

Oregon Department of Transportation Herbicide Reduction Strategy

Final Report

Abstract

In 2010, ODOT committed to a 25 percent reduction in herbicide use as part of a comprehensive review of its integrated vegetation management program. After five years, ODOT exceeded the reduction goal, achieving an average 44 percent reduction. The reduction goal was predominantly met by switching to a product with less active ingredient. Lesser contributing factors include: upgrading application equipment; reducing shoulder widths; and using the proper calibration. ODOT is confident in the ability to remain at a level that is 25 percent less than the 2010 baseline numbers and is committed to continual review of herbicide use as part of a complete and responsibly-integrated program.

Background

Since 1991, ODOT has formally implemented an Integrated Pest Management program for controlling vegetation along state highways. Because the 'pest' is vegetation, ODOT's program is called Integrated Vegetation Management or IVM. ODOT is responsible for 19,066 highway lane miles and more than 50,000 acres of right-of-way. ODOT manages these assets in a safe and sustainable manner by using a combination of mechanical, chemical, cultural and biological methods to control noxious and non-noxious vegetation along highways.

ODOT manages vegetation to prevent its encroachment on the highway; maintain adequate site distance around curves; increase sign visibility; minimize potential for falling trees; reduce animal vehicle collision rates; reduce fire fuels; and allow proper drainage off the highway which, in addition to improving safety, also preserves pavement longevity. ODOT also manages vegetation in a manner that promotes visually-pleasing corridors.

Mechanical methods. Mechanical methods include activities such as mowing, brushing, tree removal and shoulder maintenance (e.g., grading). Mowing efficiency is greatly reduced where obstacles occur such as signs, trees, debris and topographic restrictions (such as steep slopes, lack of uniform right of way, and narrow shoulders). On the other hand, mowing is efficient in open areas because large mowers can cover large areas in a single pass (e.g., multiple deck mowers can mow widths up to 20 feet). Other mechanical methods are inefficient in situations such as steep slopes (e.g., greater than 1:1) or small areas (for example under bridges, behind guardrail, along narrow vegetation strips), where string trimmers or small equipment is required. Mowing is often performed away from the edge of pavement and beyond the shoulder to reduce the risk of throwing rocks or debris into the travel lane.

Chemical methods. Chemical controls are effective, and remain in effect over a longer time, compared to mechanical methods. Worker safety is improved by reducing exposure time. A well-trained spray crew using proper protective gear and best management techniques in a moving lane closure is considerably safer than a group of 12-15 maintenance staff working all day near the edge of the road (using string

trimmers, for example), and even safer than the operator on the slow-moving mower tractors in the median or on the shoulder.

Chemical methods are critical for maintaining vegetation in areas that cannot be efficiently or effectively controlled mechanically (e.g., steep slopes can't be mowed, shoulders contain rocks that when mowed can be thrown causing safety risks) and in areas within eight feet off the pavement in order to protect worker and traveler safety. Additionally, herbicide used on shoulders prevents plant maturation, keeping root systems small, which minimizes pavement damage and promotes proper drainage.

Cultural methods. Cultural control methods emphasize preventative measures to control the spread and establishment of noxious weeds. Examples of cultural control methods include ensuring project work doesn't inadvertently create steep, grassy slopes that can't be mowed; using weed-free erosion control materials; and choosing appropriate plants for the area.

Biological methods. Biological control methods are limited to noxious weed control. Bio-control agents such as insects, mites and pathogens are released in coordination with the Oregon Department of Agriculture and target host specific noxious weeds.

In 2004, Washington Toxics Coalition vs. EPA imposed spray buffers for diuron for many of the streams in western Oregon that were considered habitat for listed salmon and steelhead species. This prompted districts in western Oregon to switch from diuron to herbicide formulations with less active ingredient. By 2009, due to the lighter formulations, ODOT reduced the amount of herbicides used west of the Cascades by 58 percent compared to 2004.

At the request of the director, ODOT implemented a statewide reduction in 2011 to further reduce herbicides by 25 percent over five years, compared to 2010 baseline numbers. This report details the request and the results of the five-year reduction.

Herbicide Reduction Commitment

In May 2010, the Oregon Transportation Commission requested a comprehensive review of the ODOT Integrated Vegetation Management (IVM) program. As part of the review, Director Matthew Garrett committed to the following:

- By the end of 2015, ODOT will reduce by 25 percent the amount of herbicides used statewide to treat non-noxious vegetation along Oregon highways, based on 2010 amounts.
- ODOT will develop and implement strategies that are economically and practically feasible and minimize impacts on level of service in vegetation management or other maintenance responsibilities.
- ODOT will track implementation progress to ensure the statewide target is met in 2015 (to be reported in 2016), and adjust as necessary.

Implementation

An Herbicide Reduction Taskforce convened in summer 2010 with representatives from the ODOT Office of Maintenance, a minimum of two representatives from each ODOT region, a Maintenance Leadership Team member, the ODOT Sustainability coordinator and the ODOT Roadside Development coordinator. The taskforce was charged to review the ODOT IVM program; make recommended changes to

implement a statewide reduction in an equitable manner across districts; track reduction efforts; and adjust the development path as necessary to ensure the 25 percent reduction target is met.

The team determined that the herbicide reduction would be measured by the pounds of active ingredients applied. "Pounds of active ingredient" is found on the products' EPA labels and is expressed as either a percentage for dry materials or by pounds per gallon for liquids. The statewide total could be tallied from daily spray reports. ODOT applicators are required by the Oregon Department of Agriculture to keep spray records to document daily spray activities. Any decreases such as reducing acres, using more accurate equipment calibration, and switching to lighter herbicide formulations would be reflected in pounds of active ingredient applied. Washington State Department of Transportation and other DOTs have tracked herbicide use in a similar manner.

While the herbicide reduction was targeted at the statewide level, each ODOT maintenance district was responsible for implementing its own reduction plan.

Here are a few examples of strategies aimed at achieving the reduction:

- *Use herbicides with less active ingredient:* Significant reduction could be met by switching from the herbicide diuron to herbicide formulations with less active ingredient. Diuron, applied at a rate of 6 – 8 pounds of active ingredient per acre, is used extensively in agriculture and non-crop sites such as roadsides. Diuron is a pre-emergent herbicide that is commonly applied annually to road shoulders to prevent vegetation growth. ODOT has used diuron for years in this manner statewide. Replacement herbicides are applied at significantly lower rates measured in ounces of active ingredient per acre compared to pounds. In 2004, the diuron label changed to include buffers around certain fish-bearing streams, prompting many of the ODOT maintenance districts west of the Cascades to stop using diuron independent of this effort. By 2010 most of the districts west of the Cascades had already reduced or eliminated diuron on road shoulders, resulting in a significant reduction in herbicides.
- *Reduce bare shoulder width:* A statewide standard for maintaining bare shoulders was established to a maximum of eight feet or to the bottom of the ditch to edge of pavement on interstate highways, and maximum six feet or to the bottom of the ditch on secondary highways. For example, on US 26, the Mt. Hood Highway, staff proposed reducing the width of the shoulder spraying from eight feet to six feet. Narrowing the shoulder width could result in a 10 percent reduction of herbicide used for the maintenance district.
- *Check effective use:* Herbicides are continually evaluated to ensure effectiveness at low application rates. This includes evaluating new chemistries as they become available for use as well as maintaining awareness of changes and alerts in herbicides currently used. The ODOT Maintenance service section will evaluate the chemicals we use to ensure they are effective, safe and efficient.
- *Calibrate equipment:* Crews placed increased emphasis on herbicide application equipment calibration.

Track and Report Progress

The taskforce met annually to review progress, share observations, and make necessary adjustments. Progress and findings were discussed annually with the State Maintenance and Operations Engineer with informal reporting to the ODOT Director's Office. Annual meeting notes were compiled and analyzed to develop the final report.

Initial Concerns Identified

Two options are available to substantially reduce herbicides: 1) Reduce the amount of area sprayed and 2) Spray the same area with lighter herbicide formulations, reducing pounds of active ingredient. Reducing areas sprayed would require increased reliance on mechanical control methods or a decision to not control the vegetation. Managing the vegetation mechanically would increase costs. Switching to lighter herbicide formulations raised concerns about effectiveness. Lighter herbicide formulations were relatively new to the market and were largely untested for large-scale, long-term use. These concerns are detailed below.

Decreased level of service

Districts were concerned that it would be difficult to maintain the same level of service with reduced herbicide use. Weeds and unwanted vegetation tend to become established in areas that were previously sprayed and are then left unsprayed. Such areas would occur when reducing bare shoulder widths to the newly established six and eight foot standards, resulting in a weedy transition zone at the edge of the road shoulder. Districts also believed that maintenance budgets would not allow for additional mechanical control methods needed to maintain level of service in the absence of herbicides.

Noxious weeds

While the herbicide reduction focused on non-noxious herbicide applications, districts were still concerned that there would be an increase in the spread and establishment of noxious weeds. Areas that are sprayed for bare ground, such as the road shoulder, are prime locations for noxious weeds to establish.

Previous reductions

Prior to 2010, many of the districts had already rotated to herbicide formulations with less active ingredient. They were concerned they wouldn't be able to show further reductions without dramatically changing roadside vegetation management – by either not managing certain areas at all or relying on more costly mechanical methods.

Added expense

Using an integrated vegetation management approach, the combination of mechanical and herbicide control methods has proven to be an effective and economical means for managing vegetation. Districts speculated that reducing herbicides would lead to a greater dependence on mechanical control methods, which increases costs. At the start of the reduction effort, newer herbicide formulations with less active ingredient were more expensive and would increase costs when switching to their use.

Uncertainty of new (lighter) herbicides

Reducing diuron use involved switching to herbicide formulations with less active ingredient that were relatively new to the vegetation management market. Though some districts west of the Cascades had previously rotated to lighter herbicides, many were still concerned about long-term effectiveness, impacts to non-target plants, species shift and added cost.

Five-Year Findings

ODOT averaged a 44 percent herbicide use reduction between 2011 and 2015, realizing a maximum reduction of 57 percent in year 5 (compared to 2010 baseline; see chart 1). As predicted, the reduction

largely resulted from switching from, diuron to herbicide formulations with less active ingredient. Diuron usage was reduced by over 21,000 pounds of active ingredient from the 2010 baseline total to the 2015 level of just under 2,600 pounds. Minor reductions were realized from reducing acres from the newly established shoulder widths.

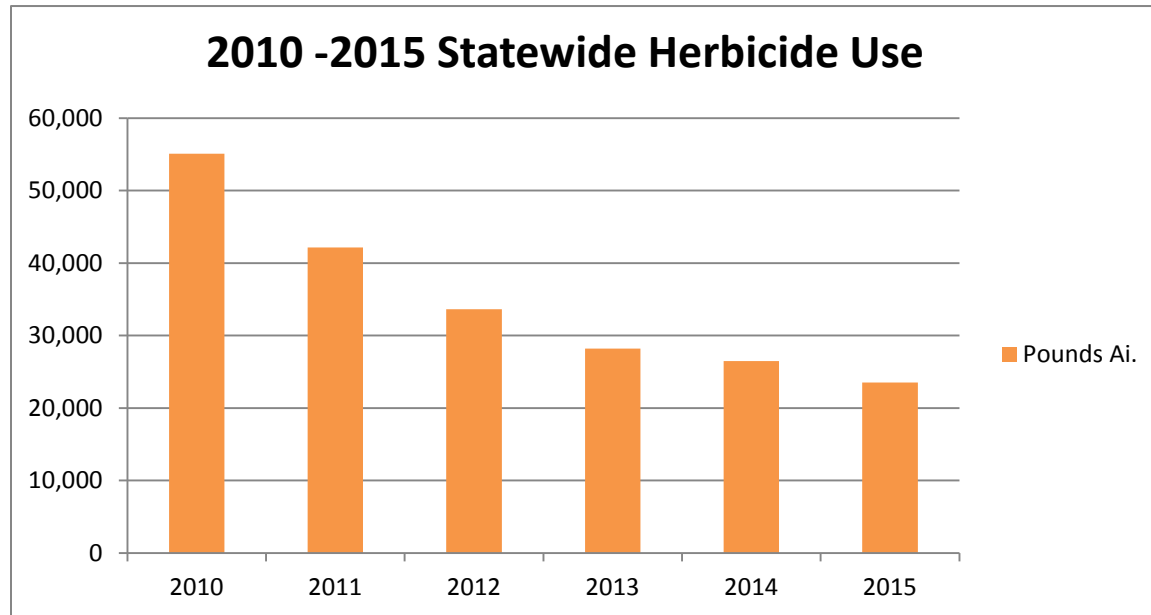


Chart 1

Level of service

No significant drop in level of service was realized as a result of the herbicide reduction. This is because the replacement (lighter) herbicides used were effective in maintaining bare shoulders and broadleaf control in transition zones. In localized areas, the narrowing of shoulders did lead to taller vegetation in the transition zone that then needed to be mowed. Left un-mowed, the taller vegetation would fall towards the travel lane making the shoulder too narrow and blocking sight distance at driveways and intersections. In other areas, weedy transition zones were reported but were being managed.

Noxious weeds

A direct correlation between reducing herbicide use and the establishment or spread of noxious weeds is difficult to quantify and hasn't been measured as part of this effort.

Added expense

Although early cost increases were realized in some locations, 2015 herbicide application expenses are relatively the same as in 2010. The cost of herbicide formulation with less active ingredient was more than diuron in the first couple of years, but those prices came down. In addition, efficiencies in labor and equipment offset higher chemical costs. Districts discovered that herbicide formulations with less active ingredient were easier to mix and load, just as effective, and easier to cleanup and dispose of because there were fewer containers. The result was more efficient applications that resulted in more acres per day being sprayed, thus lowering labor and equipment expenses.

Uncertainty of new (lighter) herbicides

ODOT is largely satisfied with the effectiveness of the herbicide formulations with less active ingredient. Long-term effectiveness of these herbicides has yet to be determined but will be monitored.

ODOT was able to switch to herbicide formulations with less active ingredient and achieve similar or better results without relying on mechanical methods. Districts are unsure if additional mechanical treatments will be necessary to achieve desired conditions where shoulder widths were narrowed or where long-term herbicide efficacy is not sustained. Overall vegetation management expenses were not affected by the herbicide reduction strategy.

Previous reductions

The combination of improved calibration, equipment upgrades and decreased shoulder widths allowed districts that had previously reduced herbicide use to reduce it even further.

Other outcomes and observations

During the five-year reduction effort, several factors influenced the quantity of active ingredient used in a given year. Some of those factors have been described (e.g., switching chemicals). Other factors included:

- Lack of available equipment (breakdowns).
- Lack of licensed applicators.
- Weather fluctuations (overly wet or overly dry conditions).
- Other maintenance activities prioritized (e.g. paving).

The herbicide reduction strategy increased the understanding of ODOT herbicide use throughout the agency. Achieving our goals required agency coordination and engagement at all levels, including the Director's Office, Project Development, the Maintenance and Operations Branch, region and district management and staff level.

Long-term sustainability of herbicide use levels

The herbicide reduction was based on the total pounds of active ingredient applied, which varies depending on the amount of product used in a given year. If product use increases so would pounds of active ingredient. Likewise, a decrease in product used would result in a decrease in pounds of active ingredient. Pounds of active ingredient would also increase or decrease depending on the product used – some products contain more or less than others. In a given year, herbicide use might fluctuate depending on:

- Increase or decrease in highway lane miles under state jurisdiction.
- Increase or decrease in noxious weed establishment pressure.
- Project design elements that increase reliance on chemical methods compared to mechanical. For example, cable barrier is difficult to effectively mow so herbicides are often used.
- Budget constraints that impact management levels. Mechanical methods have higher fuel costs; chemical methods require purchasing product.
- Long-term efficacy of herbicide formulations with less active ingredient. If it is not working, districts might have to use heavier herbicide formulations.
- Seasonal changes in the weather. This can affect the timing and rates of herbicide applications. For example herbicides are not to be applied in high winds, heavy fog or rainy conditions.

Because these conditions are common and can be persistent in some years, herbicide applications may either be delayed or cancelled altogether.

Conclusions/Recommendations

Conclusions

After five years, ODOT exceeded the 25 percent reduction target with a five-year statewide average reduction of 44 percent. The following key points were concluded in reviewing this effort:

- There is a high level of confidence that ODOT will not revert to 2010 levels and the 25 percent statewide reduction can be maintained.
- Affordable herbicide formulations with less active ingredient becoming available for use made the transition to alternative herbicides practical.
- More time is needed to determine whether the efficacy of the alternative formulations will be long-lived.
- Regarding concerns raised early, some level of impact was experienced during the reduction:
 - Until prices leveled out in about year 2, the cost of alternative herbicides was higher resulting in an increase in vegetation management costs.
 - Broadleaf weed populations increased in those areas that were managed as bare shoulders when the shoulder width was reduced.
- Reducing the amount of diuron herbicide by using alternative replacement herbicides accounted for the largest percentage of the reduction total.
- Annual herbicide use is not a static number and there will be, as was noted over the five years, fluctuations in use depending on weather, vegetation type and budget availability.
- One main reason the reduction target was exceeded is because suitable replacement herbicides were used statewide on a large-scale basis rather than in certain locations.
- Herbicide reduction by switching to herbicide formulations with less active ingredient has likely plateaued, leaving reducing acres sprayed as the only option for future reduction. Future reductions will likely result in impacts to level of service.
- Because of the dramatic switch to using almost 100 percent lighter formulations, little room is left to further reduce by simply switching from one formulation to another.

Recommendations

ODOT should continue to track herbicide use at the statewide level and review herbicide use as part of a complete and responsible Integrated Vegetation Management program. Due to annual fluctuations, focusing on a five-year average might be more helpful in terms of identifying trends in herbicide use.

ODOT should continue to:

- Evaluate new technology and new chemicals to ensure they are effective, safe and efficient while meeting management objectives.
- Integrate other maintenance practices, such as mowing and shoulder blading, with the use of herbicides to gain the most benefit and increase effectiveness and efficiency.