Cover Crop Issues and Plant-Back Restrictions
SFIREG Environmental Quality Issues Working Committee

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Background

The Maine Board of Pesticides Control (BPC) was contacted in April 2015 by a private-sector certified crop advisor seeking clarification on the use of herbicides on cover crops planted for conservation purposes only, not harvested as food, feed, or forage. His review of four herbicide labels found that rotation restrictions on the pesticide label must be adhered to if a cover crop was subsequently harvested for food or forage for either livestock or humans. However, the labels did not address cover crops planted only for conservation purposes and terminated prior to planting the subsequent crop. He found several mid-western university websites stated that cover crops for conservation purposes could be planted after use of any herbicide if the potential for damage to cover crop species from herbicide residuals in the soils was considered to be minimal.

An April 13, 2015 response to a BPC SLITS (State Label Issues Tracking System) inquiry stated that "Replant/plant-back restrictions apply even if the cover crop will not be harvest [sic] as food, feed or forage. The label must be amended to include appropriate application and management directions in cases where cover crops are being use for conservation purposes and will not be use [sic] for food or forage."

The BPC reviewed 32 herbicide labels in 2015 (Appendix A) and identified several labeling issues related to cover crops and plant-back restrictions (BPC, 2016). Thirty-one of the labels provided some rotational crop information; 12 contained some specific mention of cover crops, but only one species in the cover crop mixes was addressed; some addressed food and/or feed issues; and some addressed stunting of growth. None of the labels addressed the potential for multiple uses of cover crops such as green manure, soil erosion, feed or fodder (grazing and harvesting), or food for human consumption.

The issue was brought before the Environmental Quality Issues Working Committee (EQI WC) in 2015 for consideration. The BPC met with the University of Maine Cooperative Extension, United States Department of Agriculture - Natural Resource Conservation Service (USDA-NRCS), and a private-sector crop advisor on August 29, 2015 to discuss labeling issues for herbicides and cover crop termination. The USDA-NRCS termination guidances were found to be inconsistent in terms of language and omitted rotational intervals and grazing restrictions listed on herbicide labels.

Cover crops are an important agronomic practice for preventing topsoil erosion from wind and runoff water (a key goal of many United States Department of Agriculture (USDA) programs), provide weed control, increase soil fertility as a green manure, improve soil tilth, increase soil water, and improve overall soil health and function. The 2016-2017 Sustainable Agriculture Research and Education (SARE) Cover Crop Survey reported 88% of 2102 farmers used cover crops in 2016 (CTIC, 2017). Cover crops may consist of a single species such cereal rye, which was the most commonly planted species in 2016, or a mix of species such as grasses and legumes or a legume, small grain, and forage radish.

Increasingly, cover crops are being planted when the herbicides used in the commodity (cash) crop are still active. Carry-over residues from herbicides used in the previous cash crop, e.g., corn or soybeans can potentially damage the cover crop or specific species within cover crop mixes. Unfortunately, the herbicide label may not list all the species present in the cover crop mixture, potentially reducing the effectiveness of the cover crop. Additionally, livestock and humans may be exposed to elevated levels of herbicide residues if the cover crop is used for feed or food. Either scenario may also result in a label violation.

The EQI WC undertook a survey in the fall of 2018 to assess the degree to which cover crops and plant-back restrictions impacted growers (Appendix B; EQI WC, 2018;). Personnel from state departments of agriculture, state USDA-NRCS offices, and state cooperative extensions, representing 31 states, responded to five questions. Key findings are as follows.

- The variety of cropping systems used across the country is quite broad.
- Twenty-five states reported increasing or stable use of cover crops.
- Seventeen states reported receipt of inquiries related to the use of herbicides on the primary commodity and rotation restrictions for plants used as cover crops.
- Only four states (Indiana, Maine, Vermont, Wyoming) reported complaints of cover crop damage, e.g. cover crop failure or poor establishment of interseeded cover crops, or residue issues, e.g. adulterated crops and grazing restrictions.
- Three states (Arizona, Georgia, Indiana) reported receipt of concerns or inquiries related to rotational intervals which included: label clarity, interval between termination of the cover crop and planting of the cash crop, grazing issues, negative impacts from cover crops, crop insurance limitations, and unenforceable or contradictory label language.

It is important to note that the number of concerns, inquiries, and complaints could be greater than reported because these are not tracked in some states and may have been directed to individuals or agencies other than the respondents.

Issues Identification

Growers rely upon pesticide registrants, state and federal agencies, private crop advisers, and others for assistance in interpreting complex and sometimes contradictory label language, navigating federal and state pesticide laws, and developing crop management plans that meet another host of conservation and insurance requirements. As a result, conflicting information and misinformation may be disseminated, potentially resulting in crop failure or residue contamination. Although the initial question was if cover crops used only for conservation purposes were subject to plant-back restrictions, the problem seems to be broader. The primary issues identified by the EQI WC are as follows.

- Potential Crop Damage: Uptake of active herbicide residues in the soil by the succeeding crop(s) may potentially result in crop damage if rotational intervals are not followed.
    - Cover crop failure and poor establishment of interseeded crops was reported in the 2018 EQI WC Survey. Although this may in part be due to growers simply failing to follow the label, it does not explain all the causes.

- Potential crop damage was identified as a risk in 25 of the 32 herbicide labels reviewed by the BPC.

- Plant species used in cover crop mixtures may not be specifically listed on the label. Not only might herbicide residues in the soil result in failure of the cover crop, a potential label violation exists. However, although unlisted species are not exempt from plant-back, harvesting, or grazing restrictions, most plant back restrictions default to the maximum interval of 12 months or longer if the plant is not on the label. All growers may not be aware of this default restriction.

- Potential Residues and Tolerance Exceedances in Food, Feed, or Forage: Failure to follow rotational intervals may result in residues in plants that may be eaten by humans and other animals. Of concern is the toxic effects in humans or animals consuming those products. Some corn herbicides have an 18-month plant back restriction. If applied in the spring or early summer, grazing of stalks after the harvest is prohibited if the animal is to be used for food.

- Poor Pesticide Label Language and Disconnect with USDA-NRCS Standards and Guidances: Lack of coordination among federal agencies in developing standard language to be used on pesticide labels and USDA-NRCS documents contributes to misinterpretation of these documents and potential failure to follow plant-back and forage/grazing restrictions.

    - Issues with unenforceable, contradictory, or incomplete pesticide label language has been raised by growers and states. The 2018 EQI WC Survey highlighted concerns with cover crop rotational intervals, crop termination intervals, label clarity, and unenforceable or contradictory label language.

    - The 2015 BPC label review highlighted problematic label language such as: food/feed and nonfood uses on the same label, language indicating cover crops may be grazed (clomazone), conflicting restriction language versus guidelines for fruit and vegetable uses (rimsulfuron), and confusing language such "nonfood perennial bioenergy crops" (Cadence NXT).

    - The NRCS 2014 Conservation Cover Crop Termination Guidelines uses the terms "herbicide" and "chemical", but does not mention rotational intervals or grazing restrictions from the herbicide labels. Item 8 under "additional Cover Crop Termination Considerations", page 3, Cover Crop Grazing or Forage Harvest reads, "Cover crops may be grazed or harvested as hay or silage, unless prohibited by RMA crop insurance policy provisions. Cover crops cannot be harvested for grain or seed."

    - The USDA-NRCS fact sheets for using cover crops commonly uses the term "chemical termination", but rarely connects chemical termination to herbicides.

Proposed Resolutions

EQI WC proposes the following options as resolutions to the identified issues.

- Determine whether cover crops can be used for food or feed for humans and other animals:
    - Allow cover crops as food or feed: This option would provide growers a potential economically sound option for growing cover crops. Residue studies to support tolerances for food and feed and metabolism studies to determine residues in meat, eggs, and milk if a cover crop is used for feed would be required. The risk assessment and registration review processes would require updating to include these studies. Additional label language regarding grazing restrictions may be required.
    - Define cover crops as nonfood: Include a statement on the label that the use of cover crops for food, feed, or forage would is prohibited. This this would clarify that cover crops are to be used for conservation purposes only (soil improvement, erosion control, weed control, etc.). Unfortunately, growers would be prevented from using crops to supplement feed and forage.
- Improve Pesticide Label Language:
    - Standardize pesticide label language among products and crops. Clarify rotational intervals and plant-back restrictions when the herbicide is used on rotational crops including cover crops which are rotational crops. Label language should differentiate between plant-back restrictions for rotational crops (second commercial crop) and cover crops used for soil improvement including green manure, erosion control, and weed control.
    - Differentiate between guidelines (unenforceable language) for rotational intervals for cover crops by plant type sensitive to carryover and restrictions (mandatory language) for rotated food/feed crops (illegal residues). This would clarify for growers when an herbicide would stunt the growth of cover crop plants (e.g. clopyralid and alfalfa) and inform growers if there is a potential tolerance violation if their cover crops (or meat from livestock grazing on these commodities) were to enter interstate commerce (regulated by the FDA).
    - Update PR Notice 2000-5 regarding mandatory and advisory label language and add a section to the Label Review Manual to include cover crop language. These are avenues by which registrants would be informed that labels regarding cover crops and plant-back restrictions need to be revised. They also serve as reminders to ensure labeling clearly separates mandatory and advisory language.
- Improve Coordination Among Federal Agencies
    - Involve USDA-NRCS specialists in making specific cover crop recommendations for soil improvement including green manure, erosion control and weed control. Revise NRCS guidance and fact sheets to clearly address plant-back restrictions, ensure terminology used (chemical versus herbicide) is consistent across documents, and address herbicide

label issues when chemical termination involves herbicides that may require these restrictions.

- Support Residue Studies and Bioassays:

    - Encourage growers to conduct bioassays which indicate if herbicide residues are present in the soil and at concentrations high enough to adversely impact the crop.

    - Encourage collaboration among growers, commodity groups, extension, NRCS, and industry to conduct studies to identify carry-over residues and determine concentrations at which residues of specific herbicides would have no impact on the cover crop. These studies would refine and clarify plant-back and forage/harvest restrictions.

- Organize cropping systems within growing regions. This would facilitate teams of state, federal, extension, and industry groups to work on pesticide labels, NRCS 340, and crop rotation issues.

Summary

Cover crops and rotational plant-back restrictions continue to be problematic for some growers. Failure to follow these restrictions may result in damage to succeeding crops or human and livestock exposure to residues if cover crops are used for feed, food, or forage. Plant-back restrictions on pesticide labels are intended to reduce the potential for these incidences; however, label language that is unclear or contradictory and NRCS guidance that does not conform to the pesticide label ensures continued confusion for growers. Suggested resolutions to determine if cover crops are feed and food; improve pesticide label language to ensure plant-back restrictions and guidance are clearly differentiated; and promote collaboration among federal agencies, extension, and commodity groups to provide consistency in messaging may reduce crop damage, residues exposure, and pesticide label violations.

References

EQI WC. 2018. Cover Crop and Plant-Black Survey Excel workbook. (available on request)

Maine Board of Pesticides Control. 2016. Master plant-product Excel workbook. (available on request).

CTIC. 2017. Report of the 2016-17 National Cover Crop Survey. Joint publication of the Conservation Technology Information Center, the North Central Region Sustainable Agriculture Research and Education Program, and the American Seed Trade Association. West Lafayette, IN. https://www.sare.org/Learning-Center/Topic-Rooms/Cover-Crops/Cover-Crop-Surveys.

USDA. 2014. Cover Crop Termination Guidelines. ver 3. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/climatechange/?cid=stelprdb1077238

USDA. 2014. NRCS Conservation Practice Standard. Code 340.

Appendix A

Issue Paper on Cover Crops; Pros and Cons 11-29-30

Growing cover crops to protect soils from erosion is a key goal of many USDA programs. Sometime cover crops are single species (winter rye) or other times several species cover crop mixes are used. Residues from herbicides used in the previous cash crop (corn, soybean etc.) can potentially damage the cover crop or specific species in cover crop mixes. Increasingly, cover crops are being planted (applied by high-boy seeder, flown on, or planted at canopy closure) when the herbicide used in the commodity crop is still active which could damage the cover crop effectiveness or, if the cover crops are used for feed, herbicide residues could end up in milk or food produced by those animals. The major issues are:

- Potential crop damage, 25 of 32 the herbicide labels reviewed mentioned crop injury. (see appendix A for the list of labels reviewed [(1)])
    - Cover crops which do not thrive result in poor soil benefits
    - There is a question of liability on the part of the registrant
- If the rotational intervals are not followed, there is a possibility of: at best, illegal residues in the food and feed-stuffs; and worst-case, toxic effects in humans or animals consuming those products, 10 of the 32 herbicide labels reviewed mentioned illegal residues (see appendix A for the list of labels reviewed [(1)])

The goals of resolution of these issues are:

- Standardization and clarification of pesticides label language regarding rotational intervals and plant-back restrictions on herbicide product labels when the herbicide is used on the primary cash commodity and the second crops are either rotational or cover crops
- Encouragement of the use of cover crops in agriculture used for soil improvement including green manure, erosion control and weed control.

The Maine Board of Pesticides Control undertook a review of prototype labels for 32 herbicides in 2015 (see appendix A for the list of labels reviewed [(1)]). All but one of the herbicide labels reviewed had some rotational crop information and 12 of the 32 contained some specific mention of cover crops. Most of these statements did not address more than one type of plant found in cover crop mixes. Some addressed food and/or feed issues and other addressed stunting of growth. None addressed the potential for multiple uses of the cover crops such as green manure, soil erosion, feed or fodder (grazing and harvesting) or food (harvesting the cover crop as a human food) [(1)].

The pesticide labeling and registrations issues identified in this review and the pros and cons of addressing these issues are found below:

- Differentiate between plant-back restrictions for rotational crops (second commercial crop) and cover crops (used for soil improvement including green manure, erosion control and weed control)

- Pros: this would avoid confusion regarding commodities such as corn (primary cash crop) rotated with a legume (second cash crop)
- Cons: The length of already lengthy labels would increase

- Allow cover crops as food or feed
  - Pros: this would allow growers from using cover crops as food or feed sources if this was an economically sound choice
  - Cons: registrants would have to perform the residue studies to support tolerances for food and feed, in addition to metabolism studies to determine residues in meat, eggs, and milk if cover crop is used for feed. May require additional label language regarding grazing restrictions.
- Define cover crops as nonfood, require this description on labels
  - Pros: this would clarify that cover crops are meant for soil improvement including green manure, erosion control and weed control
  - Cons: this would prevent growers from using cover crops as food or feed sources if this was an economically sound choice
- Differentiate between guidelines for rotational intervals for cover crops (by plant type sensitive to carryover) and restrictions for rotated food/feed crops (illegal residues)
  - Pros: this would clarify to growers when an herbicide would stunt the growth of cover crop plants (e. g. clopyralid and alfalfa), and let growers know there is a potential tolerance violation if their cover crops (or meat from livestock grazing on these commodities) were to enter interstate commerce (FDA related)
  - Cons???
- Update PR notice 2000-5 [(2)] regarding mandatory and advisory label language and add a section to the Label Review Manual [(3)] on cover crop language
  - Pros: this would be one way to educate the registrants that the labels regarding cover crops and plant-back restrictions need to be revised
- Encourage bioassays as a means of assuring growers that their cover crops will grow
- Standardize regions of the country; listing states with or without subdivisions

In addition to the herbicide label review, the 2014 USDA Cover Crop Termination Guideline (attached) and a dozen cover crop fact sheets (available on request) from USDA NRCS were also reviewed. At an August 29th meeting with University of Maine Cooperative Extension, and USDA NRCS personnel, and a private-sector certified crop advisor, the following issues were identified:

- In the USDA NRCS guidelines for termination, the term “herbicide” is used once and the word “chemical” is used once with no mention of rotational intervals or grazing restrictions from the herbicide labels.

- Item number 8 under the "Additional Cover Crop Termination Considerations [(4)]": page 3 reads:
    - "Cover Crop Grazing or Forage Harvest – Cover crops may be grazed or harvested as hay or silage, unless prohibited by RMA crop insurance policy provisions. Cover crops cannot be harvested for grain or seed NRCS practice standard 340 [(5)]"
- In the USDA NRCS fact sheets for using cover crops the term "chemical termination" is commonly used and consideration that the chemicals used in chemical termination are herbicides is rarely seen.

References cited

1) Maine Board of Pesticides Control; master plant-product wkbk 8-18-16.xlxs, available on request
2) EPA 2000e, PRN 2000-5: Guidance for Mandatory and Advisory Labeling Statements
3) EPA 2014j, Label Review Manual
4) USDA 2014 Cover Crop Termination Guideline

USDA 2015c NRCS Production Standard 340

Appendix A. List of Herbicides Products Reviewed by the State of Maine for Cover Crop, Rotational Crop and Grazing Label Statements, Labels were the most recent EPA approved Federal Labels		
Cited as	Active Ingredient	Citation
Loveland Products 2015	2,4-D DMA	Loveland Products 2015, Savage, 2,4-D DMA Water Soluble Crystals 95% ai; 78.9% ae, EPA# 34704-606, EPA Label
Loveland Products 2013b	Acetochlor	Loveland Products 2013b, Cadence NXT Herbicide Acetochlor EC 75.9% EC (7 lbs/gal) EPA# 34704-1083)
Makhteshim Agan of North America 2013	Atrazine	Makhteshim Agan of North America, Inc, 2013, Atrazine 90 DF, Atrazine WSP 90% atrazine and related compounds, EPA# 66222-37, EPA Label
BASF 2005	Basagran	BASF 2005, Basagran, Sodium Bentazon 44% EC (4 lbs ae/gal), EPA# 7969-45, EPA Label
FMC, 2014	Clomazone	FMC, 2014, Command 3ME, Clomazone 31.1% ME (3 lbs/gal), EPA# 279-3158, EPA Label
Dow AgroSciences 2014a	Clopyralid	Dow AgroSciences 2014a, Stinger, Clopyralid 40.9% EC (3 lbs ae/gal), EPA# 62719-73, EPA Label
BASF 2014a	Dicamba Sodium salt	BASF 2014a, SAN 845H, Dicamba Sodium salt WDG 70% ae, EPA# 7969-140, EPA Label
Loveland Products 2013a	Dimethenamide-P	Loveland Products 2013a, Slider, Dimethenamide-P 63.9% EC (6 lbs/gal), EPA# 7969-156, EPA Label
Loveland Products 2014	Ethalfluralin	Loveland Products 2014, Curbit EC, Ethalfluralin 35.3% EC (3 lbs/gal), EPA# 34704-610, EPA Label
Dow AgroSciences 2010	Flumetsulam	Dow AgroSciences 2010, Python WDG, Flumetsulam WDG in WSP 80% ai, EPA# 62719-277, EPA Label
Dow AgroSciences 2014b	Fluroxypyr	Dow AgroSciences 2014b, Starane Ultra, Fluroxypyr 45.52% ai EC, 31.59% ae, (2.8 lbs ae/gal), EPA# 62719-577, EPA Label

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Cited as	Active Ingredient	Citation
Syngenta 2015a	Fomesafen	Syngenta, 2015a, Reflex Herbicide, Fomesafen 22.8% SC (2 lbs ae//gal), EPA# 100-993, EPA Label
Bayer CropSciences 2013a	Glufosinate ammonium	Bayer CropSciences 2013a, Liberty 280 SC, Glufosinate ammonium SC 24.5% (2.34 lbs ae/gal), EPA# 264-829, EPA Label
Dow AgroSciences 2011	Glyphosate IPA	Dow AgroSciences 2011, Glypro, Glyphosate IPA EC 53.8%, (4 lbs/gal), EPA# 62719-324, EPA Label
Gowan 2014	Halosulfuruon-methyl	Gowan, 2014, Sandea Herbicide, Halosulfuruon-methyl G 75% ai, EPA# 81880-18, EPA Label
Bayer CropSciences 2009	Iodosulfuron-methyl	Bayer CropSciences 2009, Iodosulfuron-methyl 10 WDG, Iodosulfuron-methyl 10% WDG, EPA# 264-856, EPA Label
Tessenderio Kerley Inc.c/o Pyxis Regulatory Consulting 2012	Linuron	Tessenderio Kerley Inc.c/o Pyxis Regulatory Consulting, Inc, 2012, Linex 4L, Linuron FC 40.6% ai (4 lbs ai/gal), EPA# 61842-21, EPA Label
Syngenta 2015b	Mesotrione	Syngenta, 2015b, Callisto, Mesotrione EC 40% (4 lbs/gal), EPA# 100-1131, EPA Label
DuPont 2015	Metolachlor-s	DuPont 2015, Chinch, Metolachlor-s 82.4% EC (7.64 lbs ai/gal), EPA# 352-625, EPA Label
United Phosphorus 2014a	Metribuzin	United Phosphorus, 2014a, Metri 4F, Metribuzin 41% EC (4 lbs/gal), EPA# 70506-68, EPA Label
United Phosphorus 2013	Napropamide	United Phosphorus, 2013, Dervrinol 2 XT, Napropamide 22% EC (2 lbs/gal), EPA# 70506-301, EPA Label
DuPont 2009	Nicosulfuron-methyl	DuPont 2009, Accent Q, Nicosulfuron-methyl WDG 54.5%, EPA# 352-773, EPA Label

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Cited as	Active Ingredient	Citation
United Phosphorus 2014b	Pendimethalin	United Phosphorus, 2014b, Pendi Hydrocap, Pendimethalin 38.7% EC (3.8 lbs/gal), EPA# 70506-230, EPA Label
BASF 2014b	Pyroxasulfone	BASF 2014b, Zidua, Pyroxasulfone WDG 85%, EPA# 7969-338, EPA Label
DuPont 2010	Rimsulfuron (corn)	DuPont 2010, Matrix SG, Rimsulfuron Water Soluble Granular 25%, EPA# 352-768, EPA Label
DuPont 2011	Rimsulfuron (potatoes and tomatoes)	DuPont 2011, Resolve SG, Rimsulfuron Water Soluble Granular 25%, EPA# 352-748, EPA Label
BASF 2014c	Saflufenacil	BASF 2014c, Sharpen Herbicide Powered by Kixor, Saflufenacil 29.74% (2.85 lbs/gal), EPA# 7969-278, EPA Label
Bayer CropSciences 2014	Tembotrione	Bayer CropSciences 2014, Laudis Herbicide, Tembotrione34.5 EC (3.5 lbs/gal), EPA# 264-860, EPA Label
Bayer CropSciences 2013b	Thiencarbazone-methyl	Bayer CropSciences 2013b, Autumn Super 51 WDG, Thiencarbazone-methyl 45% and Iodosulfuron-methyl Sodium 6% WDG, EPA# 264-1134, EPA Label
Rotam Agrichemical 2012	Thifensulfuron-methyl	Rotam Agrichemical, 2012, Volta, Thifensulfuron-methyl 75% WDG;, EPA# 83100-9, EPA Label
AMVAC 2014	Topramezone	AMVAC 2014, Topramezone SC, Topramezone 29.7% SC (2.8 lbs/gal), EPA# 5481-524, EPA Label
Dinec Agrichemical 2010	Trifluralin	Dinec Agrichemical, 2010, Treflan 4D, Trifluralin 43% EC (4 lbs/gal), EPA# 68156-4, EPA Label

Appendix B: 2018 Environmental Quality Issues Working Committee Cover Crop & Plant-Back Survey Results Summary Tables

Question 1. Cropping Systems Used	
Cropping systems	**States Reporting**
Uncommon/nonexistent	4
Vegetables	8
Corn	8
Corn silage	5
Soybeans	6
Wheat	4
Tobacco	2
Specialty crops	2
Corn/soybean rotation	2
Corn/soybean/wheat rotation	2
Seed Corn	1
Forage/grazing	2
Cereal rye for seed	1
Small grains	2
Barley	2
Oats	2
Cotton	4
Sorghum	1
Corn/hay	2
Wheat/fallow	1
Wheat/corn	1
Wheat/corn/fallow	1
Grain/sugar beets	1
Field failure	1
Annual rye grass	3
Radishes	1
Sunflower	1
Melon	1
Organic farming	2
Rice	1
Fallow	1
Plant cane (sugar cane)	1
Vineyards	1
Annual/row crops	1
Spring/winter wheat	1
Dryland small grain/fallow	1
Irrigaton cropping systems	1
Sugarbeets	1
Tilled & notill	1
Corn/small grains/corn	1

Question 2. Extent of cover crop use	
Use	**States Reporting**
Uncommon/nonexistent	3
Stable	10
Increasing	15
Decreasing	2
Not Tracked	1

Question 3. Inquiries Received	
	States Reporting
Yes	11
No	17
Not Tracked/Unknown	3

Question 4. Compliants of damage or residue issues	
	States Reporting
Yes	4
No	24
No response/nonexistent	3

Question 5. Concerns/inquiries related to rotational interval	
	States Reporting
Yes	3
No	23
No response/nonexistent	5