy. While this case and others provide evidence to support the existence of an exposure pathway of plant uptake to humans resulting from the use of soil amendments contaminated with PFAS, not enough is understood about the various soil amendments and the plant uptake potential of PFAS to make a recommendation for testing at this time.

The environmental community is working to understand PFAS and the conversation continues to evolve as new data are generated. Work is occurring to understand PFAS and their effect on human health and

[136] Interstate Technology Regional Council. 2019. Table 4-2. UPDATES Residential soil standards and guidance values for PFAS. https://pfas-1.itrcweb.org/wp-content/uploads/2019/12/ITRCPFASFactSheetSect4Tables_Nov2019.xlsx.

[137] Stone Farm Maine. 2019. The curious case of tainted milk from a Maine dairy farm. https://www.reuters.com/article/us-usa-dairy-chemicals/the-curious-case-of-tainted-milk-from-a-maine-dairy-farm-idUSKCN1R01AJ.

the environment. The potential for PFAS to be detected in compost is an increasing concern in the organics community. Based on what is currently known, biosolids and food waste packaging may likely contain PFAS and these feedstocks would contribute to PFAS concentrations in compost. However, Metro has established a food only policy for food waste feedstocks generated in the region, eliminating compostable food packaging from the source material. In addition, biosolids are not currently composted in the Metro region. Firefighting foam is another well-known source of PFAS but is not of particular concern at compost facilities as most fires compost fires can be extinguished by suffocating the fire or by using water. Jacobs recommends these policies and practices continue to prevent known sources of PFAS from entering the compost waste stream until more is understood regarding plant uptake and various soil amendments.

3-2.8.2 Findings, Recommendations, and Level of Effort

3-2.8.2.1 Findings

We are not aware of any states engaging in a compost-specific sampling program at the time of this study.

The state of California recently issued an investigative order that requires each listed facility to sample for PFAS using private funds. The states of Michigan and Maine also required PFAS sampling of wastewater treatment plants and biosolids through public funding.

Several states and provinces such as Alaska, Michigan, North Carolina, Texas and British Columbia have established soil values for the protection human health, independent of the Federal US EPA RSLs. No jurisdiction researched requires testing of finished compost for PFAS.

PFAS concentrations and the relationship to plant uptake is an emerging field of study.

Food waste only feedstock requirements and the prohibition of biosolids composting in the Metro Region will serve to reduce PFAS in finished compost through source control.

3-2.8.2.2 Recommendations

Figure 3-7 provides a summary of the findings and recommendations for PFAS. As shown in Table 3-24, we recommend that requirements increase with increasing tier and risk level.

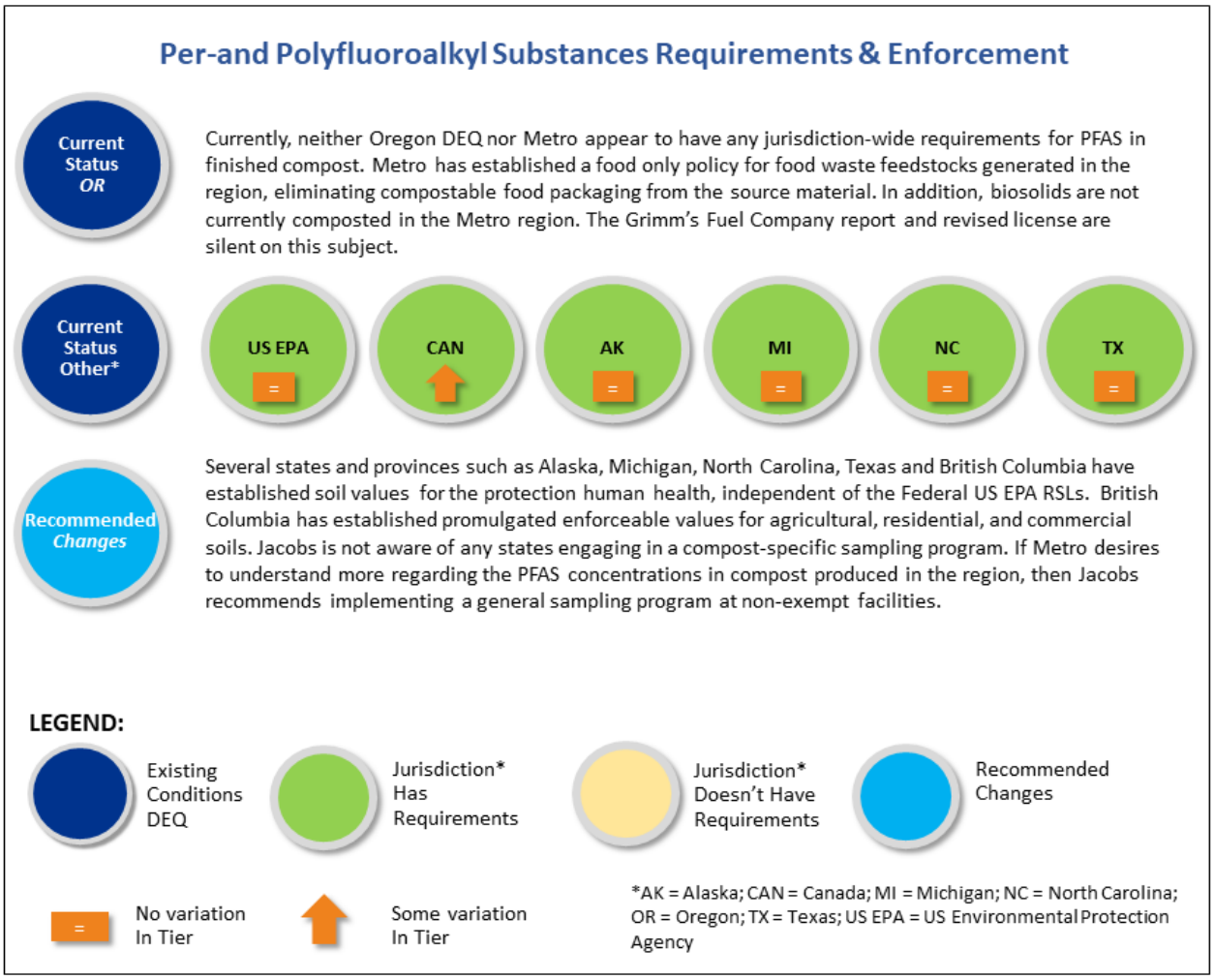

Figure 3-7. PFAS Requirements and Enforcement

Table 3-24. Recommendations for PFAS Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
Exempt	• None	• Do not impose requirements, unless issues arise at the facility (such as violations, other persistent issues), in which case Metro may consider subjecting the facility to regulation as a Low Risk facility
Low Risk / Registration Composting Facility Permit	• Accept food only feedstocks avoiding packaging • Refrain from composting biosolids until more is understood about the relationship between biosolids compost and plant uptake	• If Metro desires to understand more regarding the PFAS concentrations in compost produced in the region, then Jacobs recommends implementing a general sampling program at non-exempt facilities • Accept food only feedstocks, avoiding packaging

Table 3-24. Recommendations for PFAS Requirements and Enforcement

Tier	Recommendations for Operators	Recommendations for Metro
		• Refrain from composting biosolids until more is understood about the relationship between biosolids compost and plant uptake
Poses Potential Risk / Individual Composting Facility Permit	• Accept food only feedstocks avoiding packaging • Refrain from composting biosolids until more is understood about the relationship between biosolids compost and plant uptake emissions	• If Metro desires to understand more regarding the PFAS concentrations in compost produced in the region, then Jacobs recommends implementing a general sampling program at non-exempt facilities • Accept food only feedstocks, avoiding packaging • Refrain from composting biosolids until more is understood about the relationship between biosolids compost and plant uptake

PFAS = per- and polyfluoroalkyl substance

Additional details of each of these requirements is discussed below:

- If Metro desires to understand more regarding the PFAS concentrations in compost produced in the region, then Jacobs recommends implementing a general sampling program at non-exempt facilities. If there is an issue or other cause for action at exempt facilities, Metro can consider subjecting exempt facilities to the requirements of a Low Risk facility.
- Metro could require facilities to pull a composite sample of finished compost for every 5,000 tons of material produced as is currently required by Oregon DEQ for compost sampling. The sample would be tested for total PFAS and results submitted to Metro for comparison to the US EPA RSL.
- Materials that are shown to be of higher PFOA and PFOS values, could be investigated further through source control measures. Source materials could be sampled individually, and those with high contribution (either through concentration or mass loading) could be considered for elimination or substitution.

3-2.8.2.3 Level of Effort

The testing program would need to be defined prior to implementation to determine the number of samples required from each facility to be representative of the finished material. Each sampling event is estimated to cost $600 which includes lab fees, shipping and labor. Metro would need to develop a specific sampling plan and procedure and then determine if the facilities would pay for sampling or if Metro would pay for sampling prior to beginning this sampling program.

Chapter 4. Compost Markets

4-1. Introduction

4-1.1 Scope and Purpose

As discussed above, research for this project was divided into various topics. Topic 3 addresses regionally-relevant research and recommendations associated with the support and development of compost product markets. Drawing on information gathered through research and interviews with select jurisdictions, and other sources, this report proposes opportunities for regionally produced compost to reach local end markets. This report also presents a discussion of any unnecessary barriers to market created by recommendations from previous Topics.

Research and interviews were conducted to meet the following objectives:

- Understand how other jurisdictions are influencing how finished product reaches compost markets
- Learn about successes and failures in attempting to influence markets and/or remove barriers to compost markets
- Understand if any previous recommendations made as part of this project will pose barriers to market

4-1.2 Existing Conditions

There are a number of policies, programs, and other factors across the nation that are designed to influence compost markets. The existing applicable State of Oregon and Metro programs, policies, requirements, and other factors related to compost market support and development are briefly summarized below to provide some context around existing conditions that influence the use and sale of locally produced compost in the Metro region.

4-1.2.1 State of Oregon

While this project scope did not include an exhaustive search of all the State programs, policies, and requirements that may impact compost markets in the Metro region, there are a few notable programs, policies, requirements, and factors that were discovered as part of internet research for this project. These include:

- **State Sustainable Procurement Practices** – In 2001, Oregon established the Sustainability Act and began setting the stage for sustainable procurement in Oregon. The Sustainability Act includes sustainability goals which are inclusive of procurement such as the goal, “To make state purchases serve the broad, long-term financial interests of Oregonians and to ensure that environmental, economic and societal improvements are made to enhance their well-being.” There are several other sustainable procurement goals included in statute that could help promote the production and use of high quality locally produced compost. Since 2001, a variety of other laws and executive orders have passed to support these efforts. The Department of Administrative Services (DAS) has issued statewide policy that supports sustainable procurement practices.[138]
- Oregon Department of Environmental Quality, Water Quality Division – ODEQ published the Construction Stormwater Best Management Practices Manual in March 2013. It includes specifications for the use of compost covers, berms and socks for erosion control.[139]

[138] Oregon Department of Administrative Services. (n.d.) Sustainable Procurement., https://www.oregon.gov/das/OPM/Pages/sustainable.aspx.

[139] Oregon Department of Environmental Quality, Water Quality Division. 2013. Construction Stormwater Best Management Practices Manual. https://www.oregon.gov/deq/FilterPermitsDocs/BMPManual.pdf.

- **The Oregon Department of Transportation (ORDOT)** – ORDOT has compost use specifications that have been in place, in various forms, since 1984.[140]
- **Oregon Department of Agriculture (ODA) Fertilizer Program** – In January 2019, the Oregon Fertilizer Guide was published which, explains the role of ODA in the inspection and registration of "fertilizer, agricultural mineral, lime, and agricultural amendment products." The guide explains the registration process and provides additional guidance on steps that can be taken to address the "Western Interstate Requirements" which address standards in California, Washington, and Idaho.[141]
- **State Composters Stance on Food Only** – In March 2019 several of the composters of Oregon prepared a statement that explained their stance on a food only policy called, "A Message from Composters Serving Oregon: Why We Don't Want Compostable Packaging and Serviceware." The message states, "'Compostable' packaging and serviceware items have been on the rise for the past decade and they are increasingly ending up in our facilities. These materials compromise our composting programs and limit many of the environmental benefits of successful composting." The message includes the nine reasons that they "don't want "compostable" packaging or serviceware delivered" to their facilities which include (as specifically titled and further described in the message):[142]
  - "They don't always compost
  - Contamination happens
  - They hurt resale quality
  - We can't sell to organic farmers
  - They may threaten human and environmental health
  - It increases our costs and makes our job harder
  - Just because something is compostable doesn't mean it's better for the environment
  - In some cases, the benefits of recycling surpass those of composting
  - Good intentions aren't being realized" [143]

These and additional State programs, policies, and requirements should be further evaluated as Metro considers measures they should take to encourage the use of high quality locally produced compost.

4-1.2.2 Metro Region

Similar to the State sustainability goals, programs, and policies that are mentioned in the previous section, the Metro region has a variety of goals, programs, and policies that potentially impact compost markets. The scope of this project did not include a detailed review of these. Notable programs are listed below and provide examples of things are that are already in place in the Metro region and can be used as a reference when evaluating future activities to initiate and/or expand:

- **Metro Contract and Procurement Policies** – Metro's Code, Chapter 2.04.150 through 2.04.170 discuss sustainable procurement and "Supporting businesses and markets located in the Portland Metro region."[144]

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[140] United State Environmental Protection Agency. 2000. *Catalogue of State DOT Compost Usage Experience,* https://archive.epa.gov/composting/web/pdf/highwy3b.pdf.

[141] State of Oregon. 2019. Oregon Fertilizer Program Guide. https://www.oregon.gov/ODA/shared/Documents/Publications/PesticidesPARC/FertilizerProgramGuide.pdf.

[142] Various. 2019. *A Message from Composters Serving Oregon: Why We Don't Want Compostable Packaging and Service Ware,* https://static1.squarespace.com/static/5a7a30710abd046ac76433a4/t/5c8fd9084785d38b6cf60fe9/1552931082908/compostable_packaging_update_3-15.pdf.

[143] Various. 2019. *A Message from Composters Serving Oregon: Why We Don't Want Compostable Packaging and Service Ware,* https://static1.squarespace.com/static/5a7a30710abd046ac76433a4/t/5c8fd9084785d38b6cf60fe9/1552931082908/compostable_packaging_update_3-15.pdf.

[144] Oregon Metro Code. Chapter 2.04, https://www.oregonmetro.gov/sites/default/files/2019/03/01/Metro-Code-chapter-2-04-updated-04062017.pdf.

- **Metro Sustainability Goals and Green Metro Featured Projects** – In 2010, Metro Council adopted a Sustainability Plan that included goals, strategies, and actions in 5 key areas including: greenhouse gas emissions, toxics, waste, water, and habitat. These goals were slated for completion by 2025 (except for the 2050 target for greenhouse gases).[145] Green Metro projects highlight the numerous examples that involve Metro venues and facilities implementing actions that support Metro's various sustainability goals. One example of this is the use of locally-produced "Zoo Doo", composted animal waste in the planting beds at Blue Lake Regional Park.[146]
- **2030 Regional Waste Plan** – Metro's 2030 Regional Waste Plan: Equity, Health and the Environment includes five categories of goals and actions that have been identified to reach the region's 2030 vision. The five categories include: shared prosperity, product design and manufacturing, product use and consumption, product end-of-life management, and disaster resilience. Compost markets are addressed in Goal 15 of the Product End-of-Life Management category, "Improve the systems for recovering recyclables, food scraps and yard debris to make them resilient to changing markets and evolving community needs." Action 15.8 is, "Advocate for statewide policies or implement regional policies that create a preference, incentive or requirement for use of recycling end-markets in Oregon and the Northwest."[147]
- **Food Only Standard for Metro Central** – In March 2014, Metro sent a notification letter to businesses involved in the commercial food scraps program about upcoming changes that were being made to address the large volume of non-food items that were being received with the commercial food scraps collected from businesses and brought to Metro Central Transfer Station by haulers. This new policy was phased in as described below from an excerpt of the notification letter:
  - "As of November 1, 2014, food scrap loads may not contain regular or waxed cardboard. Loads with more than trivial amounts of these materials will be treated and charged as garbage.
  - As of March 1, 2015, food scrap loads may not contain non-food items. Loads with more than trivial amounts of these materials will be treated and charged as garbage."
  - Note: Biodegradable Products Institute (BPI) certified transparent or semi-transparent compostable bags and liners were still allowed.[148]
- **City of Portland Standard Construction Specifications (SCS), Blended Soil Specification for Vegetated Stormwater System** – The City of Portland's 2010 SCS includes a blended soil specification for vegetated stormwater systems. These blended soil specifications must be used for all public projects. The January 11, 2019 revision includes compost requirements that state, "The compost shall be derived from plant material and provided by a member of the US Composting Council Seal of Testing Assurance (STA) program." There are specific criteria for the compost including particle size, pH, limited manufactured inert material, organic matter, soluble salt, maturity, stability, Carbon/Nitrogen ration, and trace metals.[149]

[145] Oregon Metro. 2020. *Green Metro.* https://www.oregonmetro.gov/how-metro-works/green-metro.

[146] Oregon Metro 2020. *Green Metro Featured Projects.* https://www.oregonmetro.gov/how-metro-works/green-metro/featured-projects.

[147] Oregon Metro. 2019. *2030 Regional Waste Plan Equity, health and environment.*

[148] Oregon Public Broadcast. 2014. *New Rules for Commercial Composting in Portland*. https://www.opb.org/news/article/new-rules-for-commercial-composting-in-portland-fo/.

[149] City of Portland. 2019. Blended Soil Specification for Vegetated Stormwater Systems. https://www.portlandoregon.gov/bes/article/596781.

4-2. Research, Findings, Recommendations, and Level of Effort for Compost Markets Focus Areas

Ensuring the quality of finished compost is an important component of promoting compost facilities that operate safely, efficiently, and in a way that does not negatively impact the environment or surrounding neighbors as well as supporting the overall market success of the finished product. Having programs, policies, requirements, and incentives that encourage the use of high quality local compost is also an important element of successful programs. Jacobs researched and evaluated focus areas to better understand opportunities for regionally produced compost to reach local end markets and to avoid unnecessary barriers to market.

Research and interviews were conducted to meet the following objectives:

- Understand how other jurisdictions are influencing how finished product reaches compost markets
- Learn about successes and failures in attempting to influence markets and/or remove barriers to compost markets
- Understand if any previous recommendations made as part of this project will pose barriers to market

The focus areas discussed in this section are organized in the following order:

- Compost Use Incentives
- Compost Sales and Marketing

4-2.1 Researched Jurisdictions

Jacobs researched programs, policies, and requirements for finished compost that have been established by other jurisdictions and organizations. Follow-up interviews were conducted with several jurisdictions and organizations that had requirements relevant to Metro's needs. Interviewees were chosen to reflect entities with ample experience on the topic. Table 4-1 shows the contacts interviewed and the focus areas that were discussed within each jurisdiction. Several of the contacts have experience with biosolids compost, which is referenced in the information below. Although this project does not cover biosolids compost, this information and the experience of these individuals was deemed to be relevant since there is a vast history and body of experience associated with the marketing of biosolids compost and its associated barriers.

Table 4-1. Jurisdictions/Organizations Interviewed for Compost Markets

Jurisdiction/Organizations	Contact	Focus Area(s) Discussed
King County, Washington and Member of Northwest Biosolids Group	Ashley Mihle	Compost Use Incentives, Compost Sales and Marketing
King County, Washington	Andy Smith	Compost Use Incentives, Compost Sales and Marketing
Seattle Public Utilities	David McDonald (submitted answers in writing)[a]	Compost Use Incentives, Compost Sales and Marketing
Denali Water Solutions	Jason Fleury	Compost Use Incentives, Compost Sales and Marketing
Virginia Biosolids Council	Robert Crockett	Compost Use Incentives
R. Alexander Associates and Former Consultant for USCC/STA	Ron Alexander	Compost Use Incentives, Compost Sales and Marketing

Table 4-1. Jurisdictions/Organizations Interviewed for Compost Markets

Jurisdiction/Organizations	Contact	Focus Area(s) Discussed
Northern Tilth	Andrew Carpenter	Compost Use Incentives
New England Region	Former Employee of Agresource, Inc.	Compost Use Incentives, Compost Sales and Marketing

[a] David McDonald's schedule did not allow for an interview; however, he provided useful information via a completed questionnaire.

4-2.2 Compost Use Incentives

This section presents an overview and discussion of the requirements of the compost use incentives in place at the jurisdictions Jacobs researched.

4-2.2.1 Research and Interview Summaries

4-2.2.1.1 King County, Washington – Ashley Mihle

Ashley Mihle, a member of the Northwest Biosolids Group and an employee of King County, Washington was interviewed as part of this task. The information she provided regarding compost use incentives in the region are summarized below.

Compost Use Specifications

Ms. Mihle was asked what compost use specifications are currently in place in King County. She responded that King County has produced a specification for their capital projects that applies to both the projects they do and also to the compost produced by their partners.

Buy Green or Recycling Initiatives

Ms. Mihle was asked if there are any "buy green" or recycling incentives to encourage compost use in King County. The following bullets summarize her response to this question:

- King County uses a sustainability scorecard that awards more points for projects that propose the use of compost.
- King County has established green procurement requirements and sustainability requirements.
- King County has "Lunch and Learn" events with King County project managers and engineers, focused on teaching them the value of using compost on capital improvement projects.
- The King County Solid Waste Division is setting up a Request for Proposal (RFP) pool bid to get composters on board and ready for capital projects, making it easier to source composters in the region. It will also provide an interface to get composters in the region connected with King County engineers and project managers.
- Education on resource recovery and soil benefits has been key.
- Marketing of the Loop program is also an important element. Loop® is a biosolids product managed and created from the King County Biosolids Program wastewater.[150]
- There are several trade organizations: Northwest Biosolids and Washington Organics Recycling Council (WORC) which have a positive impact on the success of local compost markets.

[150] King County, Washington. 2018. Loop® biosolids. https://www.kingcounty.gov/services/environment/wastewater/resource-recovery/loop-biosolids.aspx.

Environmental Purchasing Policies

Regarding environmental purchasing policies specifically calling out compost use, Ms. Mihle mentioned that King County code has a policy that says that all county projects will use biosolids-based compost. This policy acts as a good starting point because it rolls down to county engineers, project managers, and contractors who are obligated to include biosolids compost where appropriate. This then rolls down into the purchasing agreements and the specifications used in projects.

Additionally, the King County Solid Waste Division is trying to incentivize the use of leaf and yard waste and source separated organics compost, so the policy may be amended to be more flexible by simply referencing compost (as opposed to biosolids-based compost).

Policy Implementation and Impact

Regarding implemented policy and program impacts, Ms. Mihle stated that many of the policies and programs were implemented 10 to 20 years ago, which predates her time with the county. However, many green initiatives have been implemented in the last 2 to 3 years. She also stated that because there are many agency resources and partnerships, the marketed product in their region sells out every year.

Additional Information

Ms. Mihle emphasized that for these programs to be effective, incentives should be layered, multi-faceted, and strategic. King County has a lot of other county initiatives that dovetail, such as the strategic Climate Action Plan, local food initiative, Clean Water Healthy Habitats, and Green Stormwater Infrastructure, in which, compost plays a big role in helping the environment and creating better outcomes for the communities that they serve. The Parks and Recreation and the Roads divisions use compost and many agency resources within King County are leveraged to make compost programs successful. While leveraging resources may not be as feasible for a smaller agency, larger agencies could establish successful interdepartmental partnerships.

4-2.2.1.2 King County, Washington – Andy Smith

Andy Smith, an employee of King County, Washington focused primarily on market development, provided information regarding compost use incentives in the region as summarized below.

Compost Use Specifications

With respect to compost use specifications currently in place within King County, Mr. Smith explained that the County is developing a technical assistance program wherein they have created a specification that outlines quality parameters for compost. The intention is that whenever King County purchases compost it must meet the established specifications.

Buy Green or Recycling Initiatives and Environmental Purchasing Policies

Regarding "buy green" or recycling incentives to encourage compost use in King County, Mr. Smith mentioned that King County has established the Sustainable Purchasing Program, which consists of three parts: establishment of a specification for compost use, simplified contracting arrangements, and technical assistance program to drive interest. The simplified contracting portion of the program allows composters to show that their material meets the specification prior to when it is needed, so that it can be purchased more readily.

Policy Implementation and Impact

Regarding implemented policy and program impacts, Mr. Smith stated that the resources and code for the Sustainable Purchasing Program was established in 2005. The Climate Objective was established in 2011 and compost market development has expanded beyond residential curbside collection over the last year.

Additional Information

Mr. Smith was asked if there was any specific advice he would like to share. He stated that all of their work was informed by two large stakeholder meetings where they brought 50 or 60 stakeholders together (such as academics, government agencies, and tribes) to discuss and solicit feedback on changes. Mr. Smith believes it is a good idea to crowdsource interest and feedback from the community.

Mr. Smith also stated that more coordination between proximate jurisdictions could be valuable. While the regions may not be identical, they may have similarities that could make sharing experiences valuable.

4-2.2.1.3 New England Region – Industry Professional

A retired source with over 40 years of compost industry experience who worked at a private compost company, Agresource, Inc., was interviewed regarding compost use incentives in the New England region. The source earned a doctorate degree in Botany and Plant Pathology from the University of Wisconsin and is the author of more than 35 scientific and technical papers in the fields of solid waste management, composting, and soil microbiology. The source requested to remain unnamed, but has permitted the use of the information from their interview and the name of their former employer to inform this report. Agresource, Inc. has been in business since 1984 and the source worked for the company from 1996 until recently retiring. The Agresource, Inc. website provides specifications for the products they sell as well as background information on the company.[151]

Compost Use Specifications

The anonymous source was asked what compost use specifications are currently in place in the New England region. The following information summarizes noteworthy responses to this question:

Most incentive programs are locally implemented except for the Department of Transportation (DOT) specifications. Typically, a landscape architect will specify the soil type and organic content-based requirements for their projects. Based on what's required by the landscape architect, compost may be required. Soil specifications should require a minimum of 5 percent organic matter for most uses. Some applications, like wetlands remediation, may require as high as 20 percent organic matter content. Adequate organic matter results in more water retention. Golf course projects will set their own specifications.

Biosolids compost is sometimes specifically discouraged. DOT does not discourage use of biosolids compost, but large engineering firms may not favor it.

Development of specifications would be useful to encourage the use of compost for large projects and specifications can be included as part of the building permit. A generic soil specification is usually adequate and DOT specifications could be a good starting place for development.

An initial recommendation is to determine what local specifications are in place for construction projects. If none are available, look at ORDOT or USCC STA's specification levels for compost. In the source's experience, projects would require participation in the STA program as a minimum to ensure sampling and testing of compost was performed correctly. Most projects would also require that compost meet minimum quality specifications as well. These quality specifications would vary based on the project type and soil needed.

The source also reports that the source's organization began selling blended soils. Blending to specifications was very helpful and tight specifications are preferred. Providing of a list of regional composters to contractors who need to buy compost to meet specifications may be helpful. No matter what, the specifications are critical but they must be enforced.

[151] Agresource. 2020. Agresource, rooted in success. https://www.agresourceinc.com/.

Additionally, the anonymous source notes that their organization would hold “Lunch and Learn” events to educate landscape architects and engineers on the benefits of compost. These events are a crucial marketing and education strategy.

Buy Green or Recycling Initiatives

The anonymous source was asked if there are any "buy green" or recycling incentives to encourage compost use in the region. They responded that compost is required in areas where soil improvement or disturbance occurs such as new housing construction or wetland reclamation. For these projects a specified organic matter content is required and the specifications are set by an engineer or landscape architect.

Compost Socks

The anonymous source was asked, “Can compost socks or berms be used in lieu of traditional silt fences for stormwater runoff controls during construction?” He responded that more and more often this is occurring and that in many cases the socks are filled with ground wood or mulch material rather than compost.

Additional Information

The anonymous source also provided some examples and considerations for specifications. One example considers a ball field, where the facility requires soil that drains well but has high organic matter. This would require a specific compost specification. Another example considers a county managing their parks. Jurisdictions can be helpful by specifying a minimum organic content.

Whatever the specification details, enforcement must be strong.

4-2.2.1.4 Denali Water/We Care – Jason Fleury

Jason Fleury, an employee of Denali Water Solutions/We Care, was interviewed as part of this task. He is based in New York, but his company operates and sells compost from operations in Massachusetts, New York, New Jersey, Michigan, and Arizona. The information he provided in the interview generally describes what his company does to sell compost in these markets. Mr. Fleury was asked questions regarding compost use incentives and how they affect his business. His responses are summarized below.

Compost Use Specifications

Mr. Fleury was asked what compost use specifications are currently in place in the regions where Denali sells compost. He responded that many DOTs have developed usage specifications for their projects. Those projects require composters to have a lot of material that can be moved quickly and that meet DOT specifications. DOTs will have a specification per job, although specifications will be similar for most jobs. New York typically references Cornell University for specifications. Pennsylvania typically references Pennsylvania State University for specifications. Sometimes a specification will call for participation in the STA program, plus additional project specific quality or use specifications. Rarely does a specification call for just USCC STA compost.

Buy Green or Recycling Initiatives

Mr. Fleury was asked if there are any "buy green" or recycling incentives to encourage compost use in the regions where Denali sells compost. Mr. Fleury presented an example from New York City (NYC) where rooftop gardens are intended to be green, but sometimes the specifications are too stringent or require unrealistic procurement practices and so you must deviate from the specification. For example, the specification for rooftop gardens in NYC calls for lightweight shale sourced from within 100 miles of the project site, however, this material is not mined within 100 miles of New York City. Thus, the specification

cannot be met. To sell to this project, composters would have to propose an alternative specification. The takeaway from this example is to make sure to develop specifications that are able to be met.

Compost Socks

Mr. Fleury was asked if compost socks or berms can be used in lieu of traditional silt fences for stormwater runoff controls during construction. He responded that the cost of compost socks is expensive so there's not a huge market for their use versus hay bales that are much cheaper.

Environmental Purchasing Policies

Mr. Fleury was asked if he knew of any environmental purchasing policies which specifically call out compost use. He stated that he was not aware of any purchasing policies, but some jurisdictions require compost operators to be trained. Operators can go through training sponsored by USCC, Washington, Maryland, and others. In New York, operators are required to sign off that compost was properly produced.

4-2.2.1.5 Seattle Public Utilities – David McDonald

David McDonald was asked to participate in an interview but asserted that he did not have time for a phone call. He did agree to complete a questionnaire as part of this task. The questionnaire he completed is included in Appendix F. He was referred to us by Ashley Mihle of King County, Washington. He is an employee of Seattle Public Utilities working specifically on the Soils for Salmon program. Mr. McDonald was asked questions regarding compost use incentives and how they affect his business. His responses are summarized below.

Compost Use Specifications

Mr. McDonald was asked what compost use specifications are currently in place in the Seattle region. He responded that City of Seattle's specification is widely used, citing the 2017 Standard Specifications for Municipal Construction, Section 9.14.4(8) Compost.[152]

Buy Green or Recycling Initiatives

Mr. McDonald was asked if there are any "buy green" or recycling incentives to encourage compost use in the Seattle region. He responded that Seattle encourages but does not require use of locally produced compost.

Compost Socks

Mr. McDonald was asked if compost socks or berms can be used in lieu of traditional silt fences for stormwater runoff controls during construction. He responded that compost socks are allowed for use under Washington State and many local stormwater codes.

Environmental Purchasing Policies

Mr. McDonald was asked if he knew of any environmental purchasing policies which specifically call out compost use. He stated that the Washington State stormwater code requires construction disturbed soils to be amended with compost. He then provided the following links: www.soilsforsalmon.org and www.buildingsoil.org for additional information on stormwater code requirements.

[152] City of Seattle, Washington. 2017. Standard Specifications for Municipal Construction. https://www.seattle.gov/utilities/construction-and-development/standard-specs-plans.

Policy Implementation and Impact

Mr. McDonald was asked when these policies and programs were implemented and what impact they've had. He stated that the policies and programs were implemented in 2003. He also added that in local jurisdictions (such as Seattle) that enforce the State stormwater regulations, most building sites comply. Lesser compliance is achieved in jurisdictions that don't enforce.

Additional Information

Mr. McDonald provided the following additional information: Soils for Salmon and Building Soil websites are currently being updated and combined into one site (SoilsforSalmon.org). This work is expected to be complete by May 2020.

4-2.2.1.6 Former USCC/STA – Ron Alexander

The current STA program manager was unavailable for interview at the time of this project. In place of the current STA program manager, Ron Alexander was interviewed as part of this focus area. Mr. Alexander is extremely knowledgeable in both the STA program and compost markets. He is the proprietor of R. Alexander Associates, Inc. Mr. Alexander was chosen by the USCC to develop the STA program in 2000 and he ran the program as a consultant until 2010. Ron has over 30 years of experience in all aspects of compost, biosolids-based and other organic recycled product manufacturing, marketing and utilization. He has also completed over 400 organic recycled product manufacturing, marketing, utilization and quality evaluation/assurance related consulting projects throughout North America. Mr. Alexander was asked questions regarding compost use incentives and how they affect his business. His responses are summarized below.

Compost Use Specifications

Mr. Alexander was asked what compost use specifications of which he is currently aware. His response is summarized in the bullets below:

- The gestation period for creating new specifications from scratch is long but once composters begin to take advantage of the specifications the effect is immense.
- Getting specifications in place is important but outreach is imperative to the successful implementation of a specification program.
- It is important to know if composters in your region are meeting a minimum specification, for example for regional public facilities, can those composters meet the DOT specification for your state? If so, then both the jurisdiction and the compost facility can begin outreach to potential buyers and contractors.
- There are always multiple steps with specification programs. Creating a specification is the first step but the next step is to perform outreach and marketing of regionally produced compost product.
- Mr. Alexander referenced Soils for Salmon in Washington and Model Water Efficient Landscape Ordinance programs in California that incentivize and even require the use of compost in certain applications.
- Washington, Oregon, California, and Texas DOTs all have specifications for the use of compost in their projects. Estimates there are probably 15 states with DOT specifications for use of compost for their projects.
- Confirmed he holds lunch and learn events with landscape architects, engineers, and contractors regarding compost and its use.

Buy Green or Recycling Initiatives

Mr. Alexander was asked if there are any "buy green" or recycling incentives to encourage compost use that of which he is aware. His response is summarized in the bullets below:

- Soils for Salmon is a great example, the “granddaddy of them all,” because they were able to make a stormwater management regulation that creates infiltration soils as part of stormwater management requirements.
- Denver has created a program where if you want to irrigate your lawn you must treat it with compost first.
- The Model Water Efficient Landscape Ordinance[153] in California that's now state law. Enforcement is currently very poor but that will take time. It requires new landscapes to have a water budget. California is a little unique because they have high temperatures low rainfall and they have real water problems. But there are other places, like mountain states, that have shallow soil that are starting to implement similar programs.

4-2.2.1.7 Virginia Biosolids Council – Robert Crockett

Robert Crockett, an employee of the Virginia Biosolids Council, was interviewed as part of this task. The information he provided in the interview generally describes what his organization does to encourage compost sales in these markets. Mr. Crockett was asked questions regarding compost use incentives and how they affect his business. His responses are summarized below.

Compost Use Specifications

Mr. Crockett was asked what compost use specifications are currently in place in Virginia. He responded that the public use of material and public safety of material is an important consideration for developing markets. Incentives can be developed by using the material within the local organization or jurisdiction. Composters would need to meet a local or region-specific specification. Mr. Crockett emphasized that it is extremely important to follow state legislative process each year and to track pending regulations that could inadvertently hamper compost use or compost sales. The Virginia Biosolids Council actively does this during each legislative session in Virginia.

Mr. Crockett did not have additional details to share on this topic.

4-2.2.1.8 Northern Tilth – Andrew Carpenter

Andrew Carpenter was interviewed as part of this task. He is an employee of Northern Tilth working primarily in the New England area. Mr. Carpenter was asked questions regarding compost use incentives and how they affect his business. His responses are summarized below.

Compost Use Specifications

Mr. Carpenter was asked what compost use specifications are currently in place in New England. He responded that marketing and incentives is not his primary focus, but that there are several employees at New England DOTs whose passion for composting affects the program’s success.

Buy Green or Recycling Initiatives

Mr. Carpenter was asked if there are any "buy green" or recycling incentives to encourage compost use in the New England region. He responded that most of the incentives in the region are similar to incentives in California where the focus is more on removal or diversion from landfills. Many of the incentives could be more focused on the use of compost.

Additional Information

Mr. Carpenter stated his organization often works with the National Resources Conservation Service (NRCS) doing work on nutrient management plans for farmers. According to Mr. Carpenter, the NRCS

[153] California Department of Water Resources. 2019. Model Water Efficient Landscape Ordinance. https://water.ca.gov/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/Model-Water-Efficient-Landscape-Ordinance.

provides incentives for different practices that keep nutrients out of the water and in soil. They are currently considering a conservation practice or soil health practice. One of the acceptable practices being considered is compost use. These practices should incentivize farmers to use compost.

4-2.2.2 Findings, Recommendations, and Level of Effort

4-2.2.2.1 Findings

Drawing from the research and interviews it was found that jurisdictions and organizations with successful compost marketing programs and robust compost use demand have the following characteristics in common, as related to compost use incentives:

- An established quality specification that is typically in line with or more stringent than the state DOT specifications. Specifications should be established through a stakeholder feedback process to ensure the specification is relevant to the specified use and Metro region and will not pose barriers to compost markets.
- Participation in the USCC STA sampling and testing program is usually a minimum requirement, product quality or use specifications are also typically required. During Topic 2 research, it was found that all five composters in the Metro region are already participating in this program.
- Diligent enforcement of the required specification is necessary.
- Establishment of green construction or soil amendment programs.
- Learning sessions with engineers and landscape architects to educate them on the benefits of compost use in improving soil health at disturbed sites.
- Jurisdictional programs that promote the use of compost for municipal projects (parks, medians, building construction, golf courses, etc.).
- Overall programs and/or frameworks that consist of several incentive layers and/or several layers of governance.
- Composter training or certifications.
- Rigid specifications or unrealistic procurement requirements tend to hinder the use of compost in soil amendment projects.
- A lack of enforcement or education may result in less compost use.

4-2.2.2.2 Recommendations

Figure 4-1 presents a summary of Compost Use Incentives findings and recommendations. Table 4-2 presents the recommendations for compost use incentives.

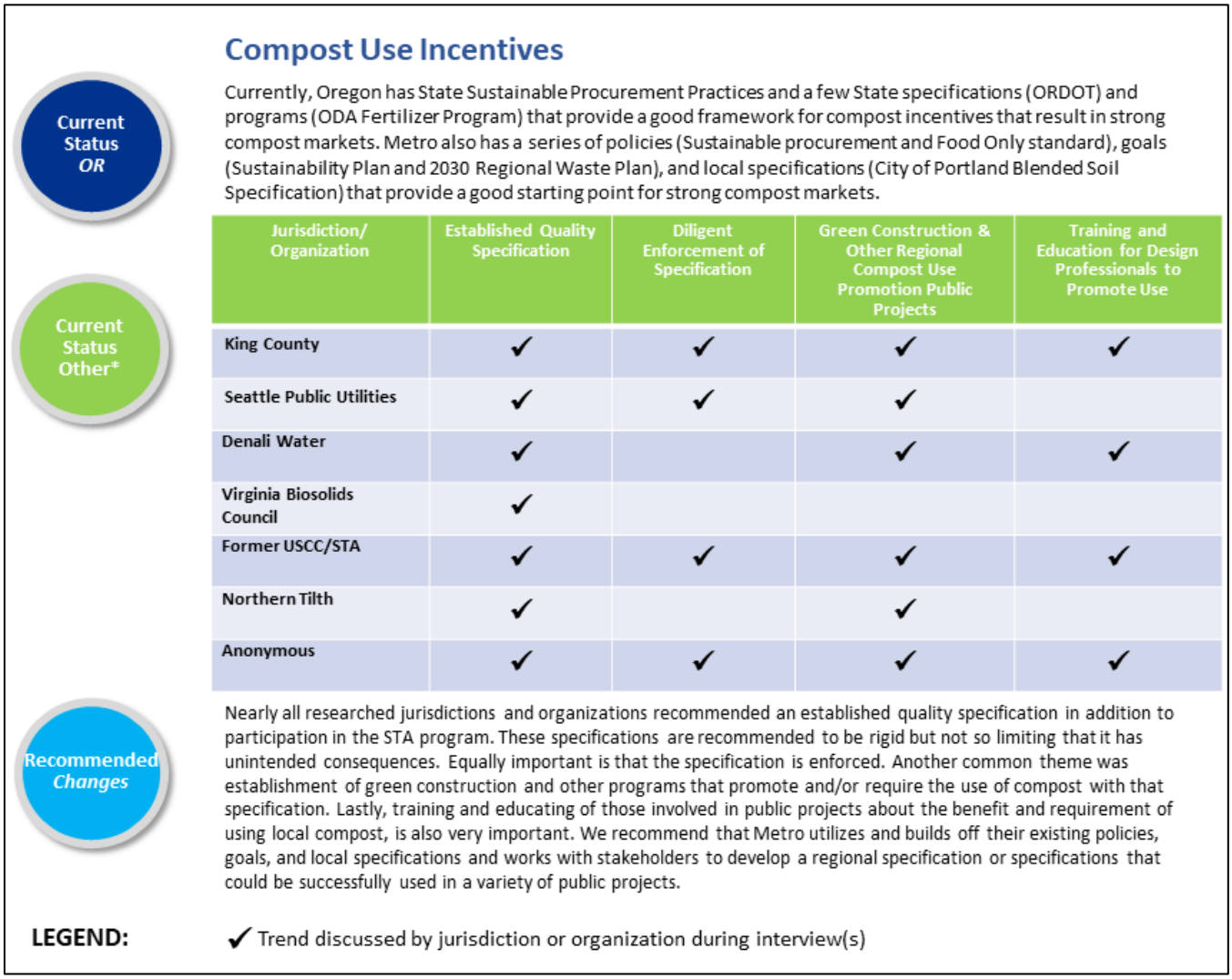

Figure 4-1. Compost Use Incentives Findings and Recommendations

Table 4-2. Recommendations for Compost Use Incentives

Focus Area	Recommendations for Metro
Compost Use Incentives	• Develop and adopt minimum soil specifications that introduce the use of compost produced in the Metro region for Metro's capital improvement projects, especially in areas where soil and stormwater health are important. Metro could start by comparing the soil specifications already adopted in Oregon and Washington and leveraging regional stakeholders to ensure specifications are appropriate for the Metro region • Develop and adopt green construction or soil amendment programs for capital improvement projects that result in soil disturbance or for projects where soil health needs improvement. These programs should favor or require use of compost produced in the Metro region that meet specifications • Implement regular learning sessions with engineers and landscape architects in the region. These learning sessions will advocate for the use of compost in soil disturbance projects and

Table 4-2. Recommendations for Compost Use Incentives

Focus Area	Recommendations for Metro
	other capital improvement projects and will educate participants on the benefits of compost for improving soil health

Recommendations for this focus area target the creation and development of Metro-specific compost use incentives. These recommendations build on the recommendations from previous topics.

Topics 1A and 1B were focused primarily on operational recommendations with emphasis on nuisance mitigation, active pile management, and health and safety concerns. Drawing from the findings of Topic 3, creating a high quality compost is imperative to improving compost markets in the region. In order to achieve a compost of the highest quality the composting process must be actively managed. The recommendations in Topics 1A and 1B are aimed at achieving this objective.

Topic 2 relates to the quality of finished compost. Again, the recommendations in Topic 3 build on the recommendations for Topic 2 which are primarily focused on the sampling of finished product to ensure it can meet quality and health and safety objectives, and that the methods and testing frequency used are standardized. The recommendation to have composters in the Metro region participate in the USCC STA program is intended to certify that compost sampling occurs according to the USCC STA program requirements, which provides scientific backing for the testing frequency and methods used to analyze compost. The USCC STA program standardizes the results from each participating compost facility making them comparable.

Metro already has much of the necessary framework, programs, and policies needed to implement the recommendations below. Those programs include the Metro Contract and Procurement Policies, Metro Sustainability Goals and Green Metro Featured Projects, 2030 Regional Waste Plan, and Food Only Standard for Metro Central. In addition, the City of Portland SCS Blended Soil Specification for Vegetated Stormwater System may be an excellent starting point for creation of a Metro soil specification.

Implementation of the Topic 3 recommendations below, in conjunction with existing framework, programs, and policies, offers an excellent opportunity to make use of the compost product produced in the Metro region. Compost in the Metro region can be used to improve soil health, reduce stormwater run-off, and improve soil drainage as well as other parameters. Building on the previous recommendations and based on the research findings of this task, the following is recommended:

- Develop and adopt minimum soil specifications that introduce the use of Metro-produced compost for Metro's capital improvement projects, especially in areas where soil and stormwater health are important. Metro can use a combination of King County's specification, the Soils for Salmon Program, City of Seattle's specification, ORDOT's specification, ODA Fertilizer Program, and City of Portland's Blended Soil specification as a starting point and then leverage feedback from Metro stakeholders to ensure specifications are appropriate for the Metro region and its projects. A list of these programs with associated links is included in Appendix G.
- Develop and adopt green construction or soil amendment programs for capital improvement projects that result in soil disturbance or for projects where soil health needs improvement. These programs should favor or require use of compost produced in the Metro region that meet specifications. This recommendation ties in to established procurement and sustainability framework programs previously mentioned. The Soils for Salmon program was referenced by several interviewees as an excellent example of this type of program and may serve as a model for development.
- Implement regular learning sessions with engineers and landscape architects in the region. These learning sessions will advocate for the use of compost in soil disturbance projects and other capital improvement projects and will educate participants on the benefits of compost for improving soil health.

4-2.2.2.3 Level of Effort

Development of new programs and regulations will be time consuming and will require significant effort and investment because Metro will need to create or adopt new programs to fully implement the recommended changes. These programs have been implemented in many regions and were found to be effective at closing the loop and helping sites sell their compost product. The programs referenced by interviewees, such as Soils for Salmon can be used as a starting point in the development of new programs. This should help to reduce the level of effort required to implement these new programs.

4-2.3 Compost Sales and Marketing

This section presents an overview and discussion of compost sales and marketing practices at the jurisdictions Jacobs researched.

4-2.3.1 Research and Interview Summaries

4-2.3.1.1 King County, Washington – Ashley Mihle

Compost Marketing Tools

Ms. Mihle was asked if King County distributes compost brochures or has established websites of example programs. Her response is summarized below:

King County has an entire education group and an education center that covers resource recovery, and specifically compost products. They do a lot of work with school children (accompanied by adults) with tours. This helps with public perception and awareness of resource recovery and the soil benefits of compost. These efforts help educate how composting connects to the individual public citizen. The education group has been key, with an educator who splits her time between the resource recovery group and other education groups and a dedicated resource recovery educator who develops resource recovery specific curriculum and resource recovery specific workshops. The dedicated resource recovery educator also coordinates presentations and workshops at science events and at universities.

Marketing Development Budget

Ms. Mihle was asked if King County has a compost market development budget. She stated that King County does a lot of marketing, including marketing campaigns, websites, a YouTube channel, and through other means. King County employs dedicated marketing and education staff who attend local trade shows (such as the Flower and Garden Show). King County belongs to two main trade organizations: Northwest Biosolids and WORC. Marketing staff focus on bringing networks together so that education materials from King County can be targeted at those groups.

Additional Information

Ms. Mihle emphasized that King County has developed lists of landscapers and contractors and the players and advocates in each market that they have good relationships with. King County relies on those people to be advocates for their products. Those advocates then promote those products for King County. They focus on creating community partnerships and public-private partnerships so that people in the community can act as messengers for the program which is more effective than the County doing this itself. The County has established public-private pilot partnerships and material application and hauling programs to alleviate barriers to market.

4-2.3.1.2 King County, Washington – Andy Smith

Compost Pricing

Mr. Smith was asked if he had information regarding compost pricing in the region where he operates. He stated that compost can sell for approximately $25 to $30 per cubic yard. This can vary significantly depending on quality, blend, and volume purchased.

Compost Marketing Tools

Mr. Smith was asked if King County distributes compost brochures or has established websites of example programs. Mr. Smith referenced several King County government websites and information including: a website for King County Solid Waste Division[154], the King County Organics Management Plan[155], the Zero Waste Commitment of Resources[156], and an Invitation to Bid for compost purchasing (Appendix H).

In addition, Mr. Smith discussed the local compost processor, Cedar Grove. Mr. Smith stated that Cedar Grove Compost Facility does a lot of work on business development and community engagement. He directed the interviewers to their company website which features several community engagement programs on their homepage as well as an order form for compost products. Mr. Smith mentioned that Cedar Grove runs a local farm as a demonstration project to show companies how they can improve poor soil quality. Food from the farm is then provided to food rescue organizations.

Marketing Development Budget

Mr. Smith was asked if the County has a marketing development budget. Mr. Smith responded that he does and that he wanted to emphasize the need to spend community dollars wisely. When he was first hired, he believes that some in his organization believed that they would simply be buying compost. Mr. Smith has been trying to develop the tools so that use and purchase of compost by the various King County agencies can be done at the agency level based on actual need. He stated that they have spent many thousands of dollars this year and will into the foreseeable future to develop these programs.

4-2.3.1.3 New England Region – Industry Professional

Compost Pricing

The anonymous source was asked if they had information regarding compost pricing in the region where they operate. They stated that compost typically sells for $7 to $18 per cubic yard. Blended soil, or custom blends of compost can sell for $30 to $40 per cubic yard. Pricing is a delivered price and is based on volume.

Compost Marketing Tools

The anonymous source was asked if the jurisdictions in the region distribute compost brochures or have established websites of example programs. They stated that the websites are used to provide required project specifications.

Additional Information

The anonymous source stated that when everyone bids on the same specifications and they know the specification will be enforced. Then bidding will be comparable and pricing for the project can be more accurately estimated.

[154] King County, Washington. 2019. Organics. https://kingcounty.gov/depts/dnrp/solid-waste/programs/linkup/organics.aspx.

[155] King County, Washington. 2019. King County Organics Market Development Plan. https://kingcounty.gov/~/media/depts/dnrp/solid-waste/linkup/documents/organics-market-development-plan.ashx?la=en.

[156] King County, Washington. 2018. Zero waste. https://kingcounty.gov/depts/dnrp/solid-waste/garbage-recycling/zero-waste.aspx.

4-2.3.1.4 Denali Water/We Care – Jason Fleury

Marketing Development Budget

Mr. Fleury was asked if his company has a compost market development budget. Mr. Fleury stated that compost quality is the number one priority. In order to produce a high quality compost, the material must be actively managed. Mr. Fleury suggested that compost operators should be trained. Composters must meet industry specifications and must understand which compost is right for which project. For some projects, biosolids are a more effective product but some specifications require a non-biosolids compost.

His company employs full-time sales staff and sends them to nearly 20 different regional trade/compost shows year. Sales employees talk with landscapers, architects, and engineers for sales by the tractor trailer load. Their goal is to find markets to sell to year-round.

A municipality typically needs to sell to everyone for the exact same price. A private company can make deals and sell the compost at whatever price they want. Some specifications for projects can be too stringent, hampering the sale of compost. In New York, there are sometimes conflicting requirements, where the material must be clean, but they also want more recycling. At times, these two things are at odds.

4-2.3.1.5 Seattle Public Utilities – David McDonald

Compost Pricing

Mr. McDonald was asked if he had information regarding pricing in the Seattle region. He stated that he does not have that information.

Compost Marketing Tools

Mr. McDonald was asked if the Seattle region distributes compost brochures or has an established website of example programs. He provided three website links in response to this question: www.compostwashington.org, www.soilsforsalmon.org, and www.seattle.gov/util/yard.

Marketing Development Budget

Mr. McDonald was asked if Seattle has a compost market development budget. He stated that they do not specifically have a marketing budget, but that the organization does allow some staff time for marketing of compost product.

4-2.3.1.6 Former USCC/STA – Ron Alexander

Additional Information

Mr. Alexander emphasized the importance of marketing and selling compost. He estimates that only 25 to 33 percent of composters take marketing seriously. He explained that if jurisdictions can help in the marketing push that markets would grow. Mr. Alexander emphasized that in order to close the loop environmentally and fiscally, the product has to be used.

Mr. Alexander also explained that expanded compost markets are typically created in response to a regulatory change that expands the supply of compost without changing the demand for the product.. He gave California's Senate Bill (SB) 1383 as an example that will significantly increase compost production in the state. This expands the production of compost outside of the normal supply and demand curve that is typically followed in this country. Rather than viewing the compost product as a waste, it needs to be viewed as a product and the producers of this material (both the composters and the jurisdictions that promote composting) need to actively work to develop markets and uses for composting.

4-2.3.2 Findings, Recommendations, and Level of Effort

4-2.3.2.1 Findings

Drawing from the research and interviews it was found that jurisdictions and organizations with successful compost programs and healthy markets have the following characteristics in common, as related to compost sales and market:

- Training and education promoting compost use. Learning sessions with engineers and landscape architects to educate them on the benefits of compost in improving soil health at disturbed sites.
- Individual facility and regional marketing of local compost using a variety of sources to reach a larger audience. Jurisdictions requiring composting need to market material made in their regions through websites, brochures, YouTube channels, public-private demonstration projects, lunch and learn events, and other educational curriculum. Suggested marketing tools include:
  - Education programs for students, landscape architects, and engineers
  - Workshops
  - University sustainability clubs
  - Trade shows
  - Industry groups such as Northwest Biosolids Association and WORC
  - Websites that provide users with program info and required specifications
  - YouTube channels and other social media accounts
- Dedicated market development budget.
  - King County and Denali Water employ full-time sales and marketing staff. The sale of compost back into the market for use in plant growth and soil conditioning is the only way to close the loop sustainably.
  - King County participates in public-private partnerships and compost demonstration projects that organically create advocates within the private sector.
  - Denali Water sends sales staff to 20 trade shows a year.
  - Compost quality is paramount. In some cases, a project specification will call for Denali compost or similar.
  - Sometimes the specification can be too stringent and that creates a barrier to selling compost to that project.
- Jurisdictional programs, specifications, and ordinances that promote the use of compost for municipal projects (parks, medians, building construction, golf courses, etc.).
  - Jurisdictions create market by establishing a specification for all jurisdictional projects or by requiring that a landscape architect or engineer produce a specification for projects within the jurisdiction.
  - Many jurisdictions have established ordinances to promote legitimate uses for compost in parks, medians, golf courses, construction, public ball fields, wetland reclamation, etc.

Additionally, it was found that because markets are usually driven by regulation, they naturally cannot follow the normal supply and demand curve. In California, for example, SB1383 is going to require the construction of additional compost facilities which will result in the supply of compost product exceeding the current demand for material. In order to increase demand additional markets will have to be developed or created. This will be important for Metro to consider its role in market development as it adopts organics recycling initiatives.

4-2.3.2.2 Recommendations

Figure 4-2 gives a summary of Compost Sales and Marketing findings and recommendations. Table 4-3 presents the recommendations for compost sales and marketing.

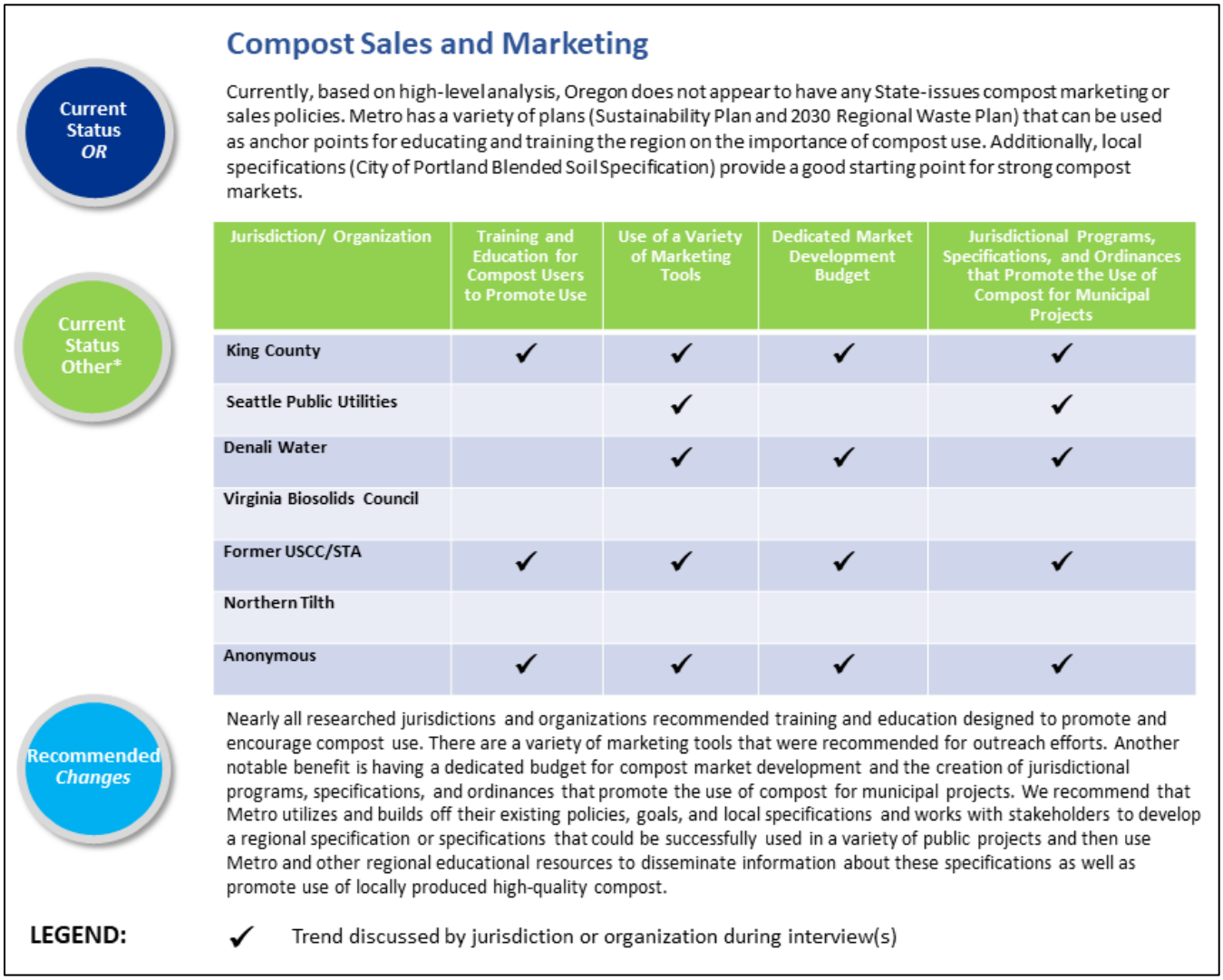

Figure 4-2. Compost Sales and Marketing Findings and Recommendations

Table 4-3. Recommendations for Compost Sales and Marketing

Focus Area	Recommendations for Metro
Compost Sales and Marketing	• As required in Topic 2, establish and enforce a requirement that all composters in the Metro region will produce high-quality compost which meet or exceed USCC Seal of Testing Assurance (STA) program standards • Implement training and education to promote the use of compost produced in the Metro region • Implement a variety of marketing practices to promote compost produced by composters in the Metro region

Table 4-3. Recommendations for Compost Sales and Marketing

Focus Area	Recommendations for Metro
	• Establish a dedicated market development budget. This may include staff who are responsible for attending trade shows, developing educational and marketing materials, engaging with industry groups, developing and updating website content, and managing social media • Market the green construction or soil amendment programs established to promote the use of compost produced in the Metro region for Metro projects

The recommendations for this focus area target the development of compost markets for compost produced in the Metro region. These recommendations build on the recommendations from previous topics.

Metro has implemented many of the necessary framework programs needed to implement the recommendations in this section. Specifically, the Green Metro Featured Projects initiative would dovetail nicely with public-private demonstration projects similar to those in King County, Washington. The Food Only Standard for Metro Central will serve to greatly reduce the amount of contamination in food waste compost, helping composters make a higher quality product that can be more effectively marketed.

Drawing on the information gathered during interviews and research, Jacobs is making the following recommendations:

- As required in Topic 2, establish and enforce a requirement that all composters in the Metro region produce high-quality compost which meet or exceed USCC STA program standards.
- Implement training and education programs for compost users (farmers, landscapers, etc) to promote compost produced in the Metro region
- Implement a variety of marketing practices to promote compost produced by composters in the Metro region. This includes public-private demonstration projects, social media, education programs, websites, tradeshows, and brochures.
- Establish a dedicated market development budget. This may include staff who are responsible for attending trade shows, developing educational and marketing materials, engaging with industry groups, developing and updating website content, and managing social media.
- Market the green construction or soil amendment programs established to promote the use of compost produced in the Metro region for Metro projects.

4-2.3.2.3 Level of Effort

Development of new marketing programs and a marketing strategy will be time consuming and require significant effort and investment since Metro will need to create or adopt new programs to fully implement the recommended changes. Marketing programs have been implemented in many regions and were found to be effective at closing the loop and helping facilities sell their compost product. King County, Washington employs full-time sales and marketing staff to promote and market the compost product produced by composters in their region. Gaining an understanding of what these employees are responsible for and how their jobs are funded should help to reduce the level of effort required to implement these new programs.

Conclusion

The overall goal of this project is to enhance Metro's regulatory and enforcement processes so that they are comprehensive, uniform, and transparent for regulated compost facilities within the Metro region while also improving material quality and minimizing the potential health and safety impacts of having compost facilities located within communities.

The following primary topics were researched for this project:

- Topic 1A – Site Operation
- Topic 1B – Compost Pile Mass
- Topic 2 – Quality of Finished Compost
- Topic 3 – Compost Markets

The findings from this research informed our recommendations for each of these topics. Tables C-1, C-2, C-3, and C-4 summarize the recommendations for each topic and the subsequent focus areas within that topic. The tables present recommendations for each facility tier (exempt, low risk, and poses potential risk facility tiers), pros and cons of the recommendations, and policy/code, enforcement, and practice and program changes that will be required.

Table C-1. Summary of Recommendations and Changes for Site Operation (Topic 1A)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
Odor Control Section 1-3.2	**For the Exempt Facility Tier**: • Enforce performance standards and initiate corrective action as issues arise. **For the Low Risk & Poses Potential Risk Facility Tiers:** • We recommend that Metro require odor controls as part of design and that all tiers above exempt include standardized performance standards in the license and a more comprehensive odor management plan that is reviewed annually, unless triggered sooner. • Require poses potential risk facilities perform odor modelling. • Prioritize reporting of odor complaints that are investigated or noted by Metro to ODEQ to ensure facilities are subject to the requirements of the nuisance odor strategy (NOS) for complaints (so complaints count towards the 10 complaints in 30-day requirement). • Recognizing that it may not be appropriate to wait until an ODEQ NOS Investigation is triggered to respond to an odor complaint it is recommended that Metro consider creating or implementing a standardized nuisance odor complaint response protocol like the TCEQ protocol which gives a Metro inspector a tool to evaluate odor based on four characteristics rather than intensity alone.	**For All Facility Tiers:** • The ODEQ nuisance odor strategy was developed by interviewing and studying different odor response strategies throughout the country. The intent is to ensure enforcement is defensible in court. • Use of a standardized odor complaint response protocol (e.g. TCEQ's), in addition to ODEQ's NOS, gives a Metro inspector a tool to evaluate an odor based on four characteristics rather than on intensity alone. The TCEQ method does not require the purchase of additional equipment and investigations can be conducted in any weather conditions. **For the Low Risk & Poses Potential Risk Facility Tiers:** • An OMP for each non-exempt facility would provide a tool to assist the operator with minimizing, mitigating, and reporting odors and Metro inspectors with an enforcement tool that could be used to bring a facility back into compliance and to right-size/modify/improve the OMP if issues surface.	**For All Facility Tiers:** • Does not provide a cut-and-dry standard (since there are too many variables to provide one simple solution). • Facilities that have issues will require time and effort to make changes. A number of the BMPs suggested in the Grimm's report are extremely costly and could range from the hundreds of thousands of dollars into the millions for larger facilities. These mitigations should be implemented on a case by case basis when necessary and as dictated by facility performance. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Requiring that non-exempt facilities include odor controls as part of the design and that an OMP will be prepared will take some additional effort by applicants. In addition, Metro will need to review these plans.	**For All Facility Tiers:** • Develop and implement a Metro-specific standardized nuisance odor complaint response/investigation protocol. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Change from requiring only poses potential risk facilities to prepare an OMP to requiring all non-exempt facilities to prepare a more comprehensive OMP and then perform an annual review (unless triggered sooner due to issues). • Require odor controls as part of design for non-exempt facilities. • Standardize performance standards in the license for all tiers above exempt. **For the Poses Potential Risk Facility Tier Only:** • Poses potential risk facilities would be required to do odor modelling and will be subject to higher frequency inspections.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • All facilities above the exempt tier will have an OMP that can be used for enforcement and documentation of BMP or operational changes. • Report confirmed complaints to ODEQ to support NOS for facilities that have ODEQ permits.	**For All Facility Tiers:** • Of the jurisdictions that Jacobs investigated and interviewed, none have a standardized list of BMPs that are triggered based on facility tier or type. However, BMPs are generally decided on a case-by-case basis. There is a Comprehensive Odor Response Project (California) that explores the effects of various compost conditions and the creation of odors. This is a good resource for inspectors and regulators to be aware of and may inform BMPs. **For the Low Risk & Poses Potential Risk Facility Tiers:** • According to ODEQ's "Composting Facility Risk Screening Checklist," facility risk is determined as follows: "Using readily available online information in conjunction with that provided by the applicant, ODEQ staff will determine whether the facility's operations are reasonably likely to cause odor impacts outside the boundaries of the facility." • Because ODEQ does not have a standardized list of low versus poses potential risk characteristics or corresponding BMPs, Metro may want to consider performing a separate evaluation to establish a consistent framework.

Table C-1. Summary of Recommendations and Changes for Site Operation (Topic 1A)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
Dust Control Section 1-3.3	**For the Exempt Facility Tier:** • Enforce performance standards and initiate corrective action as issues arise. **For the Low Risk & Poses Potential Risk Facility Tiers:** • We recommend that dust control measures are part of the design, that standardized performance standards are included in the license and that there is a dust management section is in the operations plan.	**For All Facility Tiers:** • Maintaining the current program provides an enforcement tool to Metro inspectors. • Existing code, enforcement, and program are consistent with industry based on research and interviews.	**For All Facility Tiers:** • None.	**For All Facility Tiers:** • No change, these elements are already included in the Metro license.	**For All Facility Tiers:** • No change.	**For All Facility Tiers:** • Of the jurisdictions that Jacobs investigated and interviewed, none has a standardized list of BMPs that are triggered based on facility tier or type. However, BMPs are generally decided on a case-by-case basis. There are generally known dust-control BMPs such as using a water truck to moisture condition roads and other high traffic areas, sweeping, and altering operations to prevent dust from leaving the site during windy conditions. Prevention of dust emissions is applicable for facilities in all tiers.
Housekeeping Section 1-3.4	**For All Facility Tiers:** • Research and interviews revealed no formal or specific regulations for housekeeping. Housekeeping is a BMP related to other nuisance conditions like dust, vector, odor, and track-out. We recommend that Metro enforce performance and initiate corrective action as issues arise.	**For All Facility Tiers:** • Implementing housekeeping measures as part of other nuisance control plans will meet the objective of preventing those nuisance conditions without adding additional regulation and monitoring effort.	**For All Facility Tiers:** • None.	**For All Facility Tiers:** • No change.	**For All Facility Tiers:** • No change.	**For All Facility Tiers:** • Housekeeping measures will be developed organically as BMPs for nuisance control plans are proposed and implemented at low and poses potential risk facilities. Many of these BMPs can be viewed as good housekeeping practices and are therefore required actions at compost facilities in all tiers including exempt.
Litter Control Section 1-3.5	**For the Exempt Facility Tier:** • Enforce performance standards and initiate corrective action as issues arise. **For the Low Risk & Poses Potential Risk Facility Tiers:** • We recommend that Metro require that all facilities submit a litter control plan either as a stand-alone document or as part of the operations plan and to enforce litter at the property line.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • A formal litter control section of the operations plan documents what efforts are required and provides Metro inspectors with a tool that makes compliance monitoring, inspections, and enforcement more effective through the use of progressive discipline. • Ensures the operator has considered and budgeted for litter controls.	**For All Facility Tiers:** • None.	**For All Facility Tiers:** • No change.	**For All Facility Tiers:** • No change.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Of the jurisdictions that Jacobs investigated and interviewed, none has a standardized list of BMPs that are triggered based on facility tier or type. However, there are generally known litter control BMPs such as portable litter fencing, trailer tarping, permanent litter fencing, litter pickers, and altering operations on windy days to minimize dispersal of litter. Litter is not likely to be an issue at the exempt tier due to the non-commercial nature of the feedstocks.

Table C-1. Summary of Recommendations and Changes for Site Operation (Topic 1A)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
Track-Out Section 1-3.6	**For the Exempt Facility Tier:** • Enforce performance standards and initiate corrective action as issues arise. **For the Low Risk & Poses Potential Risk Facility Tiers:** • We recommend regulating track-out measures under the NPDES stormwater program administered by ODEQ and that Metro include standardized performance standards in the license, and a track-out section in the operations plan. • Ensure track-out is controlled at the property line. • Report track-out issues to the proper ODEQ authority when a deficiency or issue is found during an inspection.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Use of the NPDES program ensures that a comprehensive, site-specific, stormwater evaluation is completed annually. • A stormwater pollution prevention plan, as required by the NPDES program, would serve as an enforcement tool for Metro inspectors. • In addition to track-out minimization practices, a stormwater pollution prevention plan would consider other stormwater BMPs to further protect the environment.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Track-out controls tend to be capital intense.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Standardize performance standards in the license required facilities above the exempt tier.	**For All Facility Tiers:** • Enforcement would be handled primarily by ODEQ. Failure to comply with ODEQ programs and requests could result in enforcement action initiated by Metro as it does reserve this right. Applies to exempt facilities also due to performance requirements.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Of the jurisdictions that Jacobs investigated and interviewed, none has a standardized list of BMPs that are triggered based on facility tier or type. However, there are generally known track-out BMPs such as wheel washes, rumble strips, and facility paving. • Development of interagency reporting programs would ensure inspection findings are investigated and enforced.
Vectors Section 1-3.7	**For the Exempt Facility Tier:** • Enforce performance standards and initiate corrective action as issues arise. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Require that all facilities submit a vector control plan either as a stand-alone document or as part of the operations plan. • Enforce vector control as a performance standard.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Ensures the operator has considered and budgeted for vector controls. • Provides Metro with an enforcement tool.	**For All Facility Tiers:** • Does not provide a cut-and-dry standard for what constitutes a violation for vectors.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Build on current code, which requires operators to minimize vectors by requiring a vector control plan be included in the operations plan and include standardized performance standards in the license.	**For All Facility Tiers:** • All facilities, including exempt tier, are subject to performance standards and must prevent vectors on site. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Builds on the current requirement to prevent vectors by providing a plan that can be used to verify if the operator is implementing their own BMPs.	**For All Facility Tiers:** • Of the jurisdictions that Jacobs investigated and interviewed, none has a standardized list of BMPs that are triggered based on facility tier or type. However, there are generally known vector control BMPs such as poppers, bangers, flares, falconers, drones, kites, lasers, and other measures that can be used at all facility tiers to minimize vectors.
Compost Leachate, Groundwater, and Stormwater Management Section 1-3.8	**For the Exempt Facility Tier:** • Enforce performance standards and initiate corrective action as issues arise.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • The NPDES stormwater program is already in place and the requirements are	**For All Facility Tiers:** • Reporting potential violations to the proper ODEQ authority in this case would be best. • Does not provide additional enforcement power to Metro	**For All Facility Tiers:** • Would require the development of a reporting protocol and means whereby Metro can request that a facility receive an inspection	**For All Facility Tiers:** • Enforcement would be handled primarily by ODEQ. Failure to comply with ODEQ programs and requests could result in enforcement action	**For All Facility Tiers:** • Development of interagency reporting programs would ensure inspection findings are investigated and enforced.

Table C-1. Summary of Recommendations and Changes for Site Operation (Topic 1A)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
	For the Low Risk Facility Tier: • Adhere to the ODEQ facility permitting and screening process. • We recommend that Metro include standardized performance standards in the license, and a leachate, stormwater, and groundwater management section in the operations plan. • Develop a formal Metro/ODEQ reporting protocol for water/leachate impacts. • Determine a minimum pond sizing requirement. **For the Poses Potential Risk Facility Tier:** • Implement the Low Risk Facility Tier recommendations. • Implement ODEQ ground water and storm water protection requirements at the facility level.	already protective of Oregon surface/stormwaters. • The ODEQ groundwater protection requirements such as pad thickness and permeability requirements exceed those in California and Washington. Additional measures are not recommended based on the research findings. • Many of the jurisdictions use a 25-year/24-hour storm event design standard for leachate collection ponds. This is intended to safeguard against overflows and discharges from the facility by sizing the retention basins large enough that a normal rain event would not overwhelm the basins.	inspectors as other recommendations do.	from the proper ODEQ authority.	initiated by Metro as it does reserve the right this right.	
Throughput Capacity and Process Design Requirements Section 1-3.9	**For the Exempt Facility Tier:** • Enforce performance standards and initiate corrective action as issues arise. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Create and implement facility specific design and throughput requirements for all facilities required to submit to the ODEQ screening process. This process should require input from industry experts and design and certification by an appropriate professional engineer.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Limiting tonnage to an engineered design and throughout capacity, required at non-exempt facilities, prevents acceptance of materials above a facility's realistic processing capacity. • The engineered process design requires facilities to state pile-size parameters and processing times. Metro would also create daily and annual tonnage limits for the facility. This provides Metro inspectors with additional tools for measuring compliance. • Using the tools mentioned above, Metro inspectors would have the ability to implement progressive enforcement if a	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Implementing a new requirement of this nature would require Metro to go through its formal rulemaking type process and would likely require stakeholder workshops and a public input process. Level of effort for this recommendation would be significant as it exceeds current ODEQ requirements. Rulemaking process could take 6 to 12 months. • Facilities in the Metro region would be required to spend a significant amount of effort and money to develop a facility design and throughput report. In some cases, this would also require the facility to update its operations to	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Change Metro Code to require the development of an engineered process design and throughput report for non-exempt facilities, in conjunction with the recommended pile-size requirements included as part of Topic 1B.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • An engineered process design and throughput report would allow Metro to develop maximum daily and annual tonnage limits. These limits provide Metro inspectors with a tool for measuring compliance. By reviewing tonnage records, Metro inspectors can quickly see if a facility is out of compliance with daily limits and if that facility is on pace to exceed annual limits. • Review of pile sizes and processing times can also be used as a compliance metric.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • The jurisdictions that Jacobs investigated and interviewed consistently required similar components for the process design and throughput report. These components include engineered calculations and drawings, process descriptions, proposed pile sizes, proposed composting technology, composting equipment to be used, and proposed feedstocks.

Table C-1. Summary of Recommendations and Changes for Site Operation (Topic 1A)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
		facility does not comply with their design and throughput report.	comply with the report, causing additional effort. The compliance timeline for existing facilities should be carefully considered.			
Operations Equipment Exhaust Section 1-3.10	**For All Facility Tiers:** • No change or additional permitting is recommended based on the research findings.	**For All Facility Tiers:** • New equipment and technology typically result in more efficient operations.	**For All Facility Tiers:** • Creating an equipment exhaust program for facilities only located in the Metro region would put those facilities at a significant financial disadvantage. The cost to comply with these programs would likely drive material out of the Metro region. • The cost of developing and enforcing a program like that in California and Washington would be significant. The significant increase in cost and effort would not likely be justified by the emission reductions gained.	**For All Facility Tiers:** • None recommended.	**For All Facility Tiers:** • None recommended.	**For All Facility Tiers:** • None recommended.

Note:
“All Facility Tiers” includes the Exempt, Low Risk, and Poses Potential Risk facility tiers.

Table C-2. Summary of Recommendations and Changes for Compost Pile Mass (Topic 1B)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
Compost Pile Size Section 2-2.2	**For the Exempt Facility Tier:** • Defer regulation of compost pile size to state and local fire code unless nuisance conditions develop. • If nuisance conditions develop for a facility, regulate compost pile size as a Low Risk facility. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Pile size must meet state and local fire code, at a minimum. • Require compost facilities to propose pile sizing design and engineering controls with evidence that support favorable aerobic conditions, temperature, fire prevention, and nuisance conditions. • Utilize the following compost pile sizing as a guideline: Height – 14 feet Width – 25 feet Length – 150 feet Distance between piles – 20 feet • Negotiate compost pile sizing with each facility based on compost system design and implementation of engineering controls, with the option to default to guideline sizing. • Incorporate negotiated pile size limits into the license. • Monitor facility for any fire or nuisance concerns related to pile size during routine inspections.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Negotiated pile sizing will meet the needs of the individual compost facilities based on their chosen processing method. • Submitting a design and negotiating pile size will provide Metro with a measurable enforcement metric during inspections. • Adopting a throughput and process design for each individual facility helps to ensure that composters in the region do not accept more material than they can handle. • Suggested pile sizing guidelines will serve as a starting point for throughput and process design negotiations.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Does not provide a “cut-and-dry” standard since there are many variables (feedstocks, ratios, processing method, active composting method, etc.) at each site. • Requires increased level of effort to negotiate pile sizing for each facility.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Revise Metro code and licenses to require submittal and approval of a facility specific throughput and process design.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • A calculated, negotiated and approved pile size and process design provides Metro with a measurable metric to enforce against.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Licensing processes would need to be revised to include time for a review of the throughput and process design, as well as negotiation of pile sizing.

Table C-3. Summary of Recommendations and Changes for Quality of Finished Compost (Topic 2)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
Metals Section 3-2.2	**For the Exempt Facility Tier:** • It is recommended that no regulation be required with respect to metals unless issues arise at the facility that warrant a need for regulation. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Require facilities to participate in the STA program. • Require that facilities electronically submit STA compost results to Metro. • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements. • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives. • Require facilities to retest and evaluate operations, if not meeting health and safety/quality requirements.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Metro region compost facilities already participate in the STA program voluntarily. Establishment of an STA requirement ensures this practice continues with minimal cost impact to compost facilities. • Submittal of STA results to Metro inspectors allows a review of health and safety and quality criteria • Testing in compliance with the STA program will allow Metro to adopt use specifications and sampling results will be comparable across compost facilities. • STA updates are made occasionally and would help Metro region facilities remain on the forefront of industry testing parameters. • Retesting requirements standardize the procedure for verifying failures and improving product quality.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Requires increased level of effort to review facility STA results.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Revise Metro licenses to require compost sampling according to STA program guidelines.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Require submittal of STA compost reports. • Require participation in the retesting program when facilities have results that "fail."	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Metro will need to update their inspection practices to include a review of the submitted results. Possible follow-up may be necessary if a failing result is submitted.
Pathogens Section 3-2.3	**For the Exempt Facility Tier:** • It is recommended that no regulation be required with respect to pathogens unless issues arise at the facility that warrant a need to regulate pathogens. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Adopt specific requirements for pathogen reduction methods consistent with Oregon DEQ's requirements. • Adopt the Oregon DEQ sampling tier that requires facilities that accept more than 50 percent Type 2 (manure	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Oregon DEQ has established the only pathogen reduction verification protocol that considers the potential for feedstock to affect finished compost. • Metro region compost facilities already participate in the STA program voluntarily. Establishment of an STA requirement ensures this practice continues with minimal cost impact to compost facilities. • Submittal of STA results to Metro inspectors allows a	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Requires increased level of effort to review facility STA results.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Revise Metro licenses to require sampling and reporting of pathogens according to STA program guidelines.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Require submittal of STA compost reports. • Require participation in the recommended retesting program when facilities have results that "fail."	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Metro will need to update their inspection practices to include a review of the submitted results. Possible follow-up may be necessary if a failing result is submitted.

Table C-3. Summary of Recommendations and Changes for Quality of Finished Compost (Topic 2)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
	and agricultural wastes) feedstocks to sample for fecal coliform. Facilities accepting less than 50 percent Type 2 feedstocks may choose to sample for either salmonella or fecal coliform bacteria. • Require facilities to retest and evaluate operations, if not meeting health and safety/quality requirements.	review of health and safety and quality criteria. • Testing in compliance with the STA program will allow Metro to adopt use specifications and sampling results will be comparable across compost facilities. • STA updates are made occasionally and would help Metro facilities remain on the forefront of industry testing parameters. • Retesting requirements standardize the procedure for verifying failures and improving product quality.				
Testing Frequency Section 3-2.4	**For the Exempt Facility Tier:** • Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to testing frequency similar to the STA program. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Require facilities to participate in the STA program. • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting other quality parameter requirements. • Require that facilities electronically submit STA testing results to Metro. • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Metro compost facilities already participate in the STA program voluntarily. Establishment of an STA requirement ensures this practice continues with minimal cost impact to compost facilities. • Submittal of STA results to Metro inspectors allows a review of health and safety and quality criteria. • Testing in compliance with the STA program will allow Metro to adopt use specifications and sampling results will be comparable across compost facilities. • Adopting STA sampling frequency will be more representative of the final product.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Requires increased level of effort to review facility STA results.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Revise Metro licenses to require facilities to sample according to STA requirements.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Require submittal of STA compost reports.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Review submitted STA reports and amount of product produced to verify compliance with sampling frequency.

Table C-3. Summary of Recommendations and Changes for Quality of Finished Compost (Topic 2)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
Contaminants Section 3-2.5	**For the Exempt Facility Tier:** • Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to contaminant testing and reporting. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Require facilities to participate in the STA program. Complaints about quality will trigger increased sampling and potentially process changes until the problem can be identified and addressed. • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements. • Work with USCC to create a customized Metro report format that includes physical contamination results per TMECC 03.08-A. • Require that facilities electronically submit STA testing results to Metro to learn about amount of plastic, metal, glass, stones, and sharps present (percent by dry weight). • Periodically review STA program when it is modified to ensure that it aligns with Metro's testing objectives. • Require facilities to retest and evaluate operations, if not meeting Metro's requirements.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Metro region compost facilities already participate in the STA program voluntarily. Establishment of an STA requirement ensures this practice continues with minimal cost impact to compost facilities. • Submittal of STA results to Metro inspectors allows a review of health and safety and quality criteria. • Testing in compliance with the STA program will allow Metro to adopt use specifications and sampling results will be comparable across compost facilities. • STA updates are made occasionally and would help Metro region facilities remain on the forefront of industry testing parameters. • Retesting requirements standardize the procedure for verifying failures and improving product quality. • USCC has worked with jurisdictions (e.g. TMECC 03.08-A) in the past to develop jurisdictionally specific reports that can be used to inform facility operators and Metro inspectors on the types of contamination that is making into the compost.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Requires increased level of effort to review facility STA results.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Revise Metro licenses to require facilities to sample according to STA requirements.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Require submittal of STA compost reports. • Require participation in the recommended retesting program when facilities have results that "fail" or are consistently high for contamination.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Review submitted STA reports to understand the level of contamination in each product.
Stability and Maturity	**For the Exempt Facility Tier:**	**For the Low Risk & Poses Potential Risk Facility Tiers:**	**For the Low Risk & Poses Potential Risk Facility Tiers:**	**For the Low Risk & Poses Potential Risk Facility Tiers:**	**For the Low Risk & Poses Potential Risk Facility Tiers:**	**For the Low Risk & Poses Potential Risk Facility Tiers:**

Table C-3. Summary of Recommendations and Changes for Quality of Finished Compost (Topic 2)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
Section 3-2.6	• Do not require facilities to participate in the STA program, unless issues arise at the facility (such as violations, persistent odor issues), in which case Metro may consider subjecting the facility to testing and thresholds similar to the STA program. **For the Low Risk & Poses Potential Risk Facility Tiers:** • Update facility licenses to require stability sampling and analysis. • Verify sampling is occurring by reviewing STA reports provided by the operator. • Require increase in testing frequency and that the Operations Plan and/or operational practices be reviewed and/or modified if not meeting STA requirements. • Require facilities to retest and evaluate operations, if not meeting requirements.	• Metro region compost facilities already participate in the STA program voluntarily. Establishment of an STA requirement ensures this practice continues with minimal cost impact to compost facilities. • Submittal of STA results to Metro inspectors allows a review of health and safety and quality criteria. • Testing in compliance with the STA program will allow Metro to adopt use specifications and sampling results will be comparable across compost facilities. • STA updates are made occasionally and would help Metro region facilities remain on the forefront of industry testing parameters. • Retesting requirements standardize the procedure for verifying failures and improving product quality.	• Requires increased level of effort to review facility STA results.	• Revise Metro licenses to require compost sampling according to STA program guidelines.	• Require submittal of STA compost reports. • Require participation in the recommended retesting program when facilities have results that “fail” or are consistently high for contamination.	• Metro will need to update their inspection practices to include a review of the submitted results. Possible follow-up may be necessary if a failing result is submitted. STA reports typically provide a range for maturity and stability.
Bioaerosols and Pesticides Section 3-2.7	**For the Exempt Facility Tier:** • Do not impose requirements, unless issues arise at the facility (such as violations, other persistent issues), in which case Metro may consider subjecting the facility to regulation as a Low Risk facility. **For the Low Risk & Poses Potential Risk Facility Tiers:** • If a verified pesticide or herbicide issue arises, work with the Oregon Department of Agriculture to develop source control requirements. • Require facilities to control dust emissions, thereby also	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Bioaerosols can be controlled using many of the same techniques used to minimize and control dust. • Requires moderate effort only if an issue arises. Solution provided leaves burden of enforcement with Oregon Department of Agriculture.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • Requires increased level of effort to coordinate with Oregon Department of Agriculture in the event of pesticide or herbicide issues.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • None at this time. Changes may be required if a pesticide or herbicide arises as problematic. Coordination with the Oregon Department of Agriculture would be required to determine changes.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • None at this time. Changes may be required if a pesticide or herbicide arises as problematic. Coordination with the Oregon Department of Agriculture would be required to determine changes.	**For the Low Risk & Poses Potential Risk Facility Tiers:** • None at this time. Changes may be required if a pesticide or herbicide arises as problematic. Coordination with the Oregon Department of Agriculture would be required to determine changes.

Table C-3. Summary of Recommendations and Changes for Quality of Finished Compost (Topic 2)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
	controlling bioaerosol emissions. • Verify during inspections that dust emissions are controlled.					
Per- and Polyfluoroalkyl Substances Section 3-2.8	**For the Exempt Facility Tier:** • Do not impose requirements, unless issues arise at the facility (such as violations, other persistent issues), in which case Metro may consider subjecting the facility to regulation as a Low Risk facility. **For the Low Risk & Poses Potential Risk Facility Tiers:** • If Metro desires to understand more regarding the PFAS concentrations in compost produced in the region, then Jacobs recommends implementing a general sampling program at non-exempt facilities. • Accept food only feedstocks, avoiding packaging. • Refrain from composting biosolids until more is understood about the relationship between biosolids compost and plant uptake.	**For All Facility Tiers:** • Food only program is already established and should result in reduced product contamination versus programs that allow food packaging and compostable plastics. • Biosolids composting is not currently allowed in the Metro region and refraining from composting biosolids at this time will not impact any Metro composters.	**For All Facility Tiers:** • Significant level of effort to define and implement a PFAS sampling program. • Refraining from biosolids composting eliminates a significant diversion opportunity.	**For All Facility Tiers:** • Food only feedstocks for composting. • Potential policy/code changes could arise out of a PFAS sampling program. May affect exempt tier levels.	**For All Facility Tiers:** • Potential enforcement changes could arise out of a PFAS sampling program. May affect exempt tier levels.	**For All Facility Tiers:** • Potential practice/program changes could arise out of a PFAS sampling program. May affect exempt tier levels.

Note:

“All Facility Tiers” includes the Exempt, Low Risk, and Poses Potential Risk facility tiers.

Table C-4. Summary of Recommendations and Changes for Compost Markets (Topic 3)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
Compost Use Incentives Section 4-2.2	**For All Facility Tiers:** • Develop and adopt minimum soil specifications that introduce the use of compost produced in the Metro region for Metro's capital improvement projects, especially in areas where soil and stormwater health are important. Metro could start by comparing the soil specifications already adopted in Oregon and Washington and leveraging regional stakeholders to ensure specifications are appropriate for the Metro region. • Develop and adopt green construction or soil amendment programs for capital improvement projects that result in soil disturbance or for projects where soil health needs improvement. These programs should favor or require use of compost produced in the Metro region that meets specifications. • Implement regular learning sessions with engineers and landscape architects in the region. These learning sessions will advocate for the use of compost in soil disturbance projects and other capital improvement projects and will educate participants on the benefits of compost for improving soil health.	**For All Facility Tiers:** • Several programs and specifications already exist in the Portland and Seattle areas. These programs can be used as a starting point for Metro specifications. • Having defined specifications has helped the jurisdictions and compost producers interviewed for this project to improve compost markets which improved the environmental and financial sustainability of compost facilities in their regions. • Green construction programs that promote or require the use of compost, like Soils for Salmon, have shown substantial environmental benefits in addition to the financial benefits to composters. • Education of engineers and landscape architects will serve to increase the use and quality of compost in the Metro region.	**For All Facility Tiers:** • Development of new programs and regulations will be time consuming and will require significant effort and investment because Metro will need to create or adopt new programs to fully implement the recommended changes.	**For All Facility Tiers:** • Revise Metro licenses to require compost sampling according to STA program. • Adoption of use specifications. • Adoption of green construction or soil amendment programs.	**For All Facility Tiers:** • Verify through testing, provided by the compost producer, that compost meets the designated project specification. • Verify that, where appropriate, capital projects are requiring the use of compost or compost amended soils.	**For All Facility Tiers:** • Establishment of "brown bag" education sessions for engineers and landscape architects to promote educate them on the use of compost as a soil amendment.
Compost Sales and Marketing Section 4-2.3	**For All Facility Tiers:** • As required in Topic 2, establish and enforce a requirement that all composters in the Metro region will produce high-quality compost which meet or exceed USCC Seal of Testing	**For All Facility Tiers:** • Development and improvement of compost markets in the Metro region will serve to prepare the market for food waste feedstocks and the additional	**For All Facility Tiers:** • Development of new marketing programs and a marketing strategy will be time consuming and require significant effort and investment since Metro will need to create or adopt new	**For All Facility Tiers:** • None.	**For All Facility Tiers:** • No change.	**For All Facility Tiers:** • Establishment of a dedicated compost marketing and education program and budget.

Table C-4. Summary of Recommendations and Changes for Compost Markets (Topic 3)

Focus Area	Summary of Recommendations	Pros	Cons	Policy/Code Changes	Enforcement Changes	Practice/Program Changes
	Assurance (STA) program standards. • Implement training and education to promote the use of compost produced in the Metro region. • Implement a variety of marketing practices to promote compost produced by composters in the Metro region. • Establish a dedicated market development budget. This may include staff who are responsible for attending trade shows, developing educational and marketing materials, engaging with industry groups, developing and updating website content, and managing social media. • Market the green construction or soil amendment programs established to promote the use of compost produced in the Metro region for Metro projects.	compost produced when it is introduced as a feedstock. • Development and improvement of compost markets will serve to diversify the uses of compost which will protect compost producers in the event that a market suffers for unforeseen reasons. • Education of compost users and students will serve to benefit compost producers in the long term. • Marketing of compost through trade shows, trade organizations, and other methods will notify users in the region that compost producers in the Metro region are making high quality compost that meets the Metro specification. • Development of websites, brochures, and other marketing materials will provide compost users with resources to educate themselves on compost use specifications and other programs.	programs to fully implement the recommended changes.			

Note:

"All Facility Tiers" includes the Exempt, Low Risk, and Poses Potential Risk facility tiers.

Appendix A
Composting Regulations and Tiers by Jurisdictions

Table A-1. Composting Regulations and Tiers by Jurisdiction

	Tiers	Feedstock Type	Volume Limit*	Permitting Differences	Odor Control Enforcement Differences	Dust-Control Enforcement Differences	Housekeeping Enforcement Differences	Litter Control Enforcement Differences	Track-out Enforcement Differences	Vector Control Enforcement Differences	Compost Leachate, Groundwater, and Stormwater Management Enforcement Differences	Throughput Capacity and Process Design Enforcement Differences	Operations Equipment Exhaust Enforcement Differences
ODEQ	1	Type 1 /Type 2	<100 tons [~333 cy] per year	Excluded / Exempt	Odor minimization plan is not required for Excluded / Exempt facilities.	A description of dust-control activities is not required for Excluded / Exempt facilities.	Operator is not required to describe housekeeping specific activities.	A description of litter-control activities is not required for Excluded / Exempt facilities.	A description of track-out control activities is not required for Excluded / Exempt facilities.	A description of vector-control activities is not required for Excluded / Exempt facilities.	Water quality activities not required for Excluded / Exempt facilities.	Investigations and interviews revealed no requirement to develop and implement a Throughput Capacity and Process Design.	Investigations and interviews revealed no operations equipment exhaust requirements.
		Type 3	<20 tons [~67 cy] per year										
		Type 3 (in-vessel)	<40 tons [~133 cy] per year										
		Farm Silage	Unlimited assuming performance										
		Home Composting	Unlimited assuming performance										
		On Farm	Unlimited assuming performance										
	2	Type 1/Type 2	>100 tons [~333 cy] per year	ODEQ Screening to Determine Facility Risk and Permitting Level	Odor minimization plan is required when a facility is deemed to pose a risk for odors. Both Low Risk and Poses Risk facilities must include an odor mitigation section in the Operations Plan.	A description of dust-control activities is required in operations plan.	A description of housekeeping activities is included in nuisance control plan.	A description of litter-control activities required in operations plan.	Track-out minimization required by stormwater permit.	A description of vector-control activities required in operations plan.	Leachate, stormwater and ground management plans required in operations plan. Pad, conveyance and storage requirements also apply based on ODEQ screening process. Stormwater regulated through NPDES permit.		
		Type 3	>20 tons [~67 cy] per year										
		Type 3 (in-vessel)	>40 tons [~133 cy] per year										
CalRecycle	1	All Feedstocks	100 cy at any one time	Excluded / Exempt	Odor impact minimization plan is not required for Excluded / Exempt facilities.	A description of dust-control activities is not required for Excluded / Exempt and notification tier facilities.	Operator is not required to describe housekeeping specific activities.	A description of litter-control activities is not required for Excluded / Exempt and notification tier facilities.	Track-out minimization required by stormwater permit, which is administered by the SWRCB.	A description of vector-control activities is not required for Excluded / Exempt and notification tier facilities.	Leachate, stormwater and ground management is regulated by SWRCB.	Throughput Capacity and Process Design not required for Excluded / Exempt and Notification tiers.	Operations equipment exhaust regulations are set forth at the state level and are enforced at the regional air board level. These regulations require that operators in many industries, including compost facilities, to update the equipment fleet to minimize emissions. The requirements are based on horsepower and fleet average emissions.
		Vermicomposting	Unlimited assuming performance										
		Mushroom Farming	Unlimited assuming performance										
		On Farm	Unlimited assuming performance										
	2	Green Waste	<12,500 cy on site	Enforcement Agency Notification	odor impact minimization plan required at all tiers/permitting levels above exempt. Operations plan required for registration and full tiers. Inspection frequency increases with tier.								
		Agricultural	Unlimited assuming performance										
		Biosolids at Publicly Owned Treatment Works	Unlimited assuming performance										
		Research Operation	<5,000 cy on site or >5,000 cy on site if in vessel										
		Chip and Grind	≤200 tons [~667 cy] per day										
CalRecycle	3	Vegetative Food Waste	<12,500 cy on site	Registration Permit		A description of dust-control	A description of housekeeping	A description of litter-control		A description of vector-control		Throughput capacity and	

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		Chip and Grind	>200 tons [~667 cy] per day - ≤500 tons [~1,667 cy] per day			activities is required as part of the RCSI	activities is included in nuisance control plan.	activities is required as part of the RCSI		activities is required as part of the RCSI		process design report is required for this tier to be included in the RCSI.	
	4	All Feedstocks	>100 cy on site	Full Solid Waste Facility Permit									
		Green Waste	>12,500 cy on site										
		Food Waste	>12,500 cy on site										
CA SWRCB	1	All Feedstocks	<5,000 cy at any one time	N/A	N/A	N/A	N/A	N/A	Track-out minimization required by stormwater permit.	N/A	N/A	N/A	N/A
	2	Tier 1 Feedstocks	<25k cy on site at any one time and Tier 1 Feedstocks	N/A							Water and Waste Water Management Plan required by the SWRCB for every facility. Ponds, pads, conveyance must be built to handle a 25-yr/24-hr storm. Quarterly inspections and leachate sampling. Stormwater regulated by NPDES Permit.	Design plan is required to determine tier level.	
	3	Tier 2 Feedstocks	Tier 2 Facility: >25k cy on site at any one time or Tier 2 Feedstocks	Dissolved Oxygen in pond must be above 1 mg/L							All Tier 1 requirements plus, pad, pond and conveyance system hydraulic conductivity requirements, pan lysimeter under pond, quarterly PL sampling. Stormwater regulated by NPDES Permit.	Design plan is required to determine tier level.	
WDOE	1	All Feedstocks	<5,000 gallons or 25 cy of material on-site at any one time.	Excluded / Exempt	Odor management plan required at facilities above Excluded / Exempt and notification tiers.	A description of dust-control activities is not required for Excluded / Exempt and notification tier facilities.	A description of housekeeping activities is included in nuisance control plans required above the Exempt / Excluded and notification tiers.	A description of litter-control activities is not required for Excluded / Exempt and notification tier facilities.	Track-out minimization required by stormwater permit.	A description of vector-control activities is not required for Excluded / Exempt and notification tier facilities.	Leachate management plan required for nonexempt / notification tier facilities. Pads must be asphaltic concrete, soil cement or other approved substance, pond must be lined and sized to hold a 25-yr/24-hr storm.	Facilities above the Excluded / Exempt and notification tiers must prepare and submit a facility design and throughput report.	Operations equipment exhaust regulations are set forth at the state level and are enforced at the regional air board level. These regulations require that operators in many industries, including compost facilities, to update the equipment fleet to minimize emissions. The requirements are based on horsepower and fleet average emissions.
	2	All Feedstocks	25-250 cy, <1000 cy/yr	30 day notification, dairy/farm management plans, must sample if selling offsite, must submit annual reports.									
	3	Yard Debris, Crop residue, Manure, Amendments	25-500 cy, <2500 cy/yr										
	4	Ag wastes, Yard Debris, Amendments	25/1000 cy, ≤50% yard debris										
	5	Ag Wastes, Manure, Amendments	>25 cy										

Table A-1. Composting Regulations and Tiers by Jurisdiction

	Tiers	Feedstock Type	Volume Limit*	Permitting Differences	Odor Control Enforcement Differences	Dust-Control Enforcement Differences	Housekeeping Enforcement Differences	Litter Control Enforcement Differences	Track-out Enforcement Differences	Vector Control Enforcement Differences	Compost Leachate, Groundwater, and Stormwater Management Enforcement Differences	Throughput Capacity and Process Design Enforcement Differences	Operations Equipment Exhaust Enforcement Differences
AEP	1	All Feedstocks	<20,000 tonnes [~73,487 cy] per year	General requirements implemented	Odor Management plan required for either tier. Odor modelling and D/T limit typically required at higher tier. Public liaison committee often required at higher tier.	Dust-control measures are required for either tier.	A description of housekeeping activities is included in nuisance control plans.	Litter control measures are required for either tier.	Track-out not regulated based on interviews and investigations.	Vector control measures are required for either tier. Vector control should be addressed in the operations plan.	Leachate, groundwater and stormwater management are included in the facility design. Pad requirements and conveyance, run-on and run-off control also required. If facility is not enclosed, exceeds 5000 tpy, low perm subgrade, or high-water table then groundwater monitoring is required.	Design plan required as part of the permitting process.	AEP incentivizes operators by providing GHG credits to operators that replace equipment that produces high GHG emissions with lower GHG emission equipment.
	2	All Feedstocks	>20,000 tonnes [~73,487 cy] per year	Site Specific requirements									
British Columbia	1	Land Application	Unlimited assuming performance	Excluded / Exempt	Odor management plan is not required for Excluded / Exempt facilities.	A description of dust-control activities is not required for Excluded / Exempt facilities.	Operator is not required to describe housekeeping specific activities.	A description of litter-control activities is not required for Excluded / Exempt facilities.	Track-out not regulated based on interviews and investigations. BC does cite the ODEQ 1200Z stormwater permit for water quality benchmarks.	A description of vector-control activities is not required for Excluded / Exempt facilities.	A description of leachate management activities is not required for Excluded / Exempt facilities.	Design plan not required at Excluded / Exempt facilities.	Operator not required to submit an Air Quality Control Plan at the Excluded / Exempt tier.
		Ag/On Farm	Unlimited assuming performance										
		Backyard	Production of <20 m^3 [26 cy] annually										
		Demonstration Gardens	Composting <100 m^3 [130 cy] annually										
	2	Biosolids/Food Waste	5,000 tonnes [~18,372 cy] annual production capacity	Permit / Env Impact Study Required	Odor management plan required as part of the EIS. Odor management plan and EIS must be prepared by a qualified professional.	Dust-control measures required as part of the air quality control plan.	A description of housekeeping activities is included in nuisance control plans.	Litter impacts should be considered when selecting a compost site.		Vector control processes are required by regulation and a description of required and additional measures should also be included in the Wildlife Management and Control Plan.	Leachate, groundwater, and stormwater management are included in the facility design. Plan must include leachate minimization, control, collection, treatment, and monitoring systems aimed at preventing ground and surface water contamination.	Design plan must be prepared by a qualified professional as defined in the BCMOE regulations.	Operator must prepare an Air Quality Control Plan as part of the operations plan. Equipment exhaust emission must be addressed in the plan.
	3	All Feedstocks	20,000 tonnes [~73,487 cy] annual production capacity	Permit / Env Impact Study Required									
Mass DEP	1	Group 2 (low C:N) Feedstocks	>105 tons [~350 cy]/ week or 30 tons [~100 cy]/day	General Permit	Odor management plan required for general permit, odor controls must be included as part of the design plan, odor contingency plan also required.	Environmental controls for preventing nuisance dust must be included in the design plan.	A description of housekeeping activities is included in nuisance control plans.	The operator will take measures to prevent the migration of wind-blown litter.	Track-out minimization required by stormwater permit.	Facilities are required to implement a vector-control plan as a general permit requirement.	Proposed leachate controls included in design plan. Stormwater is regulated under the NPDES program.	As a general permit requirement, the facility must have a registered professional engineer prepare a design as part of the permitting process.	Investigation did not reveal requirements to regulate equipment exhaust in the Mass DEP solid waste regulations.
		All Feedstocks	<5,000 cy/acre										
Mass DEP		All Feedstocks	<50,000 cy on site										
	2	All Feedstocks	>105 tons [~350 cy]/ week or 30 tons [~100 cy]/day	Site-specific RCC Permit									
Maryland DEP	1	Natural Wood Waste (NWW)	No Limit	NWW Recycling Facility Permit	No Odor Management Plan required at this tier.	Investigation into Maryland DEP regulations did not reveal a specific requirement to control dust.	Investigation into Maryland DEP regulations did not reveal specific housekeeping requirements.	No litter-control plan required at this tier.	No track-out control required at this tier.	Vector control required at this tier.	Stormwater regulation subject to Stormwater Associated with Industrial Activity General Discharge Permit.	No design plan/throughput capacity report required.	
	2	Type 1: Yard Waste	Farm facilities exempt if using 40,000 square feet or less in support of composting operations and only use Type 1	Composting Facility Permit Required unless meet exception. All-weather pad required for feedstock	Odor Management Plan must be included in compost facility operations plan. Regulations direct operators to			Litter control must be included in the nuisance prevention plan as a section of the compost	Track-out control procedures must be included in the compost facility operations plan.	Vector control procedures must be included in the compost facility operations plan.	Stormwater regulation subject to Stormwater Associated with Industrial Activity General Discharge Permit. All weather pad also required at a 1-6% slope. 2- 4 feet separation from water table.	Design plan and throughput capacity report required as part of the compost	

Table A-1. Composting Regulations and Tiers by Jurisdiction

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			feedstocks as well as any feedstocks generated onsite. Nonfarm facilities exempt if using 5,000 square feet or less in support of composting operations and complying with the following pile height limits: 9 feet for raw feedstocks and 12 feet for active, curing, or finished compost piles (except where smaller pile sizes are required by local law)	receiving, curing and storage.	review CalRecycle OIMP requirements (as an example).			facility operations plan.			No leachate collection/stormwater collection requirements apply.	facility operations plan.	
	3	Type 2: Food scraps, nonrecyclable paper, animal manure and bedding, industrial food processing materials, animal mortalities, compostable products	Exempt using 5,000 square feet or less in support of composting operations and complying with the following pile height limits: 9 feet for raw feedstocks and 12 feet for active, curing or finished compost piles (except where smaller pile sizes are required by local law)	Composting Facility Permit Required. Low permeability pad required for feedstock receiving and active composting areas and all-weather pad for curing finished areas.	Odor Management Plan must be included in compost facility operations plan. Regulations direct operators to review CalRecycle OIMP requirements (as an example).			Litter control must be included in the nuisance prevention plan as a section of the compost facility operations plan.	Track-out control procedures must be included in the compost facility operations plan.	Vector control procedures must be included in the compost facility operations plan.	Tier 2 (small) – Tier 1 requirements plus, 6” carbon substrate under piles, covered active piles. No leachate/stormwater collection requirements. Tier 2 (large) – requires addition of low perm pad in active areas. Contact water from feedstock and active areas must be contained and stored in a collection basin prior to reuse, transport offsite or discharge. Containment must be sized to a 25-yr/24-hr storm, have a synthetic liner, <10-7 perm, >1-ft-thick compacted clay.	Design plan and throughput capacity report required as part of the compost facility operations plan.	Equipment powered by an internal combustion engine with a bhp of 500 or greater will require a Permit to Construct. This equipment may include aeration systems, sorting system, screens, grinders, shredders, dryers, and bagging equipment.
	4	Type 3: Sewage Sludge or Biosolids, used diapers, MSW	N/A	Refuse Disposal Permit or Sewage Sludge Utilization permit required if any type 3 feedstocks are composted.	Odor management plan must be included in compost facility operations plan. Regulations direct operators to review CalRecycle OIMP requirements (as an example).			Litter control must be included in the nuisance prevention plan as a section of the compost facility operations plan.	Track-out control procedures must be included in the compost facility operations plan.	Vector control procedures must be included in the compost facility operations plan.	Engineering plans and specifications must be submitted during permitting that described the measures to be taken to prevent or control groundwater and surface/stormwater pollution.	Design plan and throughput capacity report required as part of the compost facility operations plan.	

Notes:

* The actual limit as listed in each jurisdiction is included. For those not already in cy units, a conversion factor has been used and the estimated number is shown in brackets [ ]. For mass to volume, we used 600 lbs/cy for yard waste https://www.calrecycle.ca.gov/swfacilities/cdi/tools/calculations

25k = 25,000

AEP = Alberta Environment and Parks

BCMOE = British Columbia Ministry of the Environment

Table A-1. Composting Regulations and Tiers by Jurisdiction

	Tiers	Feedstock Type	Volume Limit*	Permitting Differences	Odor Control Enforcement Differences	Dust-Control Enforcement Differences	Housekeeping Enforcement Differences	Litter Control Enforcement Differences	Track-out Enforcement Differences	Vector Control Enforcement Differences	Compost Leachate, Groundwater, and Stormwater Management Enforcement Differences	Throughput Capacity and Process Design Enforcement Differences	Operations Equipment Exhaust Enforcement Differences

cy = cubic yard(s)

cy/yr = cubic yard(s) per year

GHG = greenhouse gas

hr = hour

Maryland DEP = Maryland Department of Environmental Protection

Mass DEP = Massachusetts Department of Environmental Protection

N/A = not applicable

NPDES = National Pollutant Discharge Elimination System

ODEQ = Oregon Department of Environmental Quality

OIMP = odor impact minimization plan

RCSI = Report of Composting Site Information

SWRCB = California State Water Resources Control Board

yr = year

Appendix B
TCEQ's Odor Complaint Investigation Procedures

Texas Commission on Environmental Quality ODOR COMPLAINT INVESTIGATION PROCEDURES

This document was prepared by the TCEQ for trained investigators who perform odor complaint investigations on behalf of the TCEQ. It is intended to be used only after qualified training has been provided. Members of the public who would like to submit information related to an odor complaint should use the Odor Log located on the TCEQ webpage. For additional information, please contact the TCEQ Office of Compliance and Enforcement. The following document updates and supersedes the previous version of this document dated September 18, 2007.

DEFINITIONS

Odor:

Odor is defined in Title 5, Subtitle C, Texas Health and Safety Code (THSC), Chapter 382.003(2) as an air contaminant. "Air contaminant" means particulate matter, radioactive material, dust, fumes, gas, mist, smoke, vapor, or odor, including any combination of those items, produced by processes other than natural.

Nuisance:

Nuisance is defined in Title 30 of the Texas Administrative Code (TAC), Chapter 101.4, which states that a discharge from any source whatsoever of one or more air contaminants or combinations thereof, in such concentration and of such duration as are or may tend to be injurious to or to adversely affect human health or welfare, animal life, vegetation, or property, or as to interfere with the normal use and enjoyment of animal life, vegetation, or property.

DETECTION OF ODOR AND INITIAL RESPONSE

Detection

An odor may be detected by a citizen and reported to a Texas Commission on Environmental Quality (TCEQ) regional office as a citizen complaint, or detected by an investigator without a citizen complaint as the initiating factor. In either case, the regional office should promptly make a determination regarding the appropriate action based on the guidelines below. If an investigation is appropriate, the investigation should be conducted according to the procedures specified in this document.

Initial Response

If an odor is detected, and health effects are alleged by a complainant or suspected by the investigator, the complaint should be prioritized for immediate response and an investigation should be conducted as soon as possible, regardless of the manner of detection. The definition of alleged or suspected health effects should remain very broad in this situation to ensure that appropriate actions are taken any time there is a potential imminent threat to public health and safety.

If an odor is detected by either a complainant or an investigator and health effects are not alleged or suspected, an investigation should be conducted to determine the cause of the odor (or alleged odor) according to the incident prioritization procedures established by the Office of Compliance and Enforcement.

Complaint Information

The following information should be gathered by the regional office at the time that a complaint is received or prior to conducting an onsite investigation.

- Name(s) and address(es) of complainant(s).
- Driving directions to the site of the complaint and source as necessary.
- Where on their property was the complainant when they experienced the odor?
- Description of odor.
- Dates, times, frequency, and duration when the complainant(s) experienced the odor.
- Is the odor on-going, past or intermittent at the complainant's residence or business at this time?
- Nature of any allegation of effects on the complainant's health, property, animals, or vegetation.
- Nature of any allegation of interference with the normal use and enjoyment of the complainant's property, animals, or vegetation.
- Alleged source of the odor.
- Meteorological conditions (temp, wind direction, wind speed, etc.)
- Does the complainant want an investigator to come to their residence or business? If we go to their residence or business, they may lose their confidentiality because state vehicles are marked. Explain to the complainant that their confidentiality may be lost during an investigation to confirm nuisance. We cannot substantiate a nuisance if we don't go to the complainant's residence or business, but we can look for issues at the alleged source.

INVESTIGATION/DATA GATHERING

The purpose of all odor investigations is to determine the source of the odors and to work with that source to stop or lessen the generation of any nuisance odors, if present.

The following is a brief discussion that is not intended to restrict the collection of any information which the investigator considers appropriate or necessary to evaluate the citizen concerns during an odor investigation. For additional investigation guidance reference Field Operations Standard Operating Procedures (FOSOP) Investigation Guidance on the internal Field Operations Documents Website (FODWeb).
There are two steps TCEQ investigators perform during odor complaint investigations.

The first step is to conduct a nuisance odor investigation at the complainant's residence or business. In order to successfully pursue a nuisance violation, there must be a potentially impacted party (complainant). If the complainant does not want an onsite investigation conducted at their location, then nuisance cannot be confirmed. The second step is to determine the source of the odor and conduct an onsite investigation of the alleged source to determine compliance with applicable rules and regulations. Investigators may refer members of the public to the TCEQ webpage titled "What if Your Complaint is About an Odor" for additional information.

Additionally, if a nuisance violation is to be pursued and objective evidence is not otherwise available, the complainant must submit a written, signed statement describing the impact and nuisance condition. The complainant must also be advised that if formal enforcement proceedings (such as a State Office of Administrative Hearings) result from a nuisance violation issued under these circumstances, the complainant will be required to formalize this statement in the form of a sworn, notarized affidavit. The affidavit may be provided in lieu of the written statement initially, if preferred by the complainant. Templates for a statement and affidavit are both available on FODWeb. The complainant must also be informed that they must be willing to testify in a related enforcement action regarding the contents of their statement. Additional information concerning nuisance violations can be found in the Nuisance Violations Memo on FODWeb.

If during the investigation the investigator experiences health effects, or complainant health effects are confirmed, refer to the procedures outlined within the Implementation of Revised Approval Process for Using THSC Citation 382.085(a) available on FODWeb.

If the investigation is initiated as the result of detection of an odor by an investigator (no complainant) the purpose of the investigation would be to determine the cause of the odor and require corrective actions. With regards to anonymous complaints, the investigator would not be able to confirm a nuisance condition but could investigate the source of the odor. If a potentially impacted party is identified during the course of an investigation that was initiated by the investigator, the investigator should proceed with the following investigation protocol to document the presence or absence of nuisance odor.

Safety

Prior to conducting an investigation at any site, the staff shall be familiar with all applicable agency investigation and safety protocols including but not limited to:

- FOSOP Guidance Document for Field Operations Investigation of Complaints;
- TCEQ Safety Manual;
- TCEQ OPP Chapter 6, General Operations Section 6.06; and
- Hydrogen Sulfide Investigation Guidance at Natural Gas and Other Sites.

If unknown or if the nature of the odor described and knowledge of the alleged source indicates the potential presence of a toxic gas (H2S, chlorine, etc.) or a gas that could pose a potential inhalation or explosive hazard, the investigator must approach the location from the upwind direction and use the appropriate handheld monitoring equipment and/or personal monitoring equipment as available. Be aware that there may be toxic gases present that may not be detected with available monitoring equipment.

Investigations at isolated locations, unauthorized disposal sites, or investigations in confrontational situations pose particular investigator safety concerns. When investigating these situations, having additional field staff, law enforcement, or personnel from other agencies accompany the investigator may be prudent and appropriate.

The investigator should only continue the investigation as long as they feel confident with site conditions and have no health and/or safety concerns.

Equipment

The investigator should properly prepare and take any equipment necessary to address safety concerns and any sampling equipment that could provide relevant information concerning the odor and its source.

Prior to the use of TCEQ sampling/monitoring equipment, the investigator must have demonstrated a level of proficiency with that piece of equipment. This level of proficiency is checked through the Initial Demonstration of Capability (IDC) Procedure. There are several documents associated with IDC, all of which can be found on the FODWeb OCE Quality Program page.

In all sampling cases, ensure that all necessary paperwork, such as chain of custody forms, sample record sheets, field observation notebooks, calibration logs, etc. are accurately maintained. It is important to collect and record legally defensible data.
For samples that need to be analyzed by a certified laboratory, complete a TCEQ Request for Analysis Form available on FODWeb.

Frequency, Intensity, Duration, and Offensiveness (FIDO) Chart

The FIDO chart is a method used to provide consistent nuisance determinations and assist in description of odors.

Each of the four tables on the FIDO Chart represents a level of offensiveness (Highly Offensive, Offensive, Unpleasant, and Not Unpleasant). Offensiveness is the character of the odor which can be distinguished even in very light concentrations.

The intensity of the detected odor is documented using the legend on the right side of the chart, with "VS" representing Very Strong odors, "S" for Strong odors, "M" for Moderate odors, "L" for Light odors, and "VL" for Very Light odors. Intensity is the relative measure of the perceived concentration. If the odor intensity is variable throughout the duration period, the investigator should record the changes and determine the duration using a weighted average at the conclusion of the period. Investigators learn to determine relative intensity through experience and/or butanol training. The Butanol Reference Method was developed by Texas A&M University in the 1990s. It is a method of rating intensity without regard to specific compounds or odor type. The method consists of the comparison by an objective observer of the level of intensity of a subject odor to several known concentrations of 1-butanol. These known concentrations relate directly to the intensity levels on the FIDO Chart, as such the use of the Butanol Method is recommended, per regional discretion.

Frequency is the number of times that an odor has been complained about and documented to have occurred (either directly or circumstantially) by the investigator. The regional office files should provide the investigator enough information to determine the frequency of a particular odor from a particular facility. Regional management has the option of specialized handling to adapt to unique situations as they arise. Guidelines for each frequency category are explained below.

- Daily: The odor has been documented during an investigator's odor survey at least three consecutive times in a 14-day rolling period at the complainant's site.
- Weekly: The odor has been documented during an investigator's odor survey at least three times at the complainant's site or equal distance in any 30-day period.
- Monthly: The odor has been documented during an investigator's odor survey at least two times at the complainant's site or equal distance in any 60-day period.
- Quarterly: The odor has been documented during an investigator's odor survey at least two times at the complainant's site or equal distance in any 90-day period.
- Single Occurrence: The odor has been documented during an investigator's odor survey at the complainant's site or equal distance.

Duration is the length of time that an odor which has been complained about and confirmed by the investigator to have occurred. The minimum time that an investigator remains on-site to determine if a nuisance condition exists is based on many factors including how safe the

investigator feels at that location, but the investigator should try to remain on-site for at least 15 minutes.

The frequency and duration are plotted on the horizontal and vertical axes of the appropriate table. If the odor situation is at least as intense as the colored block in which it is plotted, it is considered a nuisance odor. If the plot falls outside the colored area of the table (NA), the odor does not represent a nuisance.

Investigation

All odor complaint investigation activities and results should be documented in the investigation report. The items and discussion below should be included in the investigation, but should not be construed as limiting either the collection or reporting of relevant information.

The investigator should attempt to locate and assess the odor firsthand. It would be ideal if an investigator could be at the complainant's location at the time that the odor is occurring, in order to experience the same conditions that generated the complaint. An effort should be made, possibly including multiple trips to the location and multiple investigations per management discretion, to duplicate the experience of the complainant.

- Complete the attached Investigator FIDO Log and if necessary the Supplemental Investigator's Odor Intensity Time Log.
- Describe any physical effects experienced by the investigator which are indicative of effects upon health.
- Describe the normal use of property affected by the odor, and the manner in which such odor could reasonably be expected to interfere with this use, if possible without compromising complainant confidentiality.
- Determine and document the extent of the odor plume. Document on a map the odor survey route, the time the investigator was at each location, and the odor observations at each location. This survey should include observations upwind and downwind of the alleged source as necessary. If the wind direction has changed from the original complaint, then the investigator should move to a location downwind from the alleged source, equal in distance from the complainant's residence in line with the current wind direction.
- Attempt to locate the source(s) of the odor.
- If a source is identified, attempt to locate the specific cause of the odor (i.e., the specific compound, equipment, or process emitting the odor, and the reason(s), such as a plant upset).
- Gather local meteorological data for the time the complainant(s) alleged the occurrence of the odor, as well as the time when the investigation was conducted. This should

include, at a minimum, estimates of wind speed and direction, temperature, humidity, precipitation, and sky cover.

- Describe the terrain features of the area, including natural and man-made features which could influence the flow of air.
- If an investigator has detected odors at the same location at other times or prior investigations show that odors were documented, the investigator should document a comparison of the current observations with the prior observations.
- Collect information about the frequency and duration of any detected odors. This includes information provided by the complainant or the source relative to these factors.
- If safe to do so, the investigator should remain at the complainant's site for at least 15 minutes, the minimum duration time to reach the nuisance level for the information known at that time, or as directed by regional management.
- The investigator should use their own judgment to determine the length of observation time at each point including:
  - the intensity and offensiveness of the odor observed,
  - any associated health effects incurred by the investigator,
  - any known or perceived changes in the offensiveness or intensity of the odor or odor source, and
  - any measurements using handheld or personal monitoring equipment.
- The investigator may provide the complainant an Odor Log for Public Use available on the TCEQ webpage as directed by regional management.
- The investigator may be approached in the field by a concerned individual to provide information concerning the odor investigation. If this occurs, the investigator should collect and consider the information as part of the investigation. Caution should be taken to ensure that this information-gathering procedure not be construed as soliciting additional complaints.
- If a member of the media approaches the investigator while they are conducting the investigation, the investigator should follow agency protocol/procedure regarding contact with the media.
- If any health effect or injury is documented, the source should be required to take measures to mitigate the odor immediately and appropriate enforcement action should be initiated against the responsible party as directed by regional management.

INVESTIGATION FOLLOWUP

Upon completion of the investigation, the information collected should be reviewed to determine whether a nuisance condition is confirmed. The FIDO Chart will be used to determine whether the evidence in the case constitutes a nuisance violation.

Injurious Impacts

If the preponderance of the evidence collected during the course of the investigation (including discussions with the complainant and observations by the investigator) confirms the presence of odors in such concentration and duration as to be injurious to or affect human health, welfare, animal life, vegetation, or property, remedial action should be immediately required to mitigate the odors, and appropriate enforcement action should be initiated according to agency enforcement procedures. In this situation, these actions should be taken regardless of whether the incident was complaint-generated or detected by the investigator. If documented health effects have occurred during the investigation the investigator shall use the Implementation of Revised Approval Process for Using THSC Citation 382.085(a) available on FODWeb.

Interference with Normal Use and Enjoyment of Animal Life, Vegetation, or Property

If the preponderance of the evidence does not confirm the presence of odors in such concentration and duration as to be injurious to or affect human health, welfare, animal life, vegetation, or property, the investigator should evaluate all the evidence collected during the course of the investigation using the FIDO Chart. This chart is used to determine whether a nuisance odor violation should be issued based on whether the frequency, intensity, duration, and offensiveness of detected and documented odors combined cause interference with the normal use and enjoyment of animal life, vegetation, or property.

If application of the FIDO Chart confirms a nuisance odor, the regional office should issue a nuisance odor violation, initiate appropriate enforcement action based on agency enforcement procedures, and require the responsible party to correct the problem. This should be conducted at the regional office after discussion with management.

Concentrated Animal Feeding Operation (CAFO) Nuisance

If the investigation of a CAFO facility results in documentation of nuisance conditions please refer to the following procedures outlined in the CAFO Violations Review Committee Document available on FODWeb.

FIDO CHART

ODORS CHARACTERIZED AS HIGHLY OFFENSIVE

DURATION	FREQUENCY				
	Single Occurrence	Quarterly	Monthly	Weekly	Daily
1 minute	NA	NA	VS	S	M
10 minutes	NA	VS	S	M	L
1 hour	VS	S	M	L	VL
4 hours	S	M	L	VL	VL
12 hours+	M	L	VL	VL	VL

ODORS CHARACTERIZED AS OFFENSIVE

DURATION	FREQUENCY				
	Single Occurrence	Quarterly	Monthly	Weekly	Daily
1 minute	NA	NA	NA	VS	S
10 minutes	NA	NA	VS	S	M
1 hour	NA	VS	S	M	L
4 hours	VS	S	M	L	VL
12 hours+	S	M	L	VL	VL

ODORS CHARACTERIZED AS UNPLEASANT

DURATION	FREQUENCY				
	Single Occurrence	Quarterly	Monthly	Weekly	Daily
1 minute	NA	NA	NA	NA	VS
10 minutes	NA	NA	NA	VS	S
1 hour	NA	NA	VS	S	M
4 hours	NA	VS	S	M	L
12 hours+	VS	S	M	L	VL

ODORS CHARACTERIZED AS NOT UNPLEASANT

DURATION	FREQUENCY				
	Single Occurrence	Quarterly	Monthly	Weekly	Daily
1 minute	NA	NA	NA	NA	NA
10 minutes	NA	NA	NA	NA	NA
1 hour	NA	NA	NA	NA	VS
4 hours	NA	NA	NA	VS	S
12 hours+	NA	NA	VS	S	M

Intensity Legend
VS
Very Strong
S
Strong
M
Moderate
L
Light
VL
Very Light

February 2015

TCEQ

ODOR CHARACTERIZATION EXAMPLES

The character of an odor is a unique, innate quality of an odor that does not vary with intensity. Under normal circumstances the following types/sources/processes may be characterized as indicated below, however, these examples should only be used as a guide; characterization should be based on the investigator's experience and training.

Highly Offensive

- Blood drying operations
- Sewage treatment primary sludge
- Putrefying animals/fish
- Hide processing
- Rancid grease
- Landfill gas, leachate, sour gas, paper mill black liquor, etc.-H_2S (smells like rotten eggs)
- Mercaptans (natural gas odorant)

Offensive

- Landfill garbage/waste
- Cattle lagoon cleanout
- Confined hog/poultry operations under bmp
- Decaying silage/composting
- Unprocessed rendering plant material and wastewater
- Typical grease trap odor
- Waste burning (rubber, plastic, tires, or other non-wood materials)
- Failing or improperly operated septic systems
- Organic products like auto body paint & styrene[1]

Unpleasant

- Well digested or chemically-treated sludge
- Cattle operation under best management practices
- Waste-activated sludge processes
- Water-based painting
- Gasoline, diesel fuel
- Combustion exhaust
- Asphalt odors
- Burned coffee/food
- Brush/wood burning
- Petroleum products
- Ammonia
- Chlorine

Not Unpleasant

- Ketones, esters, alcohols
- Fresh-cut grass or hay
- Normal coffee roasting
- Normal food preparation
- Bakery
- Perfume
- Spice packaging
- Winery

[1]At low concentrations, organic products such as auto body paint and styrene used in fiberglass and cultured marble operations would not normally be considered to have offensive odors. However, because of a person's potential physical response to these products at higher concentrations (where most complaints concerning these products occur), we generally consider them to have offensive characteristics.

DETERMINING FREQUENCY/DURATION

You are attempting to determine the frequency and duration that the complainant experiences over time. The frequency and duration observed during a single investigation may not accurately represent what the complainant is experiencing. You may have to use information gathered from multiple investigations (investigator observations as well as any information gathered on plant processes, weather, terrain, or complainant information) to make this determination. Consider the following:

- Daily: The odor has been documented during an investigator's odor survey at least three consecutive times in a 14-day rolling period at the complainant's site.
- Weekly: The odor has been documented during an investigator's odor survey at least three times at the complainant's site or equal distance in any 30-day period.
- Monthly: The odor has been documented during an investigator's odor survey at least two times at the complainant's site or equal distance in any 60-day period.
- Quarterly: The odor has been documented during an investigator's odor survey at least two times at the complainant's site or equal distance in any 90-day period.
- Single Occurrence: The odor has been documented during an investigator's odor survey at the complainant's site or equal distance.

Plant Processes

- Constant, seasonal, intermittent processes/activities (e.g., reactor top opened)
- Upset conditions, maintenance, startup & shutdown, etc.
- Plant records, sampling data, CEM data, etc.

Weather

- Wind rose from source to receptor
- Temperature or other meteorological data that could affect intensity or duration.

Complainant Information

- Statements as to frequency and duration
- Odor Logs
- Knowledge of source operations - times, processes
- Other information as provided

- Wind speed, day, night, summer, winter
- CAMS Station/NWS/ personal weather meter data

HOW TO USE THE FIDO CHART

Each of the four tables on this FIDO Chart represents a different level of offensiveness (Highly Offensive, Offensive, Unpleasant, and Not Unpleasant). The intensity of the observed odor is documented using the legend on the right side of the chart--with "VS" for Very Strong odors, "S" for Strong, "M" for Moderate, "L" for Light, and "VL" for Very Light. Once the overall frequency and duration have been determined (based on one or more investigations), they are then plotted on the horizontal and vertical axes of the appropriate table. If the odor situation is at least as intense as the colored block in which it is plotted for the corresponding duration and frequency, it is considered a nuisance odor. If the plot falls outside the colored area of the table (NA), the odor does not represent a nuisance.

Investigator FIDO Log

1. Characterize the odor to determine which Offensiveness table to use (Not Unpleasant to Highly Offensive)
2. Assess the Intensity of odor (Very Light to Very Strong), for variable intensities use Supplemental Investigator's Odor Intensity Time Log.
3. Determine the total Duration of the odor(s) (1 minute to 24 hours)
4. Evaluate the Frequency of odor occurrence (Single Occurrence to Daily)
5. Identify the block on the chart that corresponds to the information from Steps 1-4 and determine if a nuisance condition exists.

				Weather Conditions		

Odor Characteristic			

													Odor Intensity
							Date						
							Time(s)						
							How long did the odor occur?						

Was the odor intermittent? (Y/N)

Wind direction

Rain (Y/N)

Temperature (°F)

							Not Unpleasant						Effects/Comments/Concerns
							Unpleasant						
							Offensive						
							Highly Offensive						
							Very Light						
							Light						
							Moderate						
							Strong						
							Very Strong						

Supplemental Investigator's Odor Intensity Time Log

Date of Investigation: _____ Start Time: _____

Minutes	Odor Intensity VL, L, M, S,VS
1 min	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Minutes	Odor Intensity VL, L, M, S, VS
31 min	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	

Offensiveness: Highly_____ Offensive _____ Unpleasant _____ Not Unpleasant _____

Weighted Average Intensity:

	VS	S	M	L	VL	No Odor
1 Min						
10 Min						
1 Hour						

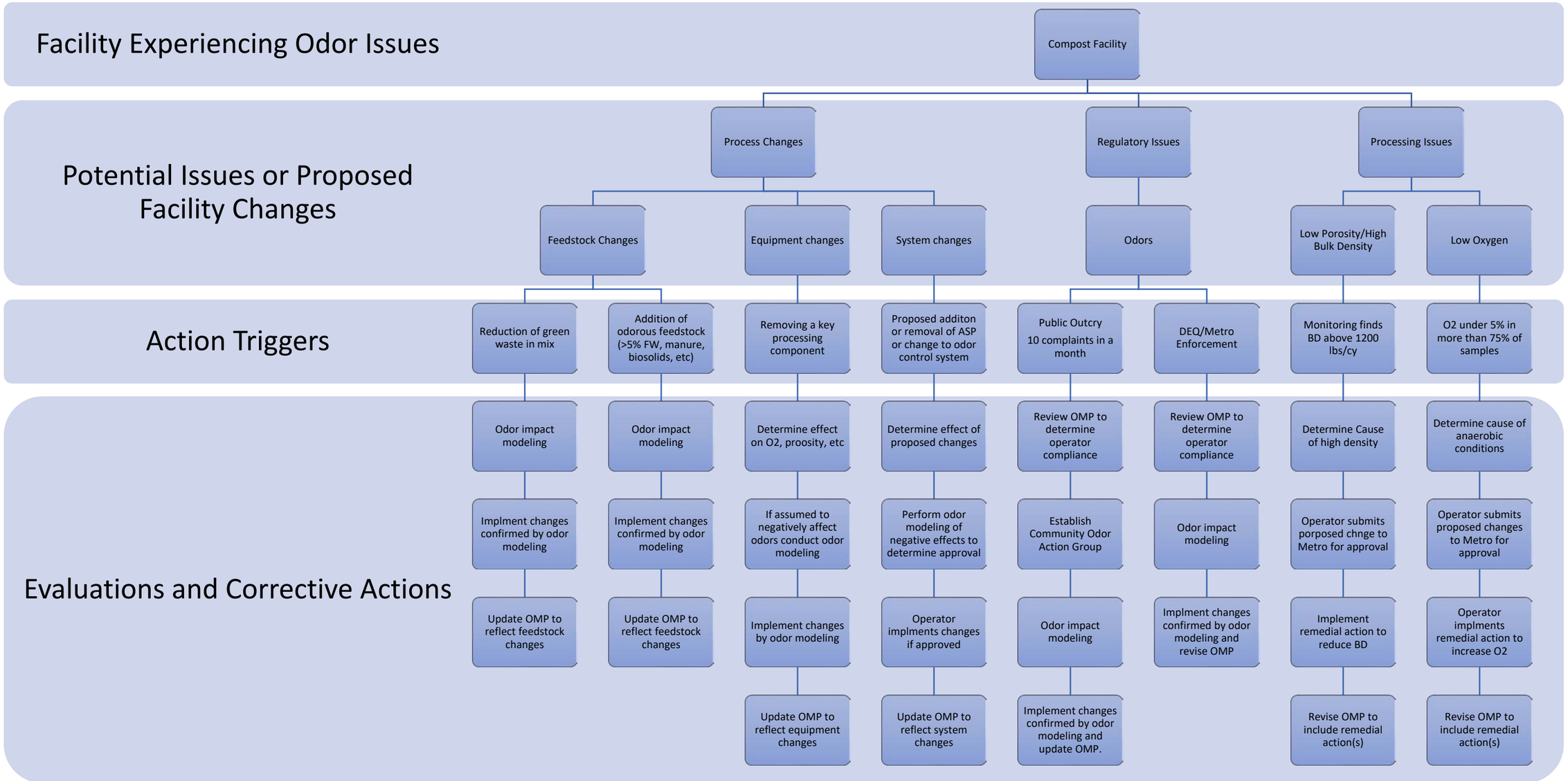
Chemical Odor Description Examples

These descriptions should only be used as a guide, based on the investigator's experience and training.

Chemical	Description	Chemical	Description
Acetaldehyde	Green, sweet, oxidized, alcohol	**Formaldehyde**	hay/straw-like, sweet, pungent
Acetic Acid	sour, vinegar	**Hydrochloric Acid Gas**	pungent, burnt
Acetone	chemical, sweet, pungent	**Hydrogen Sulfide**	boiled eggs, rotten eggs
Acrolein	burnt, pungent, sweet	**Methanol**	sweet, fruity
Acrylonitrile	onion/garlic-pungency, sweet, acrylic plastic	**Methyl Ethyl Ketone**	sweet
Allyl Chloride	garlic-onion pungency, sweet, green	**Methyl Isobutyl Ketone**	sweet, floral, fruity
Amine, Dimethyl	fishy, dirty clothes	**Methyl Mercaptan**	cabbage, sulfidy, pungent, natural gas
Amine, Monomethyl	fishy, pungent	**Methyl Methacrylate**	pungent, sulfidy, plastic
Amine, Trimethyl	fishy, pungent	**Monochlorobenzene**	chlorinated, moth balls, benzene-like
Ammonia	barn-like, pungent, cat litter-box	**Nitrobenzene**	sweet, shoe polish, pungent
Aniline	sweet, oily, solvent, pungent	**p-Cresol**	antiseptic, tar-like, pungent
Benzene	sweet, solvent	**p-Xylene**	sweet, oily, anethol, moth balls
Benzyl Chloride	sweet, solvent	**Perchloroethylene**	sweet, chlorinated
Benzyl Sulfide	sweet, cedary, sulfidy	**Phenol**	medicinal, sweet
Bromine	sweet, bleach	**Phosgene**	sweet, hay-like
Butyric Acid	cheesy, sour	**Phosphine**	oniony, mustard
Carbon Disulfide	vegetable sulfide, leaves a taste	**Pyridine**	burnt, gauze-like, pungent, diamine
Carbon Tetrachloride	sweet, pungent, feeling factor	**Styrene (Inhibited)**	solventy, rubbery, sweet, plasticy
Chloral	sweet(powdered sugar), fruity	**Styrene(Uninhibited)**	solventy, rubbery, sweet, plasticy
Chlorine	pungent, sweet, bleach	**Sulfur Dichloride**	sulfidy, putrid (leaves a metallic taste)
Dimethylacetamide	amine, burnt, oily, organic decay	**Sulfur Dioxide**	Heavy, oppressive (more taste and feel than odor)
Dimethylformamide	fishy, sweet, floral, pungent, solvent	**Toluene (From Petroleum)**	moth balls, sweet, rubbery, anethol
Dimethyl Sulfide	cooked vegetable	**Toluene (From Coke)**	heavy, sweet, floral, pungent, solventy
Ethanol	sweet, floral	**Toluene diisocyanate**	fruity, pungent
Ethyl Acrylate	sweet, hot plastic, earthy	**Trichloroethylene**	medicated bandage, sweet, sweet, solventy
Ethyl Mercaptan	earthy, sulfidy		

Appendix C
Action Triggers and Corrective Actions Flow Charts

Odor Control Requirements and Enforcement



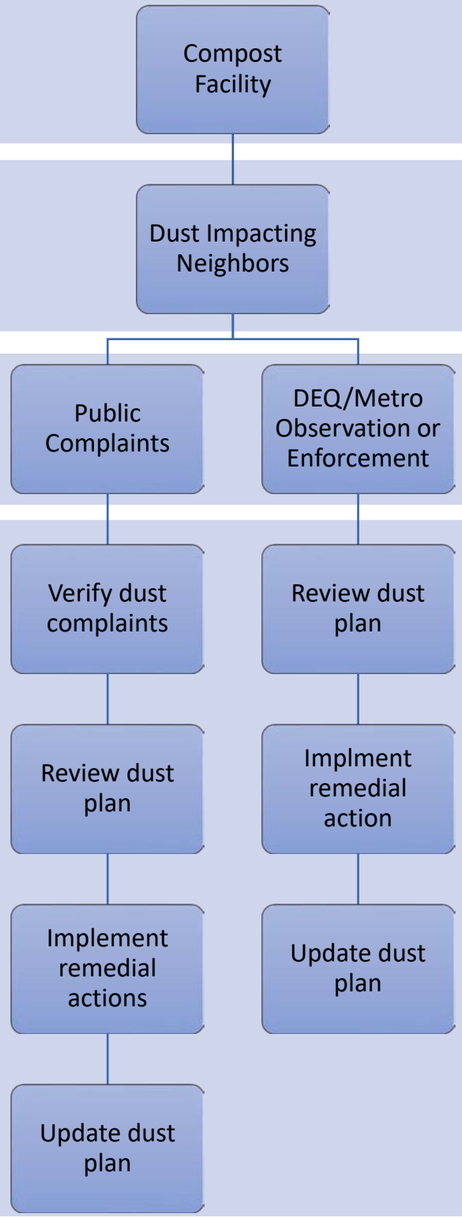
Dust Control Requirements and Enforcement

Facility Experiencing Dust Issues

Potential Issues or Proposed Facility Changes

Action Triggers

Evaluations and Corrective Actions



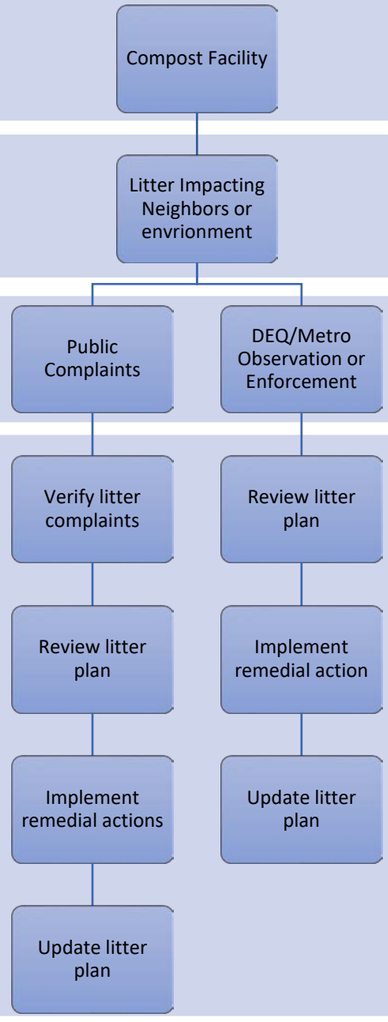
Litter Control Requirements and Enforcement

Facility Experiencing Litter Issues

Potential Issues or Proposed Facility Changes

Action Triggers

Evaluations and Corrective Actions



Track-out Minimization Requirements and Enforcement

Facility Experiencing Track Out Issues

Compost Facility

Potential Issues or Proposed Facility Changes

Track OUt Impacting Neighbors or envrionment

Action Triggers

Public Complaints

DEQ/Metro Observation or Enforcement

Evaluations and Corrective Actions

Verify track out complaints

Review track out plan

Implement remedial actions

Update track out plan

Review track out plan

Implement remedial action

Update track out plan

Vector Control Requirements and Enforcement

Facility Experiencing Vector Issues

Compost Facility

Potential Issues or Proposed Facility Changes

Vectors Impacting Neighbors or envrionment

Action Triggers

Public Complaints

DEQ/Metro Observation or Enforcement

Evaluations and Corrective Actions

Verify vector complaints

Review vector plan

Implement remedial actions

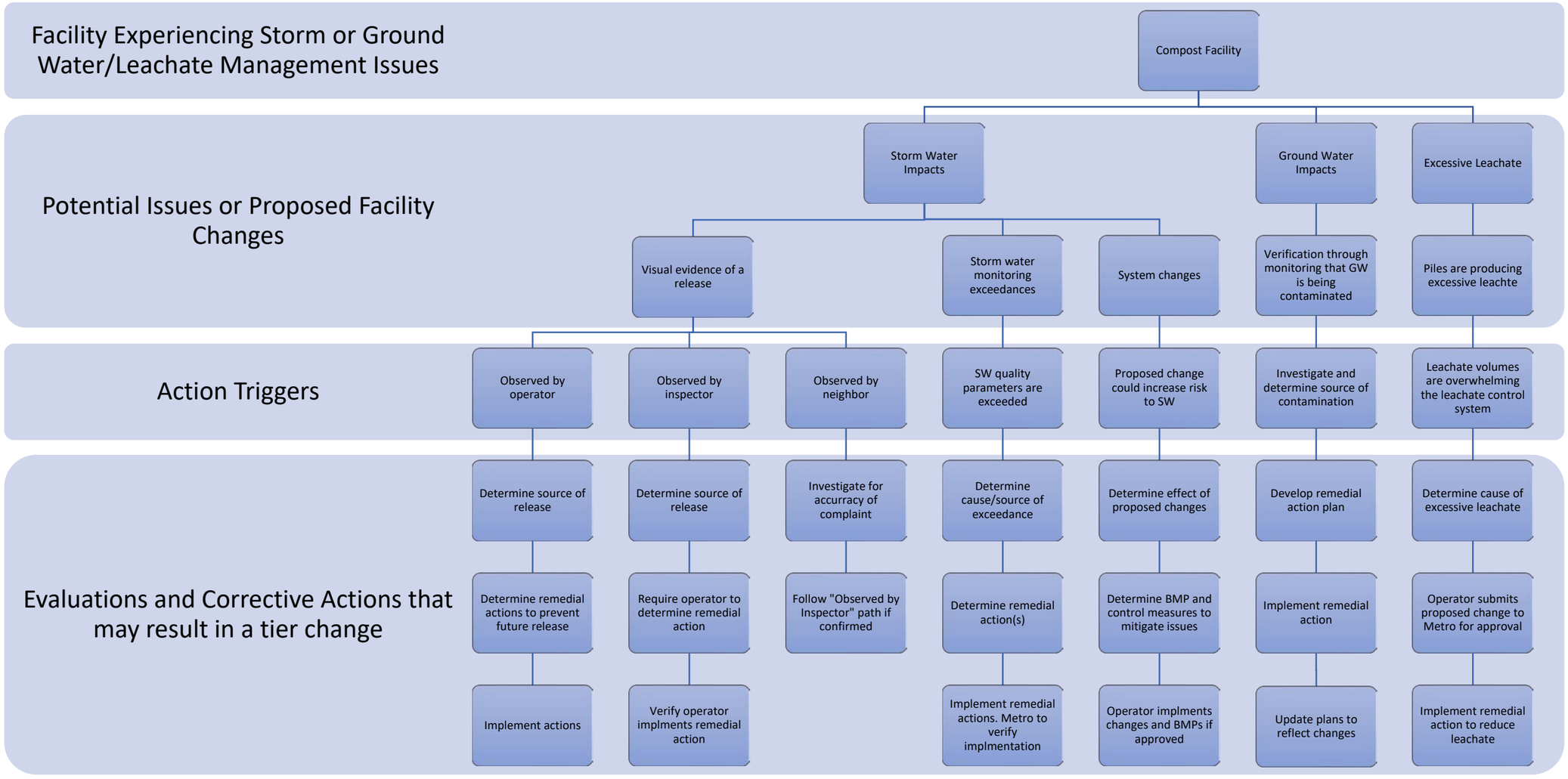
Update vector plan

Review vector plan

Implement remedial action

Update vector plan

Storm or Ground Water/Leachate Control Requirements and Enforcement



Appendix D
Quality of Finished Compost Summary of Research Findings

Jurisdiction	Metals	Pathogens	Testing Frequency	Contaminants	Stability and Maturity	Bioaerosols and Pesticides	PFAS
ODEQ	Restrictions in place. For full limits, refer to Metals section.	Types 1 and 3 with <50% Type 2: Salmonella: 3 MPN/4 g or Fecal Coliform: <1,000 MPN Types 1 and 3 with >50% Type 2: Fecal Coliform: <1,000 MPN	Sampling methods must be described in the operations plan. Pathogen testing must occur per the following: <2500 tpy (Types 1 and 2): 1 sample annually >2500 tpy (Types 1 and 2): 1 sample per 5000 tons feedstock used or 1 sample every three months <2500 tpy (Type 3): 1 sample every four months >2500 tpy (Type 3): 1 sample per 5000 tons feedstock used or 1 sample monthly	Based on product marketability	No Information Found	Oregon Department of Agriculture limits the use of clopyralid in compost feedstocks	No restrictions outside of the Federal US EPA RSLs at this time, see PFAS section for more information.
Metro Code	N/A	N/A	N/A	No Information Found	No Metro Wide Requirements/ Information Found. Stability testing at Grimm's is required.	No Information Found	No restrictions outside of the Federal US EPA RSLs at this time, see PFAS section for more information.
Grimm's Report	Metals testing (if required)	Follow the EPA's requirements to ensure safe levels of pathogens for human handling. OAR 340-096-0070(4) and 340-096-0140(3)	A minimum of quarterly sampling for the following: Fecal coliform and salmonella Stability pH C:N ratio Electrical conductivity Metals (if required)	No information found	Stability testing suggested every quarter at a minimum. SolvitaTM test kits are recommended for this testing.	No Information Found	No restrictions outside of the Federal US EPA RSLs at this time, see PFAS section for more information.
Washington Department of Ecology (WDOE)	Restrictions in place. For full limits, refer to Metals section.	Salmonella: 3 MPN/4 g OR Fecal Coliform: <1,000 MPN/gram	<5,000 ypy: 1 sample/year >5,000 ypy: 1 sample/ 5,000 cy of finished material "Representative" USCC TMECC Method 02.01-A through E Composite sampling	≤ 1 percent by weight total, not to exceed 0.25 percent film plastic by weight, no sharps	No information found	The Washington State Department of Agriculture (WSDA) enacted an emergency ban in March 2002, which barred the use of clopyralid in compost	No restrictions outside of the Federal US EPA RSLs at this time, see PFAS section for more information.
California (CalRecycle)	Restrictions in place. For full limits, refer to Metals section.	Salmonella: 3 MPN/4 g AND Fecal Coliform: <1,000 MPN	12:1 composite sample <1,000 ypy: exempt <5,000 ypy: 1 sample/year >5,000 ypy: 1 sample/ 5,000 cy of finished material	<0.5% contaminants by dry weight >4 mm , <20% of 0.5% shall be film plastic >4 mm	No Information Found	California banned the use of aminopyralid and clopyralid on residential lawns. Clopyralid is banned at the national level. Professional applicators are required to notify property owners/managers that clippings are not to be composted	No restrictions outside of the Federal US EPA RSLs at this time, see PFAS section for more information.

Jurisdiction	Metals	Pathogens	Testing Frequency	Contaminants	Stability and Maturity	Bioaerosols and Pesticides	PFAS
Hawaii	No specific limit values found.	No specific limit values found.	No specific limit values found.	Compost should be “free of injurious components or particles”	The facility must describe operational procedures and quality of the compost, including how the compost shall become “biologically and chemically stable… and capable of sustaining plant growth”	No Information Found	No restrictions outside of the Federal US EPA RSLs at this time, see PFAS section for more information.
United States Composting Council	Restrictions in place. For full limits, refer to Metals section.	Salmonella: 3 MPN/4 g OR Fecal Coliform: <1,000 MPN/gram	Testing frequency ranges from <1 per quarter to once per month depending on volume	Recommended testing method is TMECC 03.08-A, reported in percentage by dry weight	Stability testing is required and must be reported in TMECC 5.08 Respirometry.	No Information Found	No restrictions outside of the Federal US EPA RSLs at this time, see PFAS section for more information.
Maryland Department of Agriculture	Restrictions in place. For full limits, refer to Metals section.	No Information Found	For facilities only accepting agricultural and yard waste, compost should be tested every 20,000 tons or every quarter, whichever is more frequent. For facilities accepting other feedstocks, the operator should develop a quality assurance plan approved by the Department that describes monitoring, sampling, and testing of both the process and product during the first 15 months of operation for any new facility.	For General Use Compost: Less than 2% dry weight of human-made inerts > 4mm, less than 2% dry weight film plastic > 4mm. Limited Use Compost has the same requirements, except may contain up to 4% dry weight human-made inerts.	Both general and limited use compost products must be stabilized. To be considered stable, compost must have ceased active biological decomposition, which is tested against these parameters: Temperature of a 4-foot-high, 6-foot-diameter pile of compost may not rise more than 20°C above ambient temperature when the pile is left undisturbed for 72 hours at the composting facility.	No Information Found	No restrictions outside of the Federal US EPA RSLs at this time, see PFAS section for more information.
Canada	Restrictions in place. For full limits, refer to Metals section.	For most areas requirements include the following (detailed requirements in Pathogens section.) Salmonella: 3 MPN/4 g AND Fecal Coliform: <1,000 MPN	CCME, OMOE, and BC have information on this topic available, most have a recommendation of a 10:1 composite. Detailed findings available in Testing Frequency section.	Requirements vary by jurisdiction as well as product class. Detailed findings available in Contaminants section.	The CCME ,AEP, CFIA and BNQ have adopted the same standards for product stability. Under the programs, there are three standards and compost must meet one of them to be considered stable and mature- regardless of product class. Detailed findings available in Stability and Maturity section.	No Information Found	British Columbia limits soil levels of PFOS 1, 2.5, 7.5 and PFBS 300, 650, 4500 (mg/kg)

Jurisdiction	Metals	Pathogens	Testing Frequency	Contaminants	Stability and Maturity	Bioaerosols and Pesticides	PFAS
Australia	Restrictions in place. For full limits, refer to Metals section.	Enteric viruses < 1 plaque-forming unit per 10 grams total (dry weight) Helminth ova < 1 per 4 grams dry solids E. coli < 100 MPN per gram (dry weight) Faecal coliforms < 1,000 MPN per gram (dry weight) Salmonella spp. Absent in 50 grams of final product (dry weight)	Compost products must be initially tested to verify they meet the required standard	Glass, metal and rigid plastics: Less than or equal to 0.5% DW Plastics: Less than or equal to 0.05% DW	There are three classes of products regulated by the Victoria EPA: Pasteurized: low level of stability and maturity. Compost: Passing 3 stability and maturity tests Mature Compost: Passing 4 stability and maturity tests	No Information Found	No restrictions at this time, see PFAS section for more information.
United Kingdom	Restrictions in place. For full limits, refer to Metals section.	No Information Found	The PAS 100 regulations state a minimum monitoring frequency for temperature and moisture based on the method of composting utilized.	Only voluntary standards exist: Glass, metal, plastic and non-stone fragments >2mm: 0.5% mass/mass air dry sample, with up to 0.25% mass/mass of plastic Stones >4mm: 8% mass/mass Weed seeds and propagules: average of 0 seeds and propagules per liter of compost	There are no requirements for stability of compost, however, temporal guidelines are provided in regulation for achieving the varying levels of maturity.	Bioaerosol monitoring is only needed if a trigger level is exceeded during testing. The code recommends managing dust and bioaerosols by planning for where and when they are most likely to occur.	No restrictions at this time, see PFAS section for more information.
Texas Commission on the Environmental Quality (TCEQ)	Restrictions in place. For full limits, refer to Metals section.	Fecal Coliform: For Grade 1- less than 1,000 MPN per gram of solids or meets PFRP, For Grade 2- Geometric mean density less than 2,000,000 MPN per gram of solids or meets PSRP Salmonella: Less than 3 MPN per 4 grams total solid or meets PFRP	No Information Found	No Information Found	Stability analysis is based on the reduction of organic matter calculation method and is required for the first 18 months of operation, the completion of the maturity testing protocol, or the facility quality assurance and quality control plan, whichever comes first.	No Information Found	Texas limits soil levels of PFOA .5, PFOS 1.5 and PFBS 80 (mg/kg)

Appendix E
Quality of Finished Compost Resource and Regulation Excerpts from Relevant Documentation

Appendix E.1 Oregon DEQ Resources and Regulations

OAR 340-096-0090 Special Rules Relating to Composting: Operations Plan Approval[157]

(e) Pathogen reduction. Unless the facility is exempt from pathogen reduction under OAR 340-096-0140(1), the Operations Plan must describe methods the facility will use to comply with OAR 340-096-0140: Pathogen Reduction, including:

(A) Methods the facility will use to comply with OAR 340-096-0070(5) to achieve the pathogen reduction standards set out in OAR 340-096-0140(2);

(B) Methods the facility will use for sampling and testing of composted material and digestate to assure that the required human pathogen reduction is being achieved; and

(C) Procedures the facility will use for handling composted material and digestate that does not meet pathogen reduction standards.

OAR 340-096-0140 Special Rules Pertaining to Composting: Pathogen Reduction[158]

(1) All composting facilities must comply with this rule, except that agricultural operations, as defined by ORS 467.120(2)(a), producing composted material and digestate only for on-farm use are not subject to the requirements of this rule. The department may require that an agricultural operation, or other facility whose digestate is excluded under section 2 of this rule, comply with this rule if the department determines that such compliance is necessary to protect human health or the environment.

(2) All composted material and digestate, excluding: 1) composted material and digestate that is sent as feedstock to a composter possessing either a composting permit or registration; or 2) digestate applied to soil at agronomic application rates and consistent with site restrictions in 40 C.F.R. §503.32(b)(5), must meet the following limits:

(a) For composted material produced from Type 1 or Type 3 feedstock, or a mix of Type 1 and 3 feedstocks, analysis must be performed for salmonella or fecal coliform and meet the following limits:

(A) Salmonella analysis must result in less than 3 Most Probable Number per 4 grams of total solids (dry weight).

(B) Fecal coliform analysis must result in less than 1,000 Most Probable Number per gram of total solids (dry weight).

(b) For composted material and digestate produced from Type 1 or Type 3 feedstock with less than 50% by volume of Type 2 feedstock, analysis must be performed for salmonella or fecal coliform and meet the following limits:

(A) Salmonella analysis must result in less than 3 Most Probable Number per 4 grams of total solids (dry weight).

(B) Fecal coliform analysis must result in less than 1,000 Most Probable Number per gram of total solids (dry weight).

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157 https://secure.sos.state.or.us/oard/viewSingleRule.action;JSESSIONID_OARD=VD0PqGnfp3O9qloKQNIknddeiLztSis_ED_5tRQjYJOD5t1xV_f!-2071884724?ruleVrsnRsn=71345

158 https://secure.sos.state.or.us/oard/viewSingleRule.action;JSESSIONID_OARD=VD0PqGnfp3O9qloKQNIknddeiLztSis_ED_5tRQjYJOD5t1xV_f!-2071884724?ruleVrsnRsn=259512

(c) For composted material and digestate produced from feedstock containing more than 50% volume of Type 2 feedstock in the initial pile, analysis must be performed for fecal coliform and meet the following limits: Analysis must result in less than 1,000 Most Probable Number per gram of total solids (dry weight).

(3) Methods of Pathogen Reduction. All composting facilities subject to this rule must document and implement a pathogen reduction plan that addresses requirements of the Code of Federal Regulations, 40 CFR Part 503. The plan must include a Process to Further Reduce Pathogen (PFRP), under 40 CFR Part 503 Appendix B, item (B)(1), dated February 19, 1993, that must include one of the following elements:

(a) Using either the within-vessel aerobic composting method or the static aerated pile composting method, the temperature of the active composting pile must be maintained at 55 degrees Celsius or higher for three days;

(b) Using the windrow composting method, the temperature of the active composting pile must be maintained at 55 degrees Celsius or higher for 15 days or longer. During the period when the composting pile is maintained at 55 degrees Celsius or higher, there must be a minimum of five turnings of the windrow;

(4) Testing compost and solid digestate for pathogen reduction. All composting facilities subject to this rule must test composted material and solid digestate, excluding composted material and digestate that is sent as feedstock to a composter with either a composting permit or registration, with the following frequency:

(a) If less than 2,500 tons of composted material from Type 1 and 2 feedstocks are produced per year, testing must be conducted once a year.

(b) If more than 2,500 tons of composted material from Type 1 and 2 feedstock are produced per year, testing must be conducted every 5,000 tons of feedstock used or a maximum of once every three months.

(c) If less than 2,500 tons of composted material from Type 3 feedstocks are produced per year, testing must be conducted once every four months.

(d) If more than 2,500 tons of composted material from Type 3 are produced per year, testing must be conducted every 5,000 tons of feedstock used or monthly.

Appendix E.2 California Resources and Regulations

14 CCR Section 17868.1. Sampling Requirements.[159]

(b) A composite sample shall be representative and random, and may be obtained by taking twelve (12) mixed samples as described below.

(1) The twelve samples shall be of equal volume.

(2) The twelve samples shall be extracted from within the compost pile as follows:

(A) Four samples from one-half the width of the pile, each at a different cross-section;

(B) Four samples from one-fourth the width of the pile, each at a different cross-section; and,

(C) Four samples from one-eighth the width of the pile, each at a different cross-section.

14 CCR Section 17868.3. Pathogen Reduction.[160]

(c) Compost operations and facilities that utilize a windrow composting process or an aerated static pile composting process shall be monitored as follows to ensure that the standards in Subdivision (b) of this section are met:

(1) Each day during the pathogen reduction period, at least one temperature reading shall be taken per every 150 feet of windrow, or fraction thereof, or for every 200 cubic-yards of active compost, or fraction thereof.

(2) Temperature measurements for pathogen reduction shall be measured as follows:

(A) Windrow composting processes and agitated bays shall be monitored twelve (12) to twenty-four (24) inches below the pile surface;

(B) Aerated static pile composting processes shall be monitored twelve (12) to eighteen (18) inches from the point where the insulation cover meets the active compost.

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159 https://govt.westlaw.com/calregs/Document/I5F2A6DB653CC4A07BBCE6753964FF91B?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)

160 https://govt.westlaw.com/calregs/Document/I8F03F229B3E54E1CA7E88BC1C028E428?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)

Appendix E.3 United States Composting Council Resources and Regulations

USCC Model Compost Rule Template[161]

Section 2. Feedstock Categories

Type 1 feedstocks include yard trimmings, woody materials, crop residues, and other materials determined to pose a low level of risk to human health and the environment, including from physical contaminants and human pathogens.

Type 2 feedstocks include agricultural residuals, source-separated organics; and [agency] approved food processing residuals and industrial by-products. Type 2 feedstocks are materials that the department determines pose a low level of risk to the environment but have a higher level of risk from physical contaminants and human pathogens compared to Type 1 feedstocks.

Type 3 feedstocks include mixed solid waste (MSW), sludge, biosolids, diapers, and industrial by-products and food processing residuals not covered in Type 2. They include these and other materials the department determines pose a higher level of risk to human health and the environment from physical and chemical contaminants and from human pathogens compared to Type 1 and 2 feedstocks.

Section 4. Tier One

1. Designated capacity
2. Contact water must be managed (25 year/24 hour storm), NPDES
3. Ops Plan – nuisance controls must be included (Odor, vectors, fires, water)
4. Litter free
5. Residual removal
6. PFRP
    a. Windrow; 15/5@55
    b. Invessel/ASP; 3@55, 14@45
7. Processing timelines

Section 5. Tier Two

1. Engineered design capacity
2. Ops on an all-weather pad
    a. Includes GW protection conditions
3. SW Management Plan
    a. 25 year/24-hour pond
4. Pile size and spacing details included in ops plan
5. PFRP Plan and Procedure
6. Ops plan includes provisions for prompt equipment repair or replacement.
7. Feedstocks with free liquid shall be mixed with drier feedstocks, bulking material or compost so that the liquid is promptly absorbed and not allowed to flow as free liquid from the compost piles or windrows.

Section 6. Tier Three

1. Working surfaces @ $1x10^{-5}$

Sampling Requirements:

Methods:

Representative and follow TMECC

[161] https://old.compostingcouncil.org/wp-content/uploads/2016/05/US-Composting-Council-Model-Compost-Rule-Template-v1-1-4-15-13.pdf

Compost Quantity* Frequency	Compost Quantity* Frequency
1 – 2500 tons 1 per quarter (or less)	1 – 2500 tons 1 per quarter (or less)
2501 – 6200 tons 1 per quarter	2501 – 6200 tons 1 per quarter
6201 – 17500 tons 1 per 2 months	6201 – 17500 tons 1 per 2 months
17501 tons and above 1 per month	17501 tons and above 1 per month

*May test at half the frequency above for nonbiosolids compost.

2. Stability must be reported (TMECC 5.08 Respirometry)
3. Pathogens; Fecal OR Salmonella
4. Metals in 40CFR503.13(b)(3)

Pollutant	Ceiling concentration (mg/kg) [1]
Arsenic	75
Cadmium	85
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7500

Appendix E.4 Canada Resources and Regulations

Excerpts from CCME Guidelines for Compost Quality[162]

Table 1 Concentrations of Trace Elements in Compost and Cumulative Trace Element Additions to Soil

	CATEGORY A	CATEGORY B	
Trace Elements* **	Maximum Concentration within Product (mg/kg dry weight)	Maximum Concentration within Product* (mg/kg dry weight)	Maximum Cumulative Additions to Soil* (kg/ha)
Essential or beneficial to plants or animals			
Arsenic (As)	13	75	15
Cobalt (Co)	34	150	30
Chromium (Cr)	210	**	**
Copper (Cu)	400	**	**
Molybdenum (Mo)	5	20	4
Nickel (Ni)	62	180	36
Selenium (Se)	2	14	2.8
Zinc (Zn)	700	1850	370
Other			
Cadmium (Cd)	3	20	4
Mercury (Hg)	0.8	5	1
Lead (Pb)	150	500	100

3.3 Foreign Matter in Compost

a) Sharp Foreign Matter

Category A - Compost shall not contain any sharp foreign matter of dimension greater than 3 mm per 500 mL.

Category B - Compost shall have a sharp foreign matter content less than or equal to three (3) pieces of sharp foreign matter per 500 mL, and the maximum dimension of the sharp foreign matter shall be 12.5 mm. However, this compost shall not be used in pastures, parks or for residential purposes.

b) Other Foreign matter

Category A - Compost shall contain no more than one (1) piece of foreign matter greater than 25 mm in any dimension per 500 mL.

Category B - Compost shall contain no more than two (2) pieces of foreign matter greater than 25 mm in any dimension per 500 mL.

[162] https://www.ccme.ca/files/Resources/waste/organics/compostgdlns_1340_e.pdf

3.4 Maturity and Stability of Compost

Compost shall be mature and stable at the time of sale and distribution. To be considered mature and stable, a compost shall be cured for a minimum of 21 days and meet one of the following three requirements:

a) the respiration rate is less than, or equal to, 400 milligrams of oxygen per kilogram of volatile solids (or organic matter) per hour; or,

b) the carbon dioxide evolution rate is less than, or equal to, 4 milligrams of carbon in the form of carbon dioxide per gram of organic matter per day; or,

c) the temperature rise of the compost above ambient temperature is less than 8 °C .

3.5 Pathogens in Compost

As pathogenic organisms may be present in the compost feedstock, the compost itself may also contain pathogenic organisms and, as a result, may pose a risk to human health.

To adequately reduce these health risks, the compost shall conform to the criteria outlined in either a) or b) depending on the feedstock source.

a) When compost contains ***only yard waste*** the following criteria shall be met:

1. The compost shall undergo the following treatment or other process recognized as equivalent by the relevant province or territory.

- Using in-vessel composting method, the material shall be maintained at operating conditions of 55□C or greater for three days.
- Using the windrow composting method, the material shall attain a temperature of 55□C or greater for at least 15 days during the composting period. Also, during the high temperature period, the windrow shall be turned at least five times.
- Using the aerated static pile composting method, the material will be maintained at operating conditions of 55□C or greater for three days. The preferable practice is to cover the pile with an insulating layer of material, such as cured compost or wood chips, to ensure that all areas of the feed material are exposed to the required temperature.

OR

2. Organism content shall meet the following:

Fecal coliforms2 1000 most probable number (MPN)/g of total solids calculated on a dry weight basis,

AND

No *Salmonella* sp. with a detection level 3 MPN/4g total solids calculated on a dry weight basis.

When compost contains ***other feedstock***, the following criteria shall be met:

1. Undergo a treatment (described in a),

AND

2. Organism content shall meet the following:

Fecal coliforms 1000 MPN / g of total solids calculated on a dry weight basis,

OR

No *Salmonella* sp. with a detection level 3 MPN / 4g total solids calculated on a dry weight basis.

3.6 Organic Contaminants in Compost

Organic chemicals enter waste streams from a variety of industrial and domestic sources. While many degrade or volatilize during waste collection, treatment (including composting) and storage, some of these organic chemicals persist. Some compost feedstocks may contain trace amounts of persistent3 or bio-accumulating organic contaminants, such as dioxins, furans, pesticides, polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH) or herbicides (e.g. clopyralid). The manufacturer should pay special attention to raw materials that might contain such contaminants. To this effect, it is recommended that the composting of raw materials with high contents of these contaminants be avoided.

However, given the low content of dioxin and furans in compost feedstock (Webber, 1996) and in composts produced in Canada (Groeneveld and Hébert, 2004), routine analysis under the CCME Guidelines is not considered necessary. The same also applies to PCB and PAH. For specific sampling requirements in each province or territory, contact the provincial or territorial authority having jurisdiction.

Excerpts from the Technical Document on Municipal Solid Waste Organics Processing[163]

CFIA

Table 16-2: Summary of CFIA trace element standards (from T-4-93 and T-4-120)

	Maximum acceptable trace element concentrations in products (mg/kg dry weight)	Maximum acceptable cumulative metal additions to soils (kg/ha)
Arsenic	75	15
Cadmium	20	4
Chromium	–	210
Cobalt	150	30
Copper	–	150
Lead	500	100
Mercury	5	1
Molybdenum	20	4
Nickel	180	36
Selenium	14	2.8
Zinc	1850	370

Notes:
kg/ha—kilograms per hectare
mg/kg—milligrams per kilogram

16.1.2 Labelling

The CFIA also has a secondary mandate to protect consumers by enforcing mandatory minimum product labelling requirements from the Fertilizer Regulation, including:

- Product name
- Producer information
- A guarantee of the minimum quantity of OM and the maximum moisture content of the product

[163] Environment Canada. 2013. Technical Document on Municipal Solid Waste Organics Processing.

- Nutrient grade (e.g., concentration of nitrogen, phosphorus, and potassium in the product) if any type of nutrient value claim is made or implied
- Directions for use and cautionary statements

There are further protocols for label sizes and fonts, as well as an extensive set of rules surrounding claims that can and cannot be made on the label. The label must also provide a lot number for the product in the event that a product recall is required.

BNQ Organic Soil Conditioners—Composts

The BNQ is a Quebec-based organization that is part of the National Standards System of Canada. The BNQ's mandate is to develop national standards; certify products, processes, and personnel; and certify environmental management systems. Within the National Standards System of Canada, responsibility for establishing national standards for organic soil supplements has been delegated to the BNQ. The BNQ published its first national standard (CAN/BNQ 413-200, Organic Soil Conditioners—Composts) in 1997 through a consensus-based approach involving product manufacturers, users, government agencies, and interested parties. The standard was reviewed and updated in 2005.

Because the BNQ standard was developed through the National Standards System of Canada rather than being enacted under federal legislation, it has no regulatory standing. Therefore, compost producers can choose to adopt it voluntarily, or choose not to adopt it at all.

The standard establishes three categories of compost (AA, A, and B), and includes criteria for physical characteristics (e.g., moisture, OM, foreign matter, sharps); chemical characteristics (e.g., trace elements); maturity; and biological characteristics (e.g., fecal coliform and salmonella). Table 16-5 presents a summary of specific criteria contained in the BNQ standard.

Table 16-5: Summary of BNQ compost quality criteria

	Category AA	Category A	Category B
	Maximum concentration within product (mg/kg dw)	Maximum concentration within product (mg/kg dw)	Maximum concentration within product (mg/kg dw)
Trace elements			
Arsenic	13	13	75
Cadmium	3	3	20
Chromium	210	210	–
Cobalt	34	34	150
Copper	400	400	–
Lead	150	150	500
Mercury	0.8	0.8	5
Molybdenum	5	5	20
Nickel	62	62	180
Selenium	2	2	14
Zinc	700	700	1850
Pathogens			
Salmonella	Less than MPN/4-g (dw)		
Fecal coliform	Less than 1000 MPN/g (dw)		

Table 16-5: Summary of BNQ compost quality criteria (cont'd)

	Category AA	Category A	Category B
	Maximum concentration within product (mg/kg dw)	Maximum concentration within product (mg/kg dw)	Maximum concentration within product (mg/kg dw)
Foreign matter and sharp foreign matter			
Foreign matter content	Less than or equal to 0.01% dw	Less than or equal to 0.5% dw	Less than or equal to 1.5% dw
Foreign matter content with maximum dimension greater than 12.5 mm but less than 25 mm	0	Not applicable	Not applicable
Foreign matter content with maximum dimension greater than 25 mm	0	Less than or equal to 1	Less than or equal to 2
Sharp foreign matter	No sharp foreign matter less than 3 mm	No sharp foreign matter greater than 3 mm	• No sharp foreign matter greater than 3 mm if product is sold in bags • No sharp foreign matter greater than 12.5 mm, and less than or equal to 3 pieces of sharp foreign matter less than 12.5 mm per 500 mL, if product is bagged
Maturity/stability			
All compost will be mature and stable at the time of sale and distribution. To be considered mature and stable, it must be cured for a minimum of 21 days, and meet one of the following requirements: • Respiration rate less than or equal to 400 mg O_2/kg VS (or OM) per hour • CO_2 evolution rate less than or equal to 4 mg C-CO_2/kg OM per day • Temperature rise above ambient less than 8°C			
Moisture content			
	Less than 65%	Less than 65%	Less than 65%
OM			
	Greater than 50% dw	Greater than 30% dw	Greater than 30% dw

The criteria for most physical and chemical characteristics for Categories A and B are harmonized with the CCME and CFIA standards. The criteria for Category AA are the same as for Category A, except for the foreign matter criteria, which are more stringent. This reflects the intent that compost meeting Category AA is more suitable for bagging.

Excerpts from the Ontario Compost Quality Standards[164]

Section 3.3. Sewage biosolids, pulp and paper biosolids and domestic septage may be used as feedstock materials for the production of Category A and B compost. In the case of Category A compost production, sewage biosolids, pulp and paper biosolids and domestic septage shall be limited to a maximum of 25% of the feedstock blend (on a dry weight basis)

[164] https://www.ontario.ca/page/ontario-compost-quality-standards#section-2

Section 3.4. The temperature of each composting mass shall be measured daily until the requirements above have been satisfied. The days during which the composts, using the windrow composting method, are required to meet the prescribed temperature do not have to be consecutive.

Once these requirements have been met, the temperature shall be measured at least once weekly until the compost is cured.

If temperature monitoring shows that the specified minimum time and temperature relationship has not been achieved, the material from the composting process shall be incorporated back into the composting process at the pre-processing stage, or disposed of at a waste disposal site.

Additional requirements for temperature monitoring of compost may be set out in the conditions of the facility's ECA if applicable.

Table 3.3. Maximum Concentration of Foreign Matter in Compost

Parameter	Category AA	Category A	Category B
Foreign matter	Total foreign matter greater than 3 mm shall not exceed 1.0%, calculated on a dry weight basis, and plastic cannot exceed 0.5%; and Compost shall not contain any foreign matter greater than 25 mmper 500 mL.	Total foreign matter greater than 3 mm shall not exceed 1.0%, calculated on a dry weight basis, and plastic cannot exceed 0.5%; and Compost shall not contain any foreign matter greater than 25 mmper 500 mL.	Total foreign matter greater than 3 mm shall not exceed 2.0%, calculated on a dry weight basis, and plastic cannot exceed 0.5%; and Compost shall not contain any foreign matter greater than 25 mmper 500 mL.
Sharp foreign matter	Compost shall contain no material of a size or shape that can reasonably cause human or animal injury.	Compost shall contain no material of a size or shape that can reasonably cause human or animal injury.	Compost shall have a maximum of 3 pieces of sharp foreign matter per 500 mL; and The maximum dimension of any sharp foreign matter shall be 12.5 mm.

3.7 Labelling Requirements

Category A compost that is exempt from Part V of the *EPA* and *Regulation 347* does not require an ECA for the use or transport of that material. However, Category A compost should be restricted in its use to minimize accumulation of metals in soil. All Category A compost that is sold or distributed shall be labelled with the following information:

- A concise statement on the front of the bag, or in large print on a shipping bill or statement accompanying the shipment where the compost is sold or distributed in bulk, that the product contains domestic septage, and/or municipal sewage biosolids and/or pulp and paper biosolids used as feedstock for the compost, if the feedstock contained any of these materials;
- A statement that sets out the following:
  - the recommended application rate is less than the equivalent of 8 tonnes per hectare (80 kg/100 m^2) per year, on a dry weight basis, or a total of the equivalent of less than 40 tonnes dry weight per hectare (400 kg/100 m^2) over any 5 year period, should the application not occur on an annual basis.

Or

  - the recommended application rate is less than the equivalent of X tonnes per hectare per year, on a dry weight basis, or a total of the equivalent of less than Y tonnes dry weight per hectare over any 5 year period, should the application not occur on an annual basis.
    - X and Y must be determined by the method described in Appendix 7.

This statement must be expressed in clear language using units of measurement appropriate to the quantity being distributed, and calculated on a dry weight basis of the final product such as in the examples provided below:

General example:

- Apply no more than 1 kg of compost for every square meter in a year or 5 kg for every square meter for any 5 year period

Examples for a 5 kg bag (30 L) bag:

- It is recommended the contents of this bag may be spread annually over an area no smaller than 3 m^2.
- It is recommended the contents of this bag may be spread annually to a maximum depth of 1 cm or a maximum depth of 5 cm over any 5 year period.
- A statement that failure by the user to comply with the above recommendation could, under some circumstances, result in the accumulation of metals in the receiving soil to concentrations beyond those that are considered acceptable.
- A statement that the product should not be used on soils with elevated copper or zinc concentrations.

Where the compost is sold or distributed in bags, the required information must be clearly written on the bag in letters that are a minimum of 5 mm high. This size may be reduced to 3 mm in height for bags that are 10 L or less.

The federal *Fertilizers Act* and its regulations also set out labelling and application rate requirements for compost that is sold.

Table A1: Baseline Sampling Frequency of Compost (Metals, Pathogens, Maturity and Foreign Matter)

Compost Produced Annually (wet tonnes)	Baseline Number of Samples (per year) [1]	Minimum Additional Samples for Compost Containing Human Body Waste Feedstock [2] (per year)
<5000	4	+2
5000-15000	6	+2
15000-50000	12	+4
>50000	+ 2 more samples for every additional 10,000 tonnes above the 12 Baseline samples.	+ 4 additional samples above the Baseline Number of Samples

[1] Samples should be distributed throughout the production year to capture seasonal variability.

[2] By weight, on a dry weight basis. See Glossary for a definition of "Human Body Waste Feedstock".

Note: Category B compost, which is to be land-applied as a NASM on agricultural land, must also meet the sampling requirements specified in *O. Reg. 267/03*.

FEEDSTOCK SAMPLING – 10:1 composite, same procedure as above

Operators are responsible for ensuring that feedstocks are characterized according to basic physical and chemical parameters of importance to the composting process, such as carbon content, nutrient content, moisture content, physical structure, metal content, etc. To ensure the feedstock quality standards in Part II are met, characterization should occur prior to receipt of the waste (feedstock or bulking agent) at the composting facility, and should be repeated whenever changes in the generation, handling, or storage of the waste affect any of its characteristics.

Sampling and analysis can be undertaken by the operator, or the generator of the feedstock.

In some cases, operators may choose to rely on published information for wastes that have been well-studied (e.g. leaf and yard wastes, food wastes, wood etc.).

The Director may require that feedstocks which have not been well-characterized, and exhibit variability in C:N ratio, moisture content, bulk density, heavy metals or other contaminants, be subjected to a program of laboratory testing. This includes wastes such as biosolids (from sewage or pulp and paper mill processing), domestic septage, and industrial, commercial and institutional (IC&I) sludges. The Director may require that the operator establish a more detailed program of laboratory testing for these wastes.

In general, feedstocks which have not been well-characterized should be analyzed:

- prior to receipt,
- every 1-2 months in the first year of receipt, and
- if characteristics have changed.

If the waste characterization is relatively consistent, the operator can request a reduction of testing requirements from the ministry.

The Director may require that sampling frequency be increased if:

the average concentration of any regulated metal is greater than 80% of the concentration limit for the feedstock of the category of compost being produced (see Part II, section 3.3); and

the quantity of the particular feedstock is greater than 50% by weight of all materials accepted for composting; or

a change in characteristics of the feedstock is expected due to changes at the generating facility or in the collection, handling, and storage of the material.

Where increased sampling frequency is warranted, sampling should be frequent enough to demonstrate the operator's diligence in managing the composting process, and in ensuring that the resulting compost satisfies the requirements to produce Category AA, A or B compost.

Excerpts from the British Columbia Organic Matter Recycling Regulation[165]

Schedule 2 - Vector Reduction

One of the following vector attraction reduction processes are required for Class A compost:

(a) Class A compost must be treated in an aerobic process for 14 days or longer. During that time, the temperature of the compost must be higher than 40° Celsius and the average temperature of the compost must be higher than 45° Celsius. After the vector attraction reduction process is completed the carbon to nitrogen ratio of the compost must be greater than or equal to 15:1 and less than or equal to 35:1;

(b) Class A compost must be retained in curing piles for at least 21 days. After the 21 day period, the carbon to nitrogen ratio of the Class A compost must be greater than or equal to 15:1 and less than or equal to 35:1 and must not re-heat, upon standing, under the following conditions:

(i) compost is aerated and formed into a pile no smaller than 3 meters in diameter and 2 meters high with compost having a moisture content between 35 percent and 60 percent;

(ii) the pile must be formed in a location where the ambient temperature remains in the range of 5° to 30° Celsius;

[165] http://www.bclaws.ca/civix/document/id/complete/statreg/18_2002#section12

(iii) 3 days after the pile has been formed, the temperature of the compost is measured at a depth of 60 cm into the pile from the outside surface of the pile;

(iv) the compost must not re-heat upon standing to greater than 20° Celsius above ambient temperature.

If Class B compost does not meet the vector attraction reduction processes specified in section 1 of this Schedule, and Class B compost is incorporated by tillage, then no significant amount of Class B compost must remain on the soil surface 6 hours after application.

6 If Class B biosolids or Class B compost is applied to soil using other technologies, practices or methods, Class B biosolids or Class B compost must be applied in accordance with best management practices described in the most recent edition of the organic matter recycling guidelines approved by the director.

SCHEDULE 10 – Background for metals concentration limits

Appendix E.5 Australia Resources and Regulations

Excerpts from Designing, Constructing, and Operating Compost Facilities[166]

Metal Limits

Contaminant	Unrestricted use upper limits Dry weight basis (mg/kg)
Arsenic	20
Cadmium	1
Boron	100
Chromium	100
Copper	150
Lead	150
Mercury	1
Nickel	60
Selenium	5
Zinc	300

Contaminant	Unrestricted use upper limits Dry weight basis (mg/kg)
DDT/DDD/DDE	0.5
Aldrin	0.02
Dieldrin	0.02
Chlordane	0.02
Heptachlor	0.02
HCB	0.02
Lindane	0.02
BHC	0.02
PCBs	Not detectable (detection limit (0.2mg/kg)

Source: Designing, Constructing and Operating Compost Facilities, EPA Victoria, June 2017

Pathogen Limits

Parameter	Standard
Enteric viruses[11]	<1 PFU per 10 grams total (dry weight)
Helminth ova (Ascaris sp. and Taenia sp.)	<1 per 4 grams total dry solids
E. coli	<100 MPN per gram (dry weight)
Faecal coliforms[12]	<1,000 MPN per gram (dry weight)
Salmonella spp.	Absent in 50 grams of final product (dry weight)
Destruction of noxious weeds (viable plant materials and propagules)	Nil (germination) after 21 days incubation

MPN = most probable number. PFU = plaque-forming unit

Source: Designing, Constructing and Operating Compost Facilities, EPA Victoria, June 2017

Physical Contaminant Limits

Physical contaminants	Percentage of dry matter w/w
Glass, metal and rigid plastics	≤0.5
Plastics – light and flexible or film	≤0.05

Source: Designing, Constructing and Operating Compost Facilities, EPA Victoria, June 2017

[166] Environment Protection Authority Victoria. 2017. Designing, constructing and operating composting facilities. Publication 1588.1. June. https://ref.epa.vic.gov.au/~/media/Publications/ATTGTO5C.pdf.

Appendix E.6 United Kingdom Resources and Regulations

Excerpt from Biocycle's United Kingdom: Setting The Standards for Compost[167]

Minimum Monitoring Frequency

Parameter	Minimum Monitoring Frequency: Sanitization Step	Stabilization Step
Temperature	Every working day	Once per week
Moisture	In vessel: once at end; Outdoor windrow: once at start	Once per week

Batch Zone	Location And Number Of Monitoring Points: Turned Windrow (Open-Air or Housed)	In-vessel	Aerated static pile
Surface	0	1 per up to 250m^3	1 per up to 250m^3
Core	1 per up to 250m^3	1 per up to 250m^3	1 per up to 250m^3
Basal	0	1 per up to 250m^3	1 per up to 250m^3

Excerpt from The Composting Industry Code of Practice[168]

Stability Testing

Respiration rate	Description	Composting time
>20 mg CO_2/g VS/day	Active and highly unstable	Typically < 6 weeks
16.0 – 19.9 mg CO_2/g VS/day	Very immature and unstable	Typically 6-8 weeks
12.0 – 15.5 mg CO_2/g VS/day	Immature and unstable	Typically 8-10 weeks
8.0 – 11.9 mg CO_2/g VS/day	Maturing and stabilising	Typically 10-14 weeks
6.0 – 7.9 mg CO_2/g VS/day	Mature and relatively stable	Typically 14-20 weeks
<6.0 mg/CO_2/gVS/day	Very stable and mature	Typically >20 weeks

VS – Volatile Solids
CO_2 – Carbon dioxide

Excerpt from Quality Protocol: Compost[169]

Compost Protocol Standards

The Compost Protocol Standards published by the Northern Ireland Environmental Agency is applicable in England, Wales and Northern Ireland. It sets standards for the production and use of compost from source-separated organic waste.

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[167] BioCycle. 2006. United Kingdom, Setting the Standards for Compost. June. http://www.alexassoc.net/articles/Compost%20Labeling%20%26%20Certification/Biocycle%20STA-PAS%20article%206-06.pdf.

[168] The Composting Association. 2005. The Composting Industry Code of Practice. http://www.organics-recycling.org.uk/dmdocuments/Composting_Industry_Code_of_Practice.pdf.

[169] Northern Ireland Environment Agency. n.d. Quality Protocol: Compost.

This Quality Protocol will be adopted as a technical regulation under Technical Standards and Regulations Directive (98/34/EC) as amended. We recognize that there may be codes of practice or standards which apply in the European Economic Area (EEA) States other than the UK setting out requirements for the production and use of quality compost. We accept that quality compost may cease to be waste provided it has been produced in compliance with:

- a relevant standard or code of practice of a national standards body or equivalent body of any EEA State; or
- any relevant international standard recognized for use in any EEA State; or

any relevant technical regulation with mandatory or de facto mandatory application for marketing or use in any EEA State. These must give levels of product performance and protection of human health and the environment, equivalent to those required by this Quality Protocol.

Producers and users are not obliged to comply with the Quality Protocol. If they do not, the compost produced will normally be considered to be waste and waste management controls will apply to its handling, transport and application.

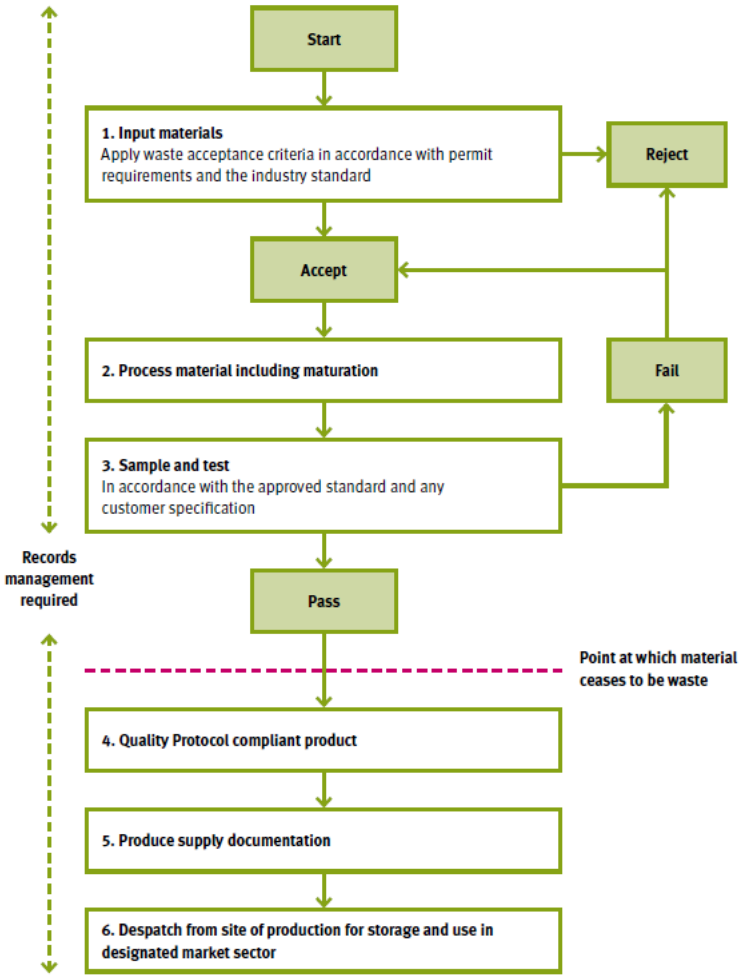
This Quality Protocol does not affect the obligation of producers to hold an environmental permit and to comply with its conditions when receiving, storing and processing waste.

Producers must demonstrate that these criteria have been met. They must do this in the ways set out in Section 3 of the Quality Protocol, that is:

- by obtaining certification from an approved certification body; and
- by producing and keeping copies of customer supply documentation that includes a declaration that the quality compost meets the approved standard, the Quality Protocol and any additional customer specifications (as agreed between the `supplier and the customer).

Detailed guidance on waste management controls can be obtained from the Environment Agency's National Customer Contact Centre on 08708 506 506, from its website http://www.environment-agency.gov.uk/subjects/waste/ or NetRegs http://www.netregs.gov.uk/

Figure 2: Main stages and control mechanisms of the Quality Protocol



Appendix E.7 State of Texas Resources and Regulations

TAC Section 332.71 Sampling and Analysis Requirements for Final Product[170]

(a) Applicability. Facilities that receive a registration or permit under this chapter are required to test final product in accordance with this section. Final product derived from municipal sewage sludge at registered facilities is not subject to the requirements of this section, but must comply with the requirements of Chapter 312 of this title (relating to Sludge Use, Disposal, and Transportation).

(d) Maturity Testing Protocol.

(1) A maturity testing protocol shall be described in the facility QAQC. The protocol shall consist of the reduction of organic matter (ROM) method or a comparison of the interim ROM method to a minimum of three test methods with one test method selected from each of subparagraphs (A), (B), and (C) of this paragraph, together with any method in subparagraph (D) of this paragraph.

(A) Chemical analyses:

(i) carbon/nitrogen ratio;
(ii) water soluble ions;
(iii) water soluble organic matter;
(iv) cation exchange capacity;
(v) electrical conductivity;
(vi) crude fiber analysis;
(vii) humification analysis; or
(viii) ratios of the above measurements.

(B) Physical analyses.

(i) Dewar self-heating; or
(ii) color.

(C) Respiration analyses:

(i) CO[sub]2[/sub]; or
(ii) O[sub]2[/sub].

(D) Other test methods proposed in the facility QAQC plan and approved by the TNRCC.

(2) The test methods used in the maturity test protocol shall be based on methodologies published in peer reviewed scientific journals, the publication entitled "Recommended Test Methods for the Examination of Composts and Composting (Compost Council, 1995), or other methods as approved by the TNRCC.

(3) The completed maturity testing protocol shall lead to a recommended maturity testing method(s) capable of classifying compost into maturity grades described in §332.72 of this title (relating to Final Product Grades) and identifying materials which are stable but not mature. The maturity test protocol shall address seasonal variations in compost feedstock and shall be completed within 18 months of the start of a new compost feedstock mixture.

(4) The results of the protocol and recommendations shall be submitted to the TNRCC for review and approval. The basis of the TNRCC review and approval shall be the demonstration that the recommended method adequately classifies compost into maturity classes. The purpose of the TNRCC review and approval is not intended to provide detailed guidance to end users about the agricultural and horticultural compost uses.

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170 https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=332&rl=71

(5) The compost maturity protocol does not need to be repeated unless a significantly new compost feedstock recipe is utilized.

(f) Sampling Frequencies.

(1) Registered facilities. For those facilities which are required to register, all final product on-site must be sampled and assigned a final product grade set forth in §332.72 of this title (relating to Final Product Grades) at a minimum rate of one sample for every 5,000 cubic yard batch of final product or annually, whichever is more frequent. Each sample will be a composite of nine grab samples as discussed in subsection (g) of this section.

(2) Permitted facilities. For facilities requiring a permit, all final product on-site must be sampled and assigned a final product grade set forth in §332.72 of this title at a minimum rate of one sample for every 3,000 cubic yard batch of final product or monthly whichever is more frequent. Each sample will be a composite of nine grab samples as discussed in subsection (g) of this section.

(3) Alternative testing frequency. One year after the initiation of final product testing in accordance with this section, an operator of a registered or permitted facility may submit to the executive director a request for an alternative testing frequency. The request shall include a minimum of 12 consecutive months of final product test results for the parameters set forth in subsection (h) of this section. The executive director will review the request and determine if an alternative frequency is appropriate.

(g) Sampling Requirements. For facilities subject to sampling and analysis, the operator shall utilize the protocol in the TNRCC QAPP or a TNRCC approved facility QAQC plan shall be followed. The executive director may at any time request that split samples be provided to an agency representative. Specific sampling requirements which must be satisfied include:

(1) Sampling from stockpiles. One third of the grab samples shall be taken from the base of the stockpile (at least 12 inches into the pile at ground level), one third from the exposed surface and one third from a depth of two feet from the exposed surface of the stockpile.

(2) Sampling from conveyors. Sampling times shall be selected randomly at frequencies which provide the same number of subsamples per volume of finished product as is required in subsection (d) of this section.

(A) If samples are taken from a conveyor belt, the belt shall be stopped at that time. Sampling shall be done along the entire width and depth of the belt.

(B) If samples are taken as the material falls from the end of a conveyor, the conveyor does not need to be stopped. Free-falling samples need to be taken to minimize the bias created as larger particles segregate or heavier particles sink to the bottom as the belt moves. In order to minimize sampling bias, the sample container shall be moved in the shape of a "D" under the falling product to be sampled. The flat portion of the "D" shall be perpendicular to the beltline. The circular portion of the "D" shall be accomplished to return the sampling container to the starting point in a manner so that no product to be sampled is included.

(j) Reporting Requirements.

(1) Facilities requiring registration must report the following information to the executive director on a semiannual basis for each sampling batch of final product. Facilities requiring a permit must report similarly but on a monthly basis. Reports must include, but may not be limited to all of the following information:

(A) batch numbers identifying the final product sampling batch;

(B) the quantities, types and sources of feedstocks received and the dates received;

(C) the quantity of final product and final product standard code assigned;

(D) the final product grade or permit number of the disposal facility receiving the final product if it is not Grade 1 or Grade 2 Compost as established in §332.72 of this title (relating to Final Product Grades);

(E) all analytical results used to characterize the final product including laboratory quality assurance/quality control data and chain-of-custody documentation; and

(F) the date of sampling.

(2) Reports must be submitted to the executive director within two months after the reporting period ends.

TAC Section 332.72 Final Product Grades[171]

(b) Grades. Compost material that has undergone the composting process and is ready for distribution shall be considered final product, and shall be classified with one of the following grade names:

(1) Grade 1 Compost;
(2) Grade 2 Compost;
(3) Waste Grade Compost.

(c) Final product testing. Final product shall be regularly tested pursuant to §332.71 of this title (relating to Sampling and Analysis Requirements for Final Product) to determine the product's grade. Testing of final product and interpretation of test results shall be conducted in accordance with the Texas Natural Resource Conservation Commission's current Quality Assurance Program Plan, or, in the case of facilities with TNRCC permits or registrations, the Quality Assurance Quality Control Plan specified in the facility's permit.

(d) Final product classification. Final product shall be classified according to the following classification system.

(2) Grade 1 Compost. To be considered Grade 1 Compost, the final product must meet all of the following criteria:

(A) Shall contain no foreign matter of a size or shape that can cause human or animal injury;

(B) Shall not exceed all Maximum Allowable Concentrations for Grade 1 Compost in Table 1 of this section;

Attached Graphic (C) Shall not contain foreign matter in quantities which cumulatively are greater than 1.5% dry weight on a 4mm screen;

(D) Shall meet the requirements of cured compost as described in Table 2 of this section;

Attached Graphic (E) Shall meet the requirements for pathogen reduction for Grade 1 Compost as described in Table 3 of this section; and

Attached Graphic (F) Shall meet the requirements for salinity and pH for Grade 1 Compost as described in Table 3 of this section.

(3) Grade 2 Compost:

(A) Shall contain no foreign matter of a size or shape that can cause human or animal injury;

(B) Shall not exceed all Maximum Allowable Concentrations for Grade 2 Compost in Table 1 of this section at a compost organic matter content which is equivalent to a mature compost when maturity is

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171 https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=332&rl=72

determined by reduction in organic matter during the interim period or a maturity test which is part of an approved maturity test protocol;

(C) Shall not contain foreign matter in quantities which cumulatively are greater than 1.5% dry weight on a 4mm screen;

(D) Shall meet the requirements of semi-mature compost, mature compost or cured compost as described in Table 2 of this section;

(E) Shall meet the requirements for pathogen reduction for Grade 2 Compost as described in Table 3 of this section; and

(F) Shall meet the requirements for salinity and pH for Grade 2 Compost as described in Table 3 of this section.

(3) Waste Grade Compost:

(A) Exceeds any one of the Maximum Allowable Concentrations for Grade 2 final product in Table 1 of this section; and

(B) Does not meet the other requirements of Grade 1 or Grade 2 Compost.

(e) Maturity adjustment. Compost which is semi-mature or mature shall have the metal concentrations adjusted to reflect the metal concentration which would occur if the compost met the criteria for a cured compost as described in Table 2, "Maturity and Stability Standards."

(f) Waste grade final product. Any material which does not meet the final product standards shall be appropriately disposed at a permitted municipal solid waste facility.

Appendix E.8 State of Maryland Resources and Regulations

15 COMAR 18.04.05[172]

A. A compost product is classified as a General Use, Limited Use, or Restricted Use compost as shown in §§B-D of this regulation.

B. General Use Compost.

(1) General Use compost may not exceed the following specifications:

Parameter	*Parameter Limit All limits apply to product leaving composting facility.*
(a) pH (range)	6.0-8.0
(b) Heavy metals (maximum)	
(i) Arsenic	41 mg/kg dry wt.
(ii) Cadmium	39 mg/kg dry wt.
(iii) Chromium	1200 mg/kg dry wt.
(iv) Copper	1500 mg/kg dry wt.
(v) Lead	300 mg/kg dry wt.
(vi) Mercury	17 mg/kg dry wt.
(vii) Molybdenum	18 mg/kg dry wt.
(viii) Nickel	420 mg/kg dry wt.
(ix) Selenium	36 mg/kg dry wt.
(x) Zinc	2800 mg/kg dry wt.
(c) PCBs	5 ppm
(d) Man-made inerts (maximum) >4mm, <13mm	2 percent dry wt.

[172] Code of Maryland Regulations. 2019. Title 15, Subtitle 18, Chapter 4, Section 5: Compost Classification. http://mdrules.elaws.us/comar/15.18.04.05.

(e) Film plastic >4mm	2 percent dry wt.
(f) Process to further reduce pathogens (required for compost from municipal solid waste or manure)	pass

(2) A General Use compost:

(a) Shall pass through a 12mm (1/2 inch) screen;

(b) Shall be stabilized;

(c) May not have an objectionable odor; and

(d) May be distributed as a soil conditioner for use by the general public or for any use allowed by this chapter.

C. Limited Use Compost.

(1) A Limited Use compost may not exceed the following specifications:

Parameter	*Parameter Limit All limits apply to product leaving composting facility.*
(a) pH (range)	6.0-8.0
(b) Heavy metals (maximum)	
(i) Arsenic	41 mg/kg dry wt.
(ii) Cadmium	39 mg/kg dry wt.
(iii) Chromium	1200 mg/kg dry wt.
(iv) Copper	1500 mg/kg dry wt.
(v) Lead	300 mg/kg dry wt.
(vi) Mercury	17 mg/kg dry wt.
(vii) Molybdenum	18 mg/kg dry wt.
(viii) Nickel	420 mg/kg dry wt.
(ix) Selenium	36 mg/kg dry wt.

(x) Zinc	2800 mg/kg dry wt.
(c) PCBs	10 ppm
(d) Man-made inerts (maximum) >4mm	4 percent dry wt.
(e) Film plastic >4mm	2 percent dry wt.
(f) Process to further reduce pathogens (required for compost from municipal solid waste or manure)	pass

(2) A Limited Use compost:

(a) Shall pass through an 18mm (3/4 inch) screen;

(b) Shall be stabilized;

(c) May not have an objectionable odor; and

(d) May only be distributed for use by a commercial, agricultural, institutional, or governmental operation, or for restricted use as provided by this chapter.

D. Restricted Use Compost:

(1) A Restricted Use compost may not exceed the indicated maximum level for any heavy metal or trace element, as follows:

(a) Arsenic	75 mg/kg dry wt.
(b) Cadmium	85 mg/kg dry wt.
(c) Chromium	3000 mg/kg dry wt.
(d) Copper	4300 mg/kg dry wt.
(e) Lead	840 mg/kg dry wt.
(f) Mercury	57 mg/kg dry wt.
(g) Molybdenum	75 mg/kg dry wt.
(h) Nickel	420 mg/kg dry wt.
(i) Selenium	100 mg/kg dry wt.
(j) Zinc	7500 mg/kg dry wt.

(2) A Restricted Use compost:

(a) May not be a hazardous waste, as defined in COMAR 26.13.02.03;

(b) May not be stockpiled or disposed of unless authorized by the Maryland Department of the Environment;

(c) May not be distributed or sold to the general public;

(d) Is restricted to distribution for use as a final, intermediate, or alternate daily landfill cover, as provided by COMAR 26.04.07, or on marginal land or in land reclamation efforts if applied at rates not to exceed limits established in Table 2 of Regulation .12 of this chapter; and

(e) Includes any compost exceeding any parameter limit for Limited Use compost, as provided in Regulation .05C of this chapter, or any compost designated by the registrant as Restricted Use classification.

Appendix F
Completed Questionnaire from Seattle Public Utilities

Jacobs Challenging today. Reinventing tomorrow.

Date: ____4___February, 2020

Compost Market Development Incentives Survey

We are supporting a regional agency who is developing ways to encourage compost use and growth of local compost markets. Your experiences with how you have enhanced compost demand will be valuabe in our efforts. We would be glad to share the outcome of our analysis when complete.

AGENCY INFORMATION	
Name of Agency:	Seattle Public Utilities
City, State:	Seattle, WA
Contact Person Name:	David McDonald
Email:	david.mcdonald@seattle.gov
Phone Number:	206-684-7650
COMPOST FACILITIES IN YOUR REGION	
Types of materials composted and compost produced:	yard waste, food waste
Compost operators/names/websites	www.compostwashington.org
Compost operators/names/websites	see link to facilites list at bottom of page https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/Organic-materials/Managing-organics-compost
Compost operators/names/websites	
Compost operators/names/websites	
Compost operators/names/websites	
Comments	
COMPOST USE INCENTIVES	
Any compost use specifications in place you are aware of?	City of Seattle's specification is widely used, https://www.seattle.gov/utilities/construction-and-development/standard-specs-plans see 2017 Std. Specs. PDF, section 9.14.4(8) Compost
Are there any "buy green" or recycling incentives to encourage compost use?	Seattle encourages but does not require use of locally produced compost.
Can compost socks or berms be used in lieu of traditional silt fences for stormwater runoff controls during construction?	Yes, per WA State and many local stormwater codes.
Are there any environmental purchasing policies which specifically call out compost use?	State stormwater code requres construction disturbed soils to be amend with compost - see info and links to state code at www.soilsforsalmon.org and www.buidingsoils.org
What year were these policies put into place?	2003
What has been the impact of these policies?	In local jurisdictions (such as Seattle) that enforce the State stormwater regulations, most building sites comply. Lesser compliance in jurisdictions that don't enforce.
Can you email us copies of any of these or provide a website addresses?	See soils for salmon and building soil websites above. We are currently updating and combineing those two sites into one (SoilsforSalmon.org) - probably done by May.
COMPOST QUALITY	
Are you familiar with U.S. Compost Council STA program?	Yes
Is there any preference or benefit you know of for sale of compost with this designation in your region?	Yes, the State stormwater manual, City of Seattle specs, and WSDOT specs all require STA compost.
Do you know if compost products are certified with the State Department of Agriculture?	Only if they are being marketed as meeting "Organic" materials certification, see p. 7 of https://agr.wa.gov/getmedia/70ef4ed6-43c5-4776-abd7-478e14ccebff/16.pdf
If yes, are they registered as fertilizer or as soil conditioner?	no
Other Comments	
COMPOST SALES	
Do you have any information about compost pricing in your area?	no
Are there compost brochures, websites of example programs in your region you know of?	www.compostwashington.org www.soilsforsalmon.org www.seattle.gov/util/yard
Does your organization have a compost market development budget? If so, what is it?	No. Some staff time.
Other Comments	
GENERAL INFORMATION	
May we use your organization by name?	Yes.
Other comments	

Appendix G
List of Green Initiative Programs

List of Referenced Green Initiative Programs

Metro can use the following programs/specifications as a starting point when developing Metro region specifications:

City of Portland Blended Soil Specification for Vegetated Stormwater Systems

City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction

King County “Achieving the Post-construction Soil Standard” Specification

ODA Oregon Fertilizer Program Guide

ORDOT Guidance Materials

WORC Soils for Salmon Program

Appendix H
King County Invitation to Bid for Compost Purchasing

SECTION 5 Technical Specifications/Scope of Work

5.1 Background

The King County Council requested that county staff develop an Organics Plan to expand and enhance the regional market for compost that is produced using the county's organics stream. The intent of the Organics Plan is to develop new uses for compost to increase local demand which will help divert organic materials (food, yard, wood and compostable paper) from the Cedar Hills Regional Landfill through recycling. Refer to **Exhibit 1 – Organics Market Development Plan.**

This contract is meant to help deliver the Organics Market Development Plan‘s recommendation to increase compost use in county operations and projects and to divert organic materials from the King County waste system by requiring portions of the compost’s feedstock originate from regional sources.

5.2 Scope of Work

A. The purpose of this Invitation to Bid (ITB) is to establish Contractors to furnish compost, application services, and related material used by various King County departments, divisions, and agencies, on an as-needed basis and as requested by an authorized King County Project Manager (KCPM) or designee.

B. The County intends to award Primary, Secondary and Tertiary contracts to the lowest responsive, responsible bidder(s) in each of five regions, as shown in **Exhibits 2 through 7**. Contractors may be awarded more than one region.

5.3 General Requirements

A. Contractor shall be an established business with all required licenses, fees, bonding, facilities, equipment and trained personnel necessary to meet all requirements and perform work as specified in this document. Contractor shall maintain compliance with these requirements throughout the life of the contract.

B. Contractor shall designate a supervisor or lead person as a single point of contact. The Contractor’s single point of contact shall be the primary person responsible for communicating directly with the KCPM concerning questions and concerns about performance of the contract.

C. During the life of the contract, meetings shall be scheduled on-site by either the Contractor or the KCPM, for the purpose of discussing project/performance. The meetings will be documented in writing by the County and distributed to the Contactor. It is the responsibility of the Contractor to state, in writing, any disagreement with the written documentation.

D. Bidders have the option of supplying prices for services, material, or both services and material.

1. If providing the compost material, the Contractor shall provide delivery and will call services within the entire region awarded.
2. If providing compost application services, the Contractor shall provide application services within the entire region awarded.

5.4 Material Specifications

A. General Compost

1. pH

   The pH shall be between 6.0 and 8.5 when tested in accordance with U.S. Composting Council TMECC 04.11-A, “1:5 Slurry pH.”

2. Physical Contaminants

   Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1 percent by weight as determined by U.S. Composting Council TMECC 03.08-A “Classification of Inerts by Sieve Size”.

   Film plastics shall be 0.1 percent or less, by dry weight.

3. Minimum Organic Matter

   Minimum organic matter shall be 40 percent by dry weight basis as determined by U.S. Composting Council TMECC 05.07A “Loss-OnIgnition Organic Matter Method (LOI)”.

4. Maturity
   Maturity shall be greater than 80 percent in accordance with U.S. Composting Council TMECC 05.05-A, “Germination and Root Elongation”.

   The KCPM may also evaluate compost for maturity using U.S. Composting Council TMECC 05.08-E “Solvita® Maturity Index”. Fine compost shall score a number 6 or above on the Solvita® Compost Maturity Test. Medium and coarse compost shall score a 5 or above on the Solvita® Compost Maturity Test.

5. Stability

   Stability shall be 7-mg CO2–C/g OM/day or below in accordance with U.S. Composting Council TMECC 05.08-B “Carbon Dioxide Evolution Rate”.

6. Feedstocks
   a. The compost product shall originate a minimum of 65 percent by volume from recycled plant waste comprised of ”yard debris,” “crop residues,” and “bulking agents” as those terms are defined in WAC 173-350-100. A maximum of 35 percent by volume of “post-consumer food waste” as defined in WAC 173-350-100 or a maximum 50 percent by volume of “biosolids” as defined in WAC 173-308-080 may be substituted for recycled plant waste.

   b. A minimum of 51 percent by volume of the feedstock shall originate from an organic waste system within King County, which includes organic waste originating from all cities and unincorporated areas within King County.

   c. The compost product shall be free of noxious weed or foreign plant growth. Noxious weeds are defined as those listed on the King County Noxious Weed List: https://www.kingcounty.gov/services/environment/animals-and-plants/noxious-weeds/laws/list.aspx

7. Carbon to Nitrogen Ratio
   a. Fine compost shall have a carbon to nitrogen ratio of less than 25:1. The carbon to nitrogen ratio shall be calculated using the dry weight of “Organic

Carbon" using TMECC 04.01A divided by the dry weight of "Total N" using TMECC 04.02D.

b. Medium compost shall have a carbon to nitrogen ratio (C:N) between 18:1 and 35:1. The carbon to nitrogen ratio shall be calculated using the dry weight of "Organic Carbon" using TMECC 04.01A divided by the dry weight of "Total N" using TMECC 04.02D.

c. Coarse compost shall have a carbon to nitrogen ratio (C:N) between 25:1 and 35:1. The carbon to nitrogen ratio shall be calculated using the dry weight of "Organic Carbon" using TMECC 04.01A divided by the dry weight of "Total N" using TMECC 04.02D.

8. Soluble Salt

   Soluble salt contents shall be less than 4.0 mmhos/cm when tested in accordance with U.S. Composting Council TMECC 04.10 "Electrical Conductivity".

9. Gradation

   Gradation requirements are as follows.

Fine Compost

Sieve Size	Minimum Percent Passing	Maximum Percent Passing
1"	99%	100%
5/8"	90%	100%
¼"	75%	100%
Note: Maximum particle length of 4 inches.		

Medium Compost

Sieve Size	Minimum Percent Passing	Maximum Percent Passing
1"	99%	100%
5/8"	85%	100%
¼"	70%	85%
Note: Maximum particle length of 4 inches.		

Coarse Compost

Sieve Size	Minimum Percent Passing	Maximum Percent Passing
2”	99%	100%
1”	90%	100%
5/8”	70%	100%
¼”	40%	60%
Note: Maximum particle length of 6 inches.		

10. Submittal Requirements **– Refer to Section 6.8 Item A – Submittal Items for Compost**

    The bidder shall submit the following information with bid:

    a. Solid Waste Handling Permit issued to the manufacturer by the Jurisdictional Health Department in accordance with WAC 173- 350 (Minimum Functional Standards for Solid Waste Handling) or for biosolid composts a copy of the Coverage Under the General Permit for Biosolids Management issued to the manufacturer by the Department of Ecology in accordance with WAC 173-308 (Biosolids Management);

    b. Lab analyses that the material complies with the processes, testing, and standards specified in WAC 173-350 and these Specifications. An independent Seal of Testing Assurance (STA) Program certified laboratory shall perform the analyses;

    c. Manufacturer’s Seal of Testing Assurance STA certification as issued by the U.S. Composting Council.

B. Bioretention Compost

1. pH

   The pH shall be between 6.0 and 8.5 when tested in accordance with U.S. Composting Council TMECC 04.11-A, “1:5 Slurry pH.”

2. Physical Contaminants

   Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1 percent by weight as determined by U.S. Composting Council TMECC 03.08-A “Classification of Inerts by Sieve Size”.

   Film plastics shall be 0.1 percent or less, by dry weight

3. Minimum Organic Matter

   Minimum organic matter shall be 40 percent by dry weight basis as determined by U.S. Composting Council TMECC 05.07A “Loss-OnIgnition Organic Matter Method (LOI)”.

4. Maturity

   Maturity shall be greater than 80 percent in accordance with U.S. Composting Council TMECC 05.05-A, “Germination and Root Elongation”.

   The KCPM may also evaluate compost for maturity using U.S. Composting Council TMECC 05.08-E “Solvita® Maturity Index”. Fine compost shall score a number 6 or above on the Solvita® Compost Maturity Test. Medium and coarse compost shall score a 5 or above on the Solvita® Compost Maturity Test.

5. Stability

   Stability shall be 7-mg CO2–C/g OM/day or below in accordance with U.S. Composting Council TMECC 05.08-B “Carbon Dioxide Evolution Rate”.

6. Feedstocks

   a. The compost product shall originate a minimum of 65 percent by volume from recycled plant waste comprised of ”yard debris,” “crop residues,” and “bulking agents” as those terms are defined in WAC 173-350-100. A maximum of 35 percent by volume of “post-consumer food waste” as defined in WAC 173-350-100, but not including biosolids or manure, may be substituted for recycled plant waste.

   b. A minimum of 51 percent by volume of the feedstock shall originate from an organic waste system within King County, which includes organic waste originating from all cities and unincorporated areas within King County.

   c. The compost product shall be free of noxious weed or foreign plant growth. Noxious weeds are defined as those listed on the King County Noxious Weed List: https://www.kingcounty.gov/services/environment/animals-and-plants/noxious-weeds/laws/list.aspx

7. Carbon to Nitrogen Ratio

   a. Fine Compost shall have a carbon to nitrogen ratio of less than 25:1. The carbon to nitrogen ratio shall be calculated using the dry weight of “Organic Carbon” using TMECC 04.01A divided by the dry weight of “Total N” using TMECC 04.02D.

   b. Medium compost shall have a carbon to nitrogen ratio (C:N) between 18:1 and 35:1. The carbon to nitrogen ratio shall be calculated using the dry weight of “Organic Carbon” using TMECC 04.01A divided by the dry weight of “Total N” using TMECC 04.02D.

   c. Coarse compost shall have a carbon to nitrogen ratio (C:N) between 25:1 and 35:1. The carbon to nitrogen ratio shall be calculated using the dry weight of “Organic Carbon” using TMECC 04.01A divided by the dry weight of “Total N” using TMECC 04.02D.

8. Soluble Salt

   Soluble salt contents shall be less than 4.0 mmhos/cm when tested in accordance with U.S. Composting Council TMECC 04.10 “Electrical Conductivity”.

9. Gradation

   Gradation requirements are as follows.

Fine Compost

Sieve Size	Minimum Percent Passing	Maximum Percent Passing
1”	99%	100%
5/8”	90%	100%
¼”	75%	100%
Note: Maximum particle length of 4 inches.		

Medium Compost

Sieve Size	Minimum Percent Passing	Maximum Percent Passing
1”	99%	100%
5/8”	85%	100%
¼”	70%	85%
Note: Maximum particle length of 4 inches.		

Coarse Compost

Sieve Size	Minimum Percent Passing	Maximum Percent Passing
2”	99%	100%
1”	90%	100%
5/8”	70%	100%
¼”	40%	60%
Note: Maximum particle length of 6 inches.		

10. Submittal Requirements Refer to Section 6.8 Item B – Submittal Items for Bioretention Compost

    The Contractor shall submit the following information for approval:

    a. Solid Waste Handling Permit issued to the manufacturer by the Jurisdictional Health Department in accordance with WAC 173- 350 (Minimum Functional Standards for Solid Waste Handling);

b. Lab analyses that the material complies with the processes, testing, and standards specified in WAC 173-350 and these specifications. An independent Seal of Testing Assurance (STA) Program certified laboratory shall perform the analyses;

c. Manufacturer's Seal of Testing Assurance STA certification as issued by the U.S. Composting Council.

C. Biosolid Compost

1. pH

The pH shall be between 6.0 and 8.5 when tested in accordance with U.S. Composting Council TMECC 04.11-A, "1:5 Slurry pH."

2. Physical Contaminants

Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1 percent by weight as determined by U.S. Composting Council TMECC 03.08-A "Classification of Inerts by Sieve Size".

Film plastics shall be 0.1 percent or less, by dry weight

3. Minimum Organic Matter

Minimum organic matter shall be 40 percent by dry weight basis as determined by U.S. Composting Council TMECC 05.07A "Loss-OnIgnition Organic Matter Method (LOI)".

4. Maturity

Maturity shall be greater than 80 percent in accordance with U.S. Composting Council TMECC 05.05-A, "Germination and Root Elongation".

The KCPM may also evaluate compost for maturity using U.S. Composting Council TMECC 05.08-E "Solvita® Maturity Index". Fine compost shall score a number 6 or above on the Solvita® Compost Maturity Test. Medium and coarse compost shall score a 5 or above on the Solvita® Compost Maturity Test.

5. Stability

Stability shall be 7-mg CO2–C/g OM/day or below in accordance with U.S. Composting Council TMECC 05.08-B "Carbon Dioxide Evolution Rate".

6. Feedstocks

a. The compost product shall contain biosolids as that term is defined in WAC 173-308-080.

b. The compost shall contain biosolids sourced from biosolids processors or distributors within 100 miles of King County, WA.

c. The compost product shall be free of noxious weed or foreign plant growth. Noxious weeds are defined as those listed on the King County Noxious Weed List: https://www.kingcounty.gov/services/environment/animals-and-plants/noxious-weeds/laws/list.aspx

7. Carbon to Nitrogen Ratio

   Compost shall have a carbon to nitrogen ratio of less than 35:1. The carbon to nitrogen ratio shall be calculated using the dry weight of "Organic Carbon" using TMECC 04.01A divided by the dry weight of "Total N" using TMECC 04.02D.

8. Soluble Salt

   Soluble salt contents shall be less than 4.0 mmhos/cm when tested in accordance with U.S. Composting Council TMECC 04.10 "Electrical Conductivity".

1. Gradation

Gradation requirements are as follows.

Fine Compost

Sieve Size	Minimum Percent Passing	Maximum Percent Passing
1"	99%	100%
5/8"	90%	100%
¼"	75%	100%
Note: Maximum particle length of 4 inches.		

Medium Compost

Sieve Size	Minimum Percent Passing	Maximum Percent Passing
1"	99%	100%
5/8"	85%	100%
¼"	70%	85%
Note: Maximum particle length of 4 inches.		

Coarse Compost

Sieve Size	Minimum Percent Passing	Maximum Percent Passing
2"	99%	100%
1"	90%	100%
5/8"	70%	100%

¼"	40%	60%
Note: Maximum particle length of 6 inches.		

9. Submittal Requirements - Refer to Section 6.8 Item C – Submittal Items for Biosolid Compost

   The Contractor shall submit the following information for approval:

   a. Solid Waste Handling Permit issued to the manufacturer by the Jurisdictional Health Department in accordance with WAC 173- 350 (Minimum Functional Standards for Solid Waste Handling) or for biosolid composts a copy of the Coverage Under the General Permit for Biosolids Management issued to the manufacturer by the Department of Ecology in accordance with WAC 173-308 (Biosolids Management);

   b. Lab analyses that the material complies with the processes, testing, and standards specified in WAC 173-350 and these Specifications. An independent Seal of Testing Assurance (STA) Program certified laboratory shall perform the analyses.

   c. Manufacturer's Seal of Testing Assurance STA certification as issued by the U.S. Composting Council.

D. Like Product – Catalog Items

Other products of like nature may be purchased under this contract. The Bidder shall provide their published catalog or price list, or access to their online catalog, which shall include a complete list of Potting Soil, Topsoil, Mulch, Bark, Compost Stocks and other soil amendment material offered by the Contractor. The Bidder shall, on **Attachment A – Pricing Schedules**, indicate a percent discount off the Contractor's current published catalog price list for related material. Refer to Sections 6.9 Catalog or Price List, and Attachment A – Item 4 Like Product – Catalog Items.

5.5 Application Services Specifications

A. General Requirements

1. The Contractor shall supply all labor, equipment, tools, appliances and appurtenances necessary to perform and complete the application services work.
2. The Contractor shall keep the work site and immediately adjacent premises free from waste material, debris and rubbish and shall remove it from the property.
3. All workers or subcontractors employed shall be competent, skilled, and experienced in the performance of the work to which they are assigned. Failure or delay in the performance of work due to any inability, for any reason, to obtain workmen of the number and skill required may be deemed by King County to constitute a default of the Contract.
4. The Contractor is responsible for safety on the project site. All rules and requirements as may be required by OSHA or WISHA shall be followed in the performance of the work. Additional rules may be imposed by the landowner in accordance with the access agreement or third-party forest certification programs.

5. The Contract requires the Contractor to perform general site supervision of its own staff or subcontractors and daily coordination of activities with the compost hauling contractor. Coordination with other contractors may be required during the course of the work.

B. Application Services

1. Compost Blankets

a. Compost

The compost type and the application depth will be decided by the KCPM.

b. Placement

(1) Compost shall be uniformly applied.

(2) Contractor shall apply compost using a pneumatic (blower) or equivalent.

(3) Project compost directly at soil surface, thereby preventing water from moving between the soil-compost interface. Apply compost layer approximately three feet beyond the top of any slope, or overlap it into existing vegetation, or as specified by the KCPM.

5.6 Reporting Requirements

Contractor shall provide electronic quarterly usage reports and detailed product order reports to King County's Procurement & Payables Section – Sustainable Purchasing Program Manager or designee. The reports shall be provided at below-designated intervals, as well as by request, and shall include all purchases made as a result of this contract. The reports shall be submitted in Microsoft Excel format.

The County reserves the right to make changes to the report and to request additional information if deemed necessary. The County reserves the right to use the output of these reports in communication to internal King County agencies and employees, and to the public.

A. Quarterly Usage Report

1. The purpose of this report will be to provide a summary and the raw data of all purchases made under this contract. The report shall be formatted to include, and sort by, all key categories listed below.

2. These reports will be issued within two weeks of the close of the previous quarter or of the request date.

3. Key categories shall be defined as:

a. Customer name

b. Customer department

c. Compost or service type

d. Quantity of compost type purchased or applied in cubic yards

e. Delivery type

f. Material Cost

g. Sales Tax

h. Delivery costs (if applicable)

i. Total order cost

B. Annual Feedstock Source Report for Material Suppliers Only

1. The purpose of this report will be to provide an annual summary of the origin of feedstock sources for the compost purchased under this contract. This report is to ensure compliance with the specification that a minimum of 51 percent by volume of the feedstock must be sourced from the King County organics system for General and Bioretention Composts or that it contains biosolids from biosolids processors or distributors within 100 miles of King County, WA for Biosolids Compost. The report shall be broken down by compost type, and formatted to include, and sort by, all key categories listed below.

2. These reports will be issued by January 15 of each year of the contract for the period of January 1 to December 31 of the previous year.

3. Key categories shall be defined as:

a. Compost type

b. Annual quantity of compost type purchased in cubic yards

c. For each feedstock type:

(1) Jurisdiction or region from which the compost was collected

(2) Hauler or supplier company name

(3) Average percentage of total cubic yards of feedstock

5.7 Delivery/Will Call Requirements

A. Will Call Orders

1. Contractor shall provide will call services for orders when requested by the KCPM or designee. Will Call orders are expected to comprise approximately 20 percent of the orders during the contract term.

2. Unless otherwise arranged at time of order, requests for will call orders shall be processed and ready for pick-up within a two-hour window from the time an order is received.

3. The Contractor shall have orders available at the designated 'will call' location at the facility or branch as requested on the order and/or as directed by the KCPM or designee.

4. The Contractor shall notify the KCPM or designee as stated on the order when the product is ready for pick up and at the designated location.

B. Delivery Services

Delivery is required as soon as possible and no later five days after placement of an order, unless otherwise agreed upon by the KCPM or designee.

1. Delivery Hours to King County

a. Unless special delivery requirements have been pre-arranged or other delivery times have been established, deliveries shall be made during King County's normal business hours which typically are Monday through Friday from 8 a.m. to 5 p.m. Pacific Time.

b. The Contractor is responsible for coordinating the delivery schedule and delivery location details with the KCPM or designee. The County reserves the right to refuse shipment of deliveries made after normal working hours.

2. Delivery service shall be provided by the Contractor including the required equipment to offload the material. There shall be no minimum quantity or truck load requirements under the Contract.

3. When requested, delivery service shall be made available at a minimum of two (2) times a day - morning and afternoon. The approximate delivery time shall be between the hours of 7:00 a.m. and 12:00 p.m. and 12:01 p.m. and 4:00 p.m. PT unless otherwise agreed upon by the KCPM or designee.

5.8 Quality Assurance

Upon request by the KCPM, the contractor shall provide samples of product for evaluation purposes at no charge to the County. Samples will be a two-pound sample in a clear zip-lock plastic bag that is clearly labeled with the Compost type, the source and the date it was manufactured; and submitted within 14-calendar days prior to its delivery or pick up from the KCPM.

The KCPM reserves the right to take and analyze samples of materials delivered by or picked up from the contractor for conformity to the Contract Documents at any time.

Rejected samples of materials shall be immediately removed from the site at the Contractor's expense. Cost of testing of materials not complying with the Contract Documents shall be paid by contractor.

All defects, indirect and consequential costs of correcting, removing or replacing any or all material deemed to not meet specifications detailed in Section 5 will be charged against the Contractor.

SECTION 6 Bid Response

6.1 Rules of Price Evaluation

Bids meeting all requirements of this ITB will be evaluated on price. Bids which state price will be established at the time of shipment will not be accepted.

6.2 Delivery

Delivery is required as soon as possible and not later than five days after placement of an order. Bid prices shall include delivery, FOB Destination – Prepay and Allow to locations throughout King County. Refer also to Section 5.7 - Delivery/Will Call Requirements.

6.3 Bidder's Contact Information

Primary Location:

A. Physical Address: _____

Mailing Address: _____

Name of Contact Person: _____

Email: _____

Telephone No.: _____

Fax No.: _____

UBI No.: _____

Washington State Contractor's License No. : _____

State hours and days of operation:

Hours: _____ a.m. to _____ p.m. Days: _____ to _____

B. State your firm's preference for receiving purchase orders. (Check only one and enter the information if different from "A" above).

☐E-mail:_____ ☐Fax:_____

6.4 Remit Address (where payment will be mailed):

_____

_____

_____

_____

6.5 Retail and Stocking/Warehouse Facility Locations (if applicable)

The Contractor shall attach a separate list of the location(s) for all facilities, including the address, contact name(s), email(s), telephone number(s), and fax number(s), for each facility.

6.6 Prompt Pay Discount

Prompt payment discounts offered by Contractors shall be used to calculate the low bid provided the discount offered allows a minimum of twenty (20) days for payment. The number

of days is calculated from the date of acceptance of goods or services or from the date a complete invoice is date stamped as received by King County, whichever event occurs last, and the check/warrant date. The County will take advantage of any prompt payment discount terms bid. Discount periods shall be extended if:

- The date printed on the invoice is more than three (3) days earlier than the invoice receipt date;
- The delay is caused awaiting a credit memo, invoice correction, adjustment or reissue;
- An invoice is received prior to receiving goods ordered.

Prompt pay discount offered _____ % - _____ Days, Net _____

6.7 Purchasing Card (P-Card) Acceptance

Contractors are requested to have the capability of accepting King County's authorized VISA P-Card as a method of payment. Price change(s) or additional fee(s) may not be assessed when accepting the P-Card as a form of payment. The Contractor may receive payment from King County by a P-Card in the same manner as other VISA purchases. **Prompt pay discounts shall apply to payments made by P-Cards.**

VISA acceptance is preferred, but is not the exclusive method of payment.

Accept VISA cards: Yes _____No _____

Additional purchasing (charge) cards accepted:

☐ American Express

☐ Discover

☐ MasterCard

☐ Other: _____

( ) _____

( ) _____

( ) _____

6.8 Bid Submittal Requirements

Bidder shall provide submittal items described in Section 5.4 Material Specifications for each item bid.

A. Compost

Submit items listed in 5.4 Material Specifications, A, Item 8.

B. Bioretention Compost

Submit items listed in 5.4 Material Specifications, B, Item 8.

C. Biosolid Compost

Submit items listed in 5.4 Material Specifications, C, Item 8.

6.9 Testing Requirements

A. Upon 'Notice of Intent to Award', the low responsive and responsible Bidder(s) shall test compost products at the Bidder's expense.

B. Samples shall be collected using the Seal of Testing Assurance (STA) sample collection protocol, available from the U.S. Composting Council, Phone: 631-737-4931, www.compostingcouncil.org

C. Properties analyzed in the tested compost include the following: pH, soluble salts, nutrient content (total N, P2O5, K2O, Ca, Mg), moisture content, organic matter content, bioassay (maturity), stability (respirometry), particle size (report only), pathogen (Fecal Coliform or Salmonella), trace metals (Part 503 regulated metals).

D. The sample shall be tested by an independent STA Program certified laboratory. A copy of the approved independent STA Program laboratory test report shall be submitted to King County prior to award.

E. If Bidder has tested within the twelve-month period prior to Notice of Intent to Award, Bidder may submit the prior test result.

F. Bidders shall submit test results within two weeks' notice. Failure to submit the test result within this timeframe may result in rejection of the bid.

6.10 Like Product – Catalog Items

Provide the name and date of the Catalog or Price List to be used for like items. Anticipated like items include Compost Socks and other soil amendments, such as Potting Soil, Topsoil, Mulch, and Bark.

Refer to Section 5.4 Item D.

Name	Date

6.11 Pricing

Refer to Attachment A – Pricing Schedules.

There are five schedules, which apply to the five regions identified in Exhibits 2-6. Enter a Unit Price for each product offered and/or for Application Services for regions you are bidding.

Enter a percent discount for Like Product – Catalog Items. Enter a '0' if you do not offer a discount.

In the event of a discrepancy between the unit price and the extended price, the unit price will prevail.