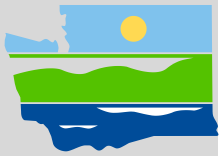

DEPARTMENT OF
ECOLOGY
State of Washington

Final Cost-Benefit and Least Burdensome Alternative Analyses

Chapter 173-360 WAC
Underground Storage Tank Regulations

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Final Cost Benefit and Least Burdensome Alternative Analysis

Chapter 173-360 WAC
Underground Storage Tank Regulations

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TABLE OF CONTENTS

TABLE OF TABLES

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Executive Summary

The Washington State Department of Ecology (Ecology) is adopting amendments to Chapter 173-360 WAC, Underground Storage Tank Regulations (UST rule). The main features of these adopted rule amendments include conditions and requirements for:

- Delivery prohibition.
- Operator training and retraining.
- Secondary and under-dispenser containment.

Cost-Benefit Analysis

The Cost-Benefit Analysis estimates the likely costs and benefits of the adopted rule, as compared to the regulatory framework (baseline) if the rule is not amended. In the case of the UST rule, this baseline for comparison includes:

- The existing rule (Chapter 173-360 WAC).
- The state law authorizing the UST rule (Chapter 90.76 RCW).
- The federal law establishing minimum requirements for state UST programs (Underground Storage Tank Compliance Act of 2005, 42 U.S.C. Sec. 15801 et seq., Energy Policy Act of 2005, P.L. 109-58, Title XV, subtitle B).

From this analysis of the qualitative and quantitative likely impacts of the adopted rule, Ecology concluded that the likely benefits of the rule are greater than the likely costs. Ecology's analysis is based on the best available information at the time of this analysis.

The Cost-Benefit Analysis estimates that the adopted rule will likely result in compliance costs associated primarily with installation or replacement of under-dispenser containment and secondary containment, and with operator training. The adopted rule will also likely result in reduced releases of hazardous substances to soil and groundwater, reduced insurance rates, reduced property value impacts, avoided cleanup costs, less product loss to leaks, less vapor contamination, and – through all these results – reduced impacts to human and environmental health.

Ecology calculated costs and benefits based on the overall program requirements that are different from the baseline, even if Ecology had little discretion in them, because (especially for benefits) the components of the adopted rule amendments in which Ecology had discretion were not necessarily separable from the overall program requirements. Table 1, below, reflects these different cost calculations.

Ecology expects facilities in Washington State with USTs will be affected by the adopted rule amendments. These are typically gasoline service stations, but may include facilities with emergency power generators (e.g., hospitals), military and other government facilities, vehicle and aircraft manufacturers and retailers, and shipping and transportation facilities.

Table 1 below shows the expected costs to the affected parties.

Table 1: Estimated Costs Summary (millions of $)

	Total Program Cost	**Discretion-Specific Cost (subset of program cost)***
Operator Training	$8.50	$0.21
Delayed Training Deadline	-$0.005	-$0.005
Longer Allowed Training Time	-$0.001	-$0.001
Secondary Containment of Tanks and Pipes	$42.40	$42.40
Under-Dispenser Containment	$6.83	$6.83
Avoided Operator Training Costs • Designation to more than one operator class • Merging Class A and Class B operator training • Reciprocity for out-of-state training • Acceptance of prior in-state training • Avoided reporting costs	(qualitative cost reductions)	
Emergency Response and Signage • Presence of trained operators at manned facilities • Emergency signage at all facilities	(qualitative costs)	
TOTAL QUANTIFIABLE COSTS	**$57.72**	**$49.43**

*The Discretion-Specific Cost is Ecology's best attempt to quantify the costs associated only with Ecology's discretion (that is, those requirements not mandated by state or federal law). Where quantifying those costs was not possible, then the total program cost was used. It is likely this analysis includes an overestimate of actual costs associated only with Ecology's discretion in this rulemaking.

Table 2 shows the expected benefits to the people of Washington.

Table 2: Estimated Benefits Summary (millions of $)

Benefit	**Low Estimate**	**High Estimate**
Avoided Property Value Losses	$20.4	$30.6
Avoided Cleanup Costs	$7.8	$59.5
Reduced Insurance Rates	$45.2	$45.2
Reduced Product Loss	$0.015	$0.522
Reduced Vapor Intrusion	$0.031	$0.597
Reduced Groundwater Contamination	$0.053	$0.398
Avoided Human Health Impacts	(qualitative)	
Avoided Ecological Impacts	(qualitative)	
TOTAL QUANTIFIABLE BENEFITS	**$73.5**	**$136.8**

Least Burdensome Alternative Analysis

Based on research and analysis required by RCW 34.05.328(d)(e) the Department of Ecology determines:

> *There is sufficient evidence that the adopted rule amendments are the least burdensome version of the rule amendments for those who are required to comply, given the goals and objectives of the law.*

In addition to the adopted rule amendments, Ecology considered various alternative combinations of policy options during the rulemaking, and determined that those alternatives either imposed unnecessary additional burden on those required to comply at this time, or resulted in requirements that would not adequately protect human health and the environment.

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CHAPTER 1: Background and Introduction

1.1 Introduction

This report reviews the economic analyses performed by the Washington State Department of Ecology (Ecology) to estimate the incremental expected benefits and costs of the adopted amendments to the Underground Storage Tank Regulations (UST rule; Chapter 173-360 WAC). This document is generally intended for use with an associated Least Burdensome Alternative (LBA) analysis (see Chapter 6) and Small Business Economic Impact Statement (SBEIS, Ecology publication 12-09-044[1]) to develop an understanding of the full impact of the adopted rule amendments.

The Washington Administrative Procedure Act (RCW 34.05.328) requires Ecology to evaluate significant legislative rules to "[d]etermine that the probable benefits of the rule are greater than its probable costs, taking into account both the qualitative and quantitative benefits and costs and the specific directives of the law being implemented."

Ecology's analysis is based on the best available information at the time of this analysis.

1.2 Description of the adopted rule amendments

The adopted rule amendments:

- Authorize Ecology to prohibit the delivery of regulated substances to UST systems not in compliance with regulatory requirements.
- Establish an operator training program for individuals who operate and maintain UST systems.
- Require secondary containment of tanks and pipes, and containment under dispenser systems.

1.3 Reasons for the adopted rule amendments

The adopted rule amendments are necessary to:

- Comply with the legislative directive in Substitute Senate Bill 5475 (2007) to adopt rules that are consistent with and no less stringent than the requirements in the federal Underground Storage Tank Compliance Act of 2005.
- Maintain federal funding for our state UST program. Such funding is contingent on state compliance with the requirements in the federal Underground Storage Tank Compliance Act of 2005.
- Reduce the number, duration, and severity of releases of petroleum and other hazardous substances from regulated UST systems in this state, which pose a serious threat to human health and the environment, including drinking water. These reductions in

[1] Available at *http://www.ecy.wa.gov/biblio/1209044.html*

releases would save UST owners money spent on cleanup, insurance, and prospective liability, as well as reduce property value impacts of soil and groundwater contamination. These reductions in releases would also reduce human and environmental exposure to petroleum and other hazardous substances stored in tanks, reducing health and environmental costs.

1.4 Document organization

Ecology organized this document into the following sections:

- **Baseline and adopted rule amendments** (Chapter 2): Description and comparison of the baseline requirements in state and federal laws and rules to the adopted rule amendments.
- **Likely costs of adopted rule amendments** (Chapter 3): Analysis of the types and size of costs Ecology expects impacted facilities to incur, including installation or replacement of secondary containment and under-dispenser containment, and operator training.
- **Likely benefits of adopted rule amendments** (Chapter 4): Analysis of the types and size of benefits expected to result from the adopted rule amendments.
- **Cost-benefit comparison and conclusions** (Chapter 5): Discussion of the complete implications of the Cost-Benefit Analysis. Comments on the results.
- **Least Burdensome Alternative Analysis** (Chapter 6): Analysis of considered alternatives to the final adopted rule amendments.

CHAPTER 2: Baseline and Adopted Rule Amendments

2.1 Introduction

In this chapter, Ecology describes the baseline to which the adopted rule amendments are compared. The baseline is the regulatory context in the absence of the amendments being adopted.

In this chapter, Ecology also describes the adopted rule amendments, and identifies which require analysis under the Administrative Procedure Act (Chapter 34.05 RCW). Here Ecology addresses complexities in the scope of analysis, and indicates which cost and benefit analyses are discussed in chapters 3 and 4 of this document.

2.2 Baseline

In most cases, the regulatory baseline is the existing rule. If there is no existing rule, the federal or local rule is the baseline. Sometimes there is no baseline because there is no regulation at any level of government, and yet other times, the baseline is for anticipated changes to other regulations (e.g., federal regulation is expected to be enacted before or just after the adopted rule; or a regulatory program would otherwise change or expire in the absence of the adopted rule).

The baseline is complex for the adopted rule amendments to the UST rule because there are multiple factors involved. These factors are:

- The existing UST rule (Chapter 173-360 WAC).
- The state law authorizing the UST rule (Chapter 90.76 RCW), as amended by Substitute Senate Bill 5475 in 2007. The state law requires the UST rule to be at least as stringent as federal law and restricts Ecology's discretion otherwise allowed under federal law.
- The federal law establishing minimum requirements for state UST programs (the Underground Storage Tank Compliance Act of 2005, 42 U.S.C. Sec. 15801 et seq., Energy Policy Act of 2005, P.L. 109-58, Title XV, subtitle B). The federal law requires compliance with federal grant guidelines established by the U.S. Environmental Protection Agency (EPA).

Ecology determined the baseline for this analysis is the most stringent of the following requirements:

- The federal grant guidelines established by EPA under federal law.
- The state law's limitations on Ecology's discretion otherwise allowed under the federal grant guidelines.

In addition, there is currently a proposed federal UST rule (US EPA, 2011) that has not been adopted.[1] While these updated proposed federal requirements are not legally required at the time of this writing, the federal rule may apply in the future. Ecology did not, however, analyze the adopted rule amendments in relation to the proposed federal rule, as it is not yet finalized.

2.3 Analytic scope

It is often the case that there is a legal requirement prompting agency rulemaking (in that the law requires a rule to be able to implement it) that is not entirely separable from the rule requirements. In the case of the UST rule, the law (Chapter 90.76 RCW) requires Ecology to have a program that meets certain goals and content (e.g., require secondary containment), and the rule describes what the regulated community must do to meet those requirements (e.g., double-walled tanks and piping).

In cases where the rule requirements are not entirely separable from the law's requirements (e.g., the Legislature creates the program, and Ecology specifies the compliance requirements), Ecology has chosen to analyze the impacts of program requirements as a whole, and then to the extent possible, identify the subset of impacts that are strictly due to Ecology's discretion.

For example, the law requires Ecology to have an operator training program. Ecology could not quantify the benefits of just the Ecology discretion requirement to train all Class C operators at a facility, and so identified the benefits of the operator training program overall. For comparability, Ecology estimated the costs and benefits of the operator training program overall (to compare costs and benefits of the adopted rule amendments), but also estimated the costs of just the Ecology requirement to train all Class C operators at a facility.

To provide the maximum reliable information to the public, Ecology has presented all of the identifiable and separable impacts, as well as the impacts of overall rule requirements including the legal mandate, to be able to assess costs and benefits on a comparable basis.

2.4 Analyzed changes

Ecology qualitatively or quantitatively analyzed the impacts of the following adopted changes to the UST rule over which it exercised discretion.

2.4.1 Operator training

Ecology analyzed the impacts of the following operator training requirements:

- All individuals – instead of at least one – who meet the definition of a Class C operator must be designated.
- Individuals may be designated to more than one operator class.
- Operators must be initially designated and trained by December 31, 2012, rather than August 8, 2012.

[1] See http://www.epa.gov/oust/fedlaws/proposedregs.html for information on the proposed federal rule.

- Class A and Class B operators must be trained within 60 days – instead of 30 days – of assuming duties of that class.
- Merging training requirements for Class A and Class B operators, and specifying additional topics based on differences between state and federal programs.
- Class C operators must be trained using a training program; examination-only approaches are not allowed.
- Reciprocity for out-of-state training.
- Acceptance of prior in-state training.
- Retraining of Class A and Class B operators may be required by Ecology for any violation, rather than just for significant noncompliance.
- Class A and Class B operators who are retrained annually are exempt from retraining requirements.
- Retraining of Class A and Class B operators must occur within 60 days – instead of 30 days – of receipt of a notice of non-compliance.
- Retraining of Class A and Class B operators must cover the areas determined to be out of compliance.
- Operation and maintenance plans may be required in addition to or in place of retraining of Class A and Class B operators due to non-compliance.
- At least one designated Class A, B, or C operator must be present at manned facilities.
- Emergency response signage is required.
- Recordkeeping – instead of reporting – is required to track compliance with operator training requirements. Records must document all currently designated operators and the training received by those operators.

2.4.2 Secondary containment of tanks and piping

Ecology analyzed the impacts of the following secondary containment requirements:

- For tanks, only double-walled systems are allowed as secondary containment.
- For piping, only double-walled closed systems or double-walled systems opening into containment sumps are allowed as secondary containment.
- If more than 50 percent of a piping run is replaced, the entire piping run must be replaced and the piping must be secondarily contained.

2.4.3 Under-dispenser containment

Ecology analyzed the impacts of the following secondary containment requirements:

- Under-dispenser containment is required when only a dispenser (not the entire dispenser system) is replaced.
- Under-dispenser containment is required when only underground piping (not the dispenser system) is replaced.

- All under-dispenser containment must allow for access and visual inspection; monitoring is not required.

For specifics of these changes, see the Appendix A. For a list of the adopted rule amendments not analyzed, see Appendix B.

CHAPTER 3: Likely Costs of Adopted Rule Amendments

3.1 Introduction

Ecology estimated the expected costs associated with the adopted amendments to the UST rule, as compared to the baseline as described in section 2.2 of this document. The baseline is the regulatory circumstances in the absence of the adopted rule amendments. The costs analyzed here are associated with the specific adopted amendments listed in section 2.4 of this document, in three general categories:

- Operator training.
- Secondary containment for tanks and pipes.
- Under-dispenser containment.

To the extent possible, Ecology has quantified these impacts, and has otherwise described them qualitatively to include in overall assessment of the costs of the adopted rule amendments.

In some cases, the adopted rule amendments are mandated by law, but the specifics of how to administer them were determined by Ecology. For example, the law requires Ecology to have an operator training program, but does not specify all components of that program. Ecology could not quantify the benefits of just the Ecology discretion requirement to train all Class C operators at a facility, and so identified the benefits of the operator training program overall. To be able to compare costs to benefits, Ecology estimated the costs of the operator training program overall. Ecology also estimated the costs of just the discretion-specific requirement to train all Class C operators at a facility.

To retain the ability to compare costs and benefits of the adopted rule amendments, Ecology has reported estimates of the impacts of Ecology's discretion, as well as of overall adopted rule amendments. In this way, Ecology hopes to have comparable estimates to determine the relative sizes of the costs and benefits, and to illustrate to the public the subset of those impacts due specifically to Ecology choice on certain components in addition to the law's requirements.

3.2 Affected facilities

The first step in determining the likely costs of the adopted rule amendments is determining how many UST facilities will need to comply with the adopted rule amendments. Affected facilities include gas and service stations, automotive and other transportation fleets, and facilities with backup generators. For general compliance with the adopted rule amendments, Ecology looked at the total number of facilities with USTs (WA Ecology, 2012a). For those elements of the adopted rule amendments that are related only to releases of substances contained in USTs, Ecology looked at the total number of releases.

For more in-depth discussion of the particular industries likely impacted – including a list of industry codes, and distribution of business size – see the associated Small Business Economic Impact Statement (Ecology publication #12-09-044).

3.3 Forecasting the number of facilities

The first step in determining the likely costs of the adopted rule amendments is determining how many UST facilities will need to comply with the adopted rule amendments. Ecology used existing data on USTs in the state to fit an estimated curve over time, and to forecast how many tanks and facilities will be regulated by the UST rule in the future. To do this, Ecology applied standard statistical methods to fit the number of releases in each year to a time-series that develops according to a set of parameters. Ecology used a model that provided a forecast of the number of tanks and piping, and the number of releases under the baseline.

3.3.1 Forecast number of releases

Ecology developed a statistical forecast of the number of UST substance releases each year. Ecology looked at the number of releases because in some elements of compliance with the adopted rule amendments, only those facilities with releases would need to comply. For forecasts of the number of facilities with leaking tanks and piping and total facilities, see subsequent sections.

Ecology employed a Box-Jenkins methodology to fit some linear combination of autoregressive (AR) and moving average (MA) processes to a time series. A time series, in this case, is a series of numbers describing the quantity of facilities with releases. A moving average process describes the ongoing relationship between averages of a subset of the time series at any given time. An autoregressive process describes the relationship between the time series at any given point in time and a subset of the time series before it. Combined, these create an ARMA process, which describes data following both individual processes. The methodology for fitting an ARMA is called the Box-Jenkins methodology. Once appropriately fit to existing data, the ARMA model can be used to forecast future values of the time series.

Ecology's time series is a count of the number of historic releases for any given month from December 1981 through January 2012. There are two noticeable jumps in the time series – in June 1995 and July 2011 – reflecting changes in recordkeeping practices that occurred at those times. (For example, there is an increase of 200 releases in July 2011 that reflects a change in recordkeeping definitions.) Because the definitions and circumstances before and after those jumps are different, Ecology would not get an appropriately fitted ARMA model; the ARMA model does not know there were exogenous recordkeeping changes and is not able to infer they occurred. Ecology, therefore, estimated the ARMA model to the time series of the number of releases between June 1995 and July 2011, when there were no changes to the recordkeeping and policy of USTs.

In using the 1995 – 2011 segment of time series data, Ecology used two assumptions in fitting this model and using the results:

- The change in the number of releases (the process the time series follows) will be the same post-2011. Absent data indicating otherwise, Ecology must make this assumption.
- The number of recorded or discovered releases (inherently Ecology can record only those USTs and releases of which it is aware; unknown releases to Ecology or to UST operators are inherently not in the database) reflects the number of actual releases in the state. The number of releases in the time series is likely an underestimate of actual releases at any given time, but is the best data available, and there is no reason to believe the trend will change.

The Box-Jenkins methodology of fitting ARMA models to data only applies to what are called stationary series. A stationary series has a consistent average and variance over time. Ecology employed a number of statistical tests to see if the series was stationary, and determined that our time series of releases is stationary. Therefore, the Box-Jenkins methodology is appropriate.

In determining the specification of the estimated model using this methodology, Ecology used a combination of criteria:

- Minimizing criteria that capture the difference between our estimates and the data, as well as penalizing for over-fitting the model (describing the pattern of the natural time series process that is random, in addition to the underlying describable relationships over time).
- Using an estimation period of 1995-2005 and then testing a forecast made from that period against actual data in a consistent regulatory time period (2006 – 2011, during which other variables did not change), while minimizing criteria that capture the difference between the forecast and the data. For our final forecast we utilized the entire sample of 1995-2011.
- Inspecting the residuals (the difference between the data and the estimated model) so that the autocorrelations are sufficiently minimized. This indicates the model is the best fit and describes a sufficient amount of the process relating values in the time series.

Using this methodology, Ecology determined that the best model fitting the data was an ARMA(1,3), where 1 and 3 are parameters describing the degree of autoregression and moving average in the model. The figure below shows the forecast curve of releases in each year, and the number of actual releases in the data.

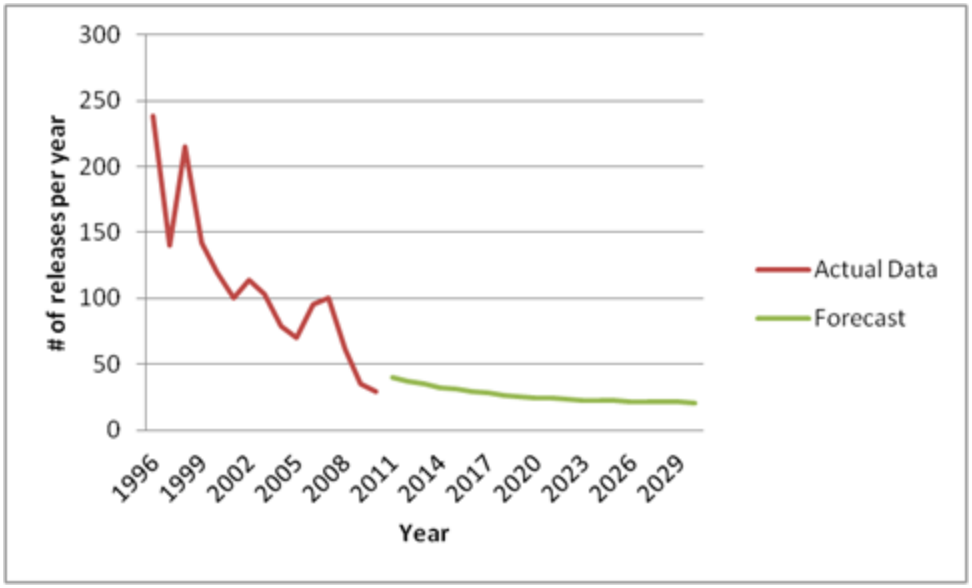

Table 3 shows the number of releases in known data in the past, and numerical estimates of the number of releases each year under the baseline. The number of releases each year is the additional number of releases confirmed each year (regardless of the number of previously confirmed releases or whether the releases have been cleaned up). The numbers forecast by the model begin in 2012. The data before 2012 are actual releases.

Table 3: Past Releases and Baseline Forecast of Releases

Year	Data and Forecast
1996	239
1997	140
1998	215
1999	142
2000	120
2001	100
2002	114
2003	103
2004	79
2005	70
2006	95
2007	100
2008	61
2009	35
2010	29
2011	40
2012	37
2013	35
2014	33
2015	31
2016	29

2017	28
2018	27
2019	26
2020	25
2021	24
2022	23
2023	23
2024	22
2025	22
2026	22
2027	21
2028	21
2029	21
2030	21
2031	21

3.3.2 Forecast number of tanks and facilities

Using Ecology data on existing tanks and facilities, Ecology forecast the number of future tanks that are operational or temporarily closed. Ecology assumptions gathered from existing data (WA Ecology, 2012a), and applied to future forecasts included:

- 3,602 existing facilities.
- 2.65 tanks per facility (9,545 total existing tanks).
- 49.45 percent of tanks and piping are single-walled.
- 35 percent of tanks do not have under-dispenser containment.
- Long-term total number of tanks prospectively falling by about 116 tanks each year. Ecology assessed the number of total operational and temporarily closed tanks each year since 2001. After an initial sharp decline in excess of 600 tanks (netting new installed tanks and removed tanks), and subsequent sharp declines likely representing removal of historically leaking tanks, the annual reduction in the number of tanks has been at an approximate annual rate of 116 tanks (or 116 / 2.65 = 44 fewer facilities).
- Long term new annual tanks amounting to 67 newly installed tanks – and, therefore, up to 67 / 2.65 = 25 new facilities each year as a maximum facility change.

3.4 Expected costs

To estimate costs per facility, Ecology used methodology extrapolated from the Environmental Protection Agency's Regulatory Impact Analysis (US EPA, 2011a and 2011b) for a currently proposed federal UST rule. These costs were adjusted to suit Ecology's adopted rule amendments, and were associated with changes to:

- Operator training.
- Secondary containment for tanks and pipes.
- Under-dispenser containment.

Though there is an existing voluntary and guideline-based program for operator training, Ecology assumed for this analysis that there was no existing program, and all facilities would experience new costs for training. The mitigating factors of the grandfathering-in clauses of the adopted rule amendments are discussed qualitatively, below.

3.4.1 Operator training costs

Overall program costs

One-time training costs

Following EPA methodology (US EPA, 2011a and 2011b), Ecology developed unit cost assumptions for operator training. Hourly wages below include benefits and overhead.

A Class A operator's unit costs were calculated assuming:

- 20 percent of the operators will only need the examination
  - A $60 exam fee
  - 1.5 hours of exam time
  - An hourly wage of $51.33
- 80 percent of the operators will require training and the exam
  - A $169 fee for training and the exam
  - 10 hours of training (including exam time)
  - An hourly wage of $51.33

A Class B operator's unit costs were calculated assuming:

- 20 percent of the operators will only need the examination
  - A $60 test fee
  - 1.5 hours exam time
  - An hourly wage of $28.18
- 80 percent of the operators will require training and the exam
  - A $169 fee for training and the exam
  - 10 hours of training (including exam time)
  - An hourly wage of $28.18

A Class C operator's unit costs were calculated assuming:

- 100 percent of the operators will require on-site training
    - 1 hour of Class B time as a trainer, divided by the number of Class C operators at the facility (the number of operators attending training)
    - A Class B hourly wage of $28.18
    - One hour of Class C time
    - A Class C hourly wage of $15

A facility's recordkeeping costs were calculated assuming:

- 0.1 hours of clerical time
- A clerical hourly wage of $17.76
- $0.10 in materials costs

Based on the above unit costs:

- For a single Class A operator, the expected training cost was:
    - 0.2*($60+1.5*($51.33)) = $27.39 if examination-only
    - 0.8*($169+10*($51.33)) = $545.71if taking a training and exam
- For a single Class B operator, the expected training cost was:
    - 0.2*($60+1.5*($28.18)) = $20.45 if examination-only
    - 0.8*($169+(10*($28.18)) = $360.64 if taking a training and exam
- For a single Class C operator, the expected training cost was:
    - 1*$28.18/(the number of Class C operators at the facility)+1*$15
- Recordkeeping costs were 0.1*$17.76+$0.10 = $1.88

As in the EPA's analysis, Ecology assumed that a facility would have on average:

- One Class A operator, shared across five facilities
- One Class B operator, shared across five facilities
- Three Class C operators

This means a facility's expected training cost would be the sum of:

- Expected Class A and B training costs, divided by the five facilities (($27.39+$545.71+$20.45+$360.64)/5 = $190.84), plus
- Expected cost of training three Class C operators (3*(1*$28.18/3+1*$15) = $73.18), plus
- Recordkeeping costs ($1.88)

These costs sum to $265.90 in expected initial, one-time training costs per facility. [1]

[1] Note: A typical facility represents the average facility in the overall range of facilities affected. This means that some facilities (e.g., those with more operators, or a different mix of operators) may have higher costs than those

Ongoing training costs[2]

In addition to one-time costs of training, EPA's analysis also acknowledged that businesses have turnover for all classes of operator. The EPA calculated annual ongoing training costs (US EPA, 2011a and 2011b) based on 22 percent turnover for Class A and Class B operators, and 119.5 percent turnover for Class C operators. The expected cost of ongoing training, based on the time and wage rates above, is the costs of training new Class A and Class B operators (.22*$190.84), plus the costs of training new Class C operators (1.195*$73.18). This sum comes to $129 per year, per facility.

Total operator training costs

To estimate the present value of one-time and ongoing operator training costs (initial training in the first year of training, plus ongoing costs every year after), Ecology uses a discount rate based on interest that could be earned risk-free on today's dollars over the relevant time period. Ecology uses the ten-year average rate of return offered on the US treasury's T-Bills (inflation-indexed short-term bonds; US Treasury Department, 2012) as the discount rate, averaging 1.58 percent over the last ten years.

Under the assumption of a constant 3,602 facilities over time, the total present value cost of operator training (one-time and ongoing) is $8.5 million.[3]

Discretion-specific costs

There are significant differences between both the baseline and Ecology's adopted rule amendments, and the proposed federal rule analyzed in the EPA analysis. Ecology adjusted the EPA analysis and cost calculations to reflect these differences for this analysis. In this way, Ecology can illustrate the particular operator training costs associated with just the areas of the adopted rule amendments over which Ecology had discretion. Ecology then used EPA methodology (US EPA, 2011a and 2011b) to analyze these differences where possible.

The following discretion-specific impacts were analyzed quantitatively:

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represented here, and others (e.g., those able to share operators across facilities) may have lower costs than those represented here. The typical facility is intended to represent how high and low cost-facilities balance out, as well as represent the facilities in between the ends of the cost range.

[2] Ongoing training costs reflect costs associated with training new employees as they turn over.

[3] High-end estimate: Using the forecast number of facilities in any given year (see section 3.3.2, including current 3,602 facilities and a maximum growth rate of 25 new facilities each year), the total present value cost of the program for operator training (initial and on-going) over 20 years is approximately $10 million at the high end. Low-end estimate: Following the net change in total tanks and piping that would correspond to 44 fewer facilities each year, this total 20-year present value cost would fall to $7.7 million. This cost estimate is based on all facilities being a typical facility, reflecting an averaging across facilities that may experience higher (e.g., single proprietorships) or lower (multi-facility ownership) costs.

Designation of Class C operators

All individuals – instead of at least one – who meet the definition of a Class C operator must be designated. Class C operators may not be trained by examination only. Ecology calculated the additional cost created by the adopted rule amendments based on training an additional two Class C operators per facility.

Using the same training assumptions, Ecology calculated training costs for two Class C operators, as one hour of Class B operator time at $28 per hour, plus one hour each of Class C time, at $15 per hour. Two additional Class C operators, therefore, were estimated to cost $28 + 2 ($15) = $58 per facility in initial training costs. This sums to a cost of up to **$209 thousand**.

Initial training deadline for all operators

Operators must be initially designated and trained by December 31, 2012, rather than August 8, 2012. This difference in training deadline is likely to reduce present-value training costs slightly for those facilities taking the extra approximately four months. At a 1.58 percent annual discount rate, each dollar saved for four extra months (1/3 year at 1.58 percent continuously compounded interest) is prospectively worth an additional approximately 0.5 cents. This means that if all classes of operator were to delay training until the last four months, each facility would save $1.40 in delayed one-time training costs. This prospective cost savings sums to nearly **$5 thousand**.

Subsequent training deadline for Class A and Class B operators

Class A and Class B operators must be trained within 60 days – instead of 30 days – of assuming duties of that class. This difference in training deadline is likely to reduce present-value training costs slightly for those Class A and Class B operators putting off training an additional 30 days. At a 1.58 percent annual discount rate, however, each dollar saved for approximately one additional month (at a rate equivalent to 1.58 percent annually) is prospectively worth an additional 0.1 cents. That means if Class A and B operators were to delay training 30 days to accommodate other business decisions, facilities could save a total of **$958** in one-time training costs.

Retraining of Class A and Class B operators based on non-compliance

Retraining of Class A and Class B operators may be required by Ecology for any violation, rather than just for significant noncompliance. Class A and Class B operators who are retrained annually are exempt. Retraining must occur within 60 days – instead of 30 days – of receipt of a notice of non-compliance, and must cover the areas determined to be out of compliance.

Ecology typically performs analyses assuming compliance with the adopted rules in question. This is because the degree of noncompliance is difficult to predict. In the case of operator training, and especially retraining following violations, however, the intent of the adopted rule amendments is to reduce noncompliance,

and thereby reduce releases. Therefore, Ecology did not quantify the possible cost of retraining.

Development of operation and maintenance plans based on non-compliance

Operation and maintenance plans may be required by Ecology due to non-compliance in addition to or in place of retraining of Class A and Class B operators. As Ecology does not typically analyze the impacts of noncompliance with an adopted rule, and as operation and maintenance plans would not necessarily be required in all cases of noncompliance, Ecology did not quantify the possible cost of these plans.

Other discretion-specific impacts are analyzed qualitatively below.

Qualitative costs and cost-mitigations

Elements of the adopted rule amendments governing operator training could only be evaluated qualitatively. Those costs and cost-mitigations are discussed below, and apply to some degree under both program requirements and discretion-specific requirements.

Designation of individuals to more than one operator class

Ecology could not determine the extent to which facilities would take advantage of the adopted rule amendments that allow an individual operator to carry multiple classifications. Ecology believes some portion of operators will be certified as both Class A and Class B. This will reduce operator training costs by both the reduced lost wages and the time lost to training another person.

Merging Class A and Class B operator training

Since Ecology could not determine the extent to which operators would take advantage of multiple class designations (see above), Ecology also could not estimate the extent to which the scope of training – overlapping Class A and Class B training requirements and content – would benefit operators. This benefit would reduce the amount of training required to achieve multiple class designations, but might also increase the additional amount of material in a Class A/B training, as the two sets of subject requirements overlap significantly, but not entirely.

Reciprocity for out-of-state training

Ecology is accepting training of Class A and Class B operators previously designated and trained in another state or at a tribal facility regulated by EPA. Ecology believes this will reduce training costs for some facilities, both in initial one-time training, and in ongoing training. This cost-mitigation is based on the ability of facilities to hire individuals already carrying an operator certification, and the ability of individuals to move to new jobs without incurring training costs again. Ecology included this cost-mitigation qualitatively, as a reduction in the estimated costs of one-time and ongoing operator training.

Acceptance of prior in-state training

Ecology is accepting prior in-state training of Class A, Class B, and Class C operators obtained under the state's existing voluntary training program. Ecology believes this will reduce training costs for some facilities, based on avoiding initial training cost for those operators already trained. Ecology could not quantify the degree to which this cost-mitigation would be taken advantage of, and so included it qualitatively, as a reduction in one-time operator training costs.

Presence of trained operators at manned facilities

Ecology is requiring that at least one designated operator be present at manned facilities. Ecology does not anticipate a cost, since the requirement does not apply when a facility is not manned, and all individuals meeting the definition of a Class C operator must be designated and trained (see section 3.4.1). This means any person manning a facility would likely already be a trained Class A, B, or C operator.

Emergency signage at all facilities

Ecology is requiring that emergency signage be posted at all UST facilities. Some facilities may already carry such signage, to comply with fire code regulations. Ecology could not determine the extent to which facilities did or did not have existing signage, and so has included this cost qualitatively. Ecology does not, however, expect the incremental, one-time cost of posting a sign to be significantly high.

Avoided reporting costs

To track compliance with operator training requirements, Ecology is requiring recordkeeping, but no reporting. Ecology believes this will benefit those facilities that would have otherwise been required to perform reporting tasks under the baseline (instead of, or in addition to, recordkeeping), by allowing them to avoid those costs. Ecology could not confidently determine the differential cost between the reporting requirement and the recordkeeping requirement, and so has included this benefit qualitatively.

3.4.2 Secondary containment costs – tanks and piping

Overall program cost calculation

Following EPA methodology in its Regulatory Impact Analysis of a proposed federal UST rule (US EPA, 2011a and 2011b), Ecology developed unit cost assumptions for secondary containment. The EPA analysis assumes that the additional cost of installing a double-walled tank and piping (as opposed to single-walled tank and piping) is $17,734.

From Ecology UST data (WA Ecology, 2012a), Ecology found that:

- There are 3,602 facilities in Washington and that each facility has on average 2.65 tanks. This means the total number of existing tanks and piping is 9,545.
- Of those 9,545 tanks and piping, 4,720 (or 49.45%) are currently singled-walled and either operational or temporarily closed.

Ecology conservatively assumed that all of those 4,720 single-walled tanks and piping would be replaced at a uniform rate of 236 tanks and piping each year. This would replace all single-walled tanks and piping over 20 years.

Ecology estimated the annual cost per tank and piping by assuming that owners would amortize the costs of tank and piping replacement over 20 years (the life of a loan, for example). At a discount rate of 1.58 percent, the differential cost of installing a double-walled tank and piping versus a single-walled tank and piping is $1,041 each year. So, to calculate the costs in each year, Ecology multiplied the number of affected tanks and piping by $1,041.

Table 4 shows the number of tanks and piping affected in each year (those beginning replacement, and those paying costs spread over time for past replacement), the cost in that year, and the present value of that cost in current dollars. However, we do not assess costs in perpetuity, but only account for the initial 20-year horizon. This means that, even though facilities replacing tanks and piping after 2013 are not done paying off the tanks and piping in 2031, for consistent comparisons, Ecology did not consider payments made after 2031.

Table 4: Present Value Costs for Replacing Single-Walled Tanks and Piping with Double-Walled Tanks and Piping

Year	Number of Tanks and Piping Affected	Cost	Present Value Cost
2012	236	$245,696	$245,696
2013	472	$491,392	$483,749
2014	708	$737,088	$714,337
2015	944	$982,784	$937,634
2016	1,180	$1,228,480	$1,153,813
2017	1,416	$1,474,176	$1,363,039
2018	1,652	$1,719,872	$1,565,478
2019	1,888	$1,965,568	$1,761,289
2020	2,124	$2,211,264	$1,950,630
2021	2,360	$2,456,960	$2,133,655
2022	2,596	$2,702,656	$2,310,515
2023	2,832	$2,948,352	$2,481,356
2024	3,068	$3,194,048	$2,646,324
2025	3,304	$3,439,744	$2,805,559
2026	3,540	$3,685,441	$2,959,201
2027	3,776	$3,931,137	$3,107,385
2028	4,012	$4,176,833	$3,250,242
2029	4,248	$4,422,529	$3,387,904
2030	4,484	$4,668,225	$3,520,497
2031	4,720	$4,913,921	$3,648,146
		Total	$42,426,450

Ecology calculated the present value cost as $42.4 million in total present value cost over 20 years, assuming a constant number of tanks and piping. The prospective 116 tanks and piping removed each year are likely to be single-walled tanks and piping that are not replaced, so Ecology did not develop a separate estimate for a decreasing number of tanks and piping.

The adopted rule amendments include:

- Requirements mandated by state and federal law (tanks shall be secondarily contained); and
- Requirements imposed by Ecology under its statutory rule-making authority (to meet secondary containment requirements, tanks must be double-walled).

Ecology could not separate the costs of these two rule components, and so used the total $42.4 million for the overall requirements in the cost-benefit comparison.

Discretion-specific costs

For the secondary containment requirement, Ecology's adopted rule amendments specify that only double-walled tanks and piping are sufficient secondary containment

for tanks and piping. The baseline simply requires secondary containment. This means that the choice Ecology made by requiring a specific form of secondary containment will likely only generate costs as compared to other forms of secondary containment under the baseline.

An alternate form of secondary containment is an external liner with monitoring. Ecology could not acquire reliable cost data on this alternate secondary containment, but is including the comparison qualitatively. The existing UST rule currently requires secondary containment for hazardous substance UST systems, but does not specify which type of secondary containment is required. Nonetheless, all facilities in the state with such systems have chosen to install double-walled tanks and piping.

Ecology has included this assessment qualitatively, and used the quantitative measure for overall program cost calculations. Discretion-specific-based costs are likely significantly lower.

Pipe replacement costs

Under the adopted rule amendments, if more than 50 percent of a piping run is replaced, the entire piping run must be replaced and the piping must be secondarily contained. This requirement is more stringent than the baseline, which reflects the minimum requirements in state and federal law.

This requirement is unlikely to result in additional costs. Ecology assumes that the requirement will not require owners to replace more piping than they otherwise would. This assumption is based on the following:

- For standard systems (such as commercial gas stations), program experience indicates that either a small percentage of a piping run is replaced to repair it or the entire piping run is replaced.
- For non-standard systems (such as at bus barns with extensive piping runs), the adopted rule provides Ecology the discretion to grant exceptions.

The EPA made these same assumptions about the proposed federal rule in its Regulatory Impact Analysis, concluding that pipe replacement thresholds would result in no additional costs, as compared to the baseline.

3.4.3 Under-dispenser containment costs

Program costs

Following EPA methodology in its Regulatory Impact analysis of a proposed federal UST rule (US EPA, 2011a and 2011b) and data from the Ecology UST database (WA Ecology 2012a), Ecology developed unit cost assumptions for under-dispenser containment. Ecology's assumptions included:

- 3,602 facilities in WA State, 2.65 tanks per facility, for 9,545 total tanks.
- There are 2 dispensers per tank.

- Installing under-dispenser containment under one dispenser costs $2,017, and therefore installation costs per tank are $4,034 per tank. This assumption requires implicit assumptions:
    - Either all dispensers at a tank have under-dispenser containment, or none do.
    - Facilities will replace all their dispensers at one time.

Ecology calculated primary costs for two mid-range scenarios, based on:

- 35 percent of dispensers do not have under-dispenser containment, and 60 percent of those dispensers without containment will be replaced over the next 20 years.
- 35 percent of dispensers do not have under-dispenser containment, and 100 percent of those dispensers without containment will be replaced over the next 20 years.

Ecology amortized the cost of under-dispenser containment over 20 years. This resulted in an annual per-tank cost of $235, or $118 per dispenser.

Across the two scenarios, Ecology estimated total costs over 20 years of $4.1 million – $6.8 million.

Scenario 1

Ecology assumed 21 percent of all current operational or temporarily closed tanks were affected, based on 35 percent of tanks with dispensers lacking under-dispenser containment, and 60 percent of those dispensers without containment being replaced over 20 years. Ecology calculated this would mean approximately 2000 tanks will replace their dispensers over 20 years, at a rate of 100 tanks per year. Table 5 summarizes the cost calculation for this scenario.

Table 5: Under-Dispenser Containment Costs (low)

Year	Number of Dispensers Affected	Cost	Present Value
2012	200	$23,682	$23,682
2013	400	$47,364	$46,627
2014	600	$71,046	$68,853
2015	800	$94,728	$90,376
2016	1,000	$118,410	$111,213
2017	1,200	$142,092	$131,380
2018	1,400	$165,774	$150,893
2019	1,600	$189,456	$169,766
2020	1,800	$213,138	$188,017
2021	2,000	$236,820	$205,658
2022	2,200	$260,502	$222,705
2023	2,400	$284,185	$239,172
2024	2,600	$307,867	$255,073

2025	2,800	$331,549	$270,421
2026	3,000	$355,231	$285,230
2027	3,200	$378,913	$299,513
2028	3,400	$402,595	$313,283
2029	3,600	$426,277	$326,552
2030	3,800	$449,959	$339,332
2031	4,000	$473,641	$351,636
		Total	$4,089,382

Scenario 2

Ecology assumed 35 percent of all current operational or temporarily closed tanks were affected, based on 35 percent of tanks with dispensers lacking under-dispenser containment, and 100 percent of those dispensers without containment being replaced over 20 years. Ecology calculated this would mean approximately 3,340 tanks will replace their dispensers over 20 years, at a rate of 167 tanks per year. Table 6 summarizes the cost calculation for this scenario.

Table 6: Under-Dispenser Containment Costs (high)

Year	Number of Dispensers Affected	Cost	Present Value
2012	334	$39,549	$39,549
2013	668	$79,098	$77,868
2014	1002	$118,647	$114,985
2015	1336	$158,196	$150,929
2016	1670	$197,745	$185,726
2017	2004	$237,294	$219,405
2018	2338	$276,843	$251,991
2019	2672	$316,392	$283,510
2020	3006	$355,941	$313,988
2021	3340	$395,490	$343,449
2022	3674	$435,039	$371,917
2023	4008	$474,588	$399,417
2024	4342	$514,137	$425,971
2025	4676	$553,686	$451,603
2026	5010	$593,235	$476,334
2027	5344	$632,784	$500,187
2028	5678	$672,333	$523,183
2029	6012	$711,882	$545,342
2030	6346	$751,431	$566,685
2031	6680	$790,980	$587,232
		Total	$6,829,269

Discretion-specific cost

As discussed in Section 3.1 above, many of the adopted changes to the UST program are mandated by state and federal law, and therefore are not within Ecology's discretion. Those changes within Ecology's discretion are analyzed below.

However, because Ecology could not quantify the portion of the program costs attributable only to its discretion, Ecology used identical program and discretion-specific costs for under-dispenser containment, understanding that actual discretion-based costs were likely lower.

Applicability of under-dispenser containment

Under the federal grant guidelines, under-dispenser containment is required only when an entire dispenser system is installed or replaced. Under its statutory rule-making authority, Ecology is also requiring under-dispenser containment:

- When only a dispenser is replaced (as opposed to the whole dispenser system).
- When only underground piping is installed or replaced (not the dispenser system connected to the piping).

However, of the total number of dispenser systems affected by the adopted rule amendments, Ecology could not distinguish how many would be affected by each of the different applicability provisions. Therefore, Ecology could not quantify the portion of the program costs attributable only to Ecology's discretion.

Performance standards for under-dispenser containment

Under the federal grant guidelines, under-dispenser containment (UDC) must meet several performance standards. One of those standards requires UDC to allow for visual inspection and access to the components in the containment system and/or be monitored. However, the guidelines do not require visual inspections of the containment system or specify how monitoring must be performed. In the proposed federal rule amendments (US EPA, 2001), EPA proposed establishing requirements for inspections and monitoring. But those proposals have not yet been adopted.

To meet the minimum requirements in the federal grant guidelines, Ecology decided to always require accessibility to the components in the containment system. While UDC may be monitored, monitoring is not required and may not be used in place of providing accessibility. Ecology does not believe this decision will impact the cost of compliance because providing accessibility is the least-burdensome alternative.

However, Ecology could not distinguish how much of the total estimated cost of under-dispenser containment is attributable to this performance standard. Further, Ecology could not distinguish between the cost of providing accessibility and the

cost of monitoring. Therefore, Ecology could not quantify the portion of the program costs attributable only to its discretion.

3.4 Total expected costs

Ecology estimated present value compliance costs over 20 years for overall program components, as well as for those areas of the program over which Ecology had discretion. Both sets of costs were estimated because there are areas in which the costs and benefits of overall parts of the UST program are not separable from the costs and benefits of specific Ecology-discretion components with a high degree of certainty in the estimates.

Table 7 below shows estimated total costs.

Table 7: Estimated Compliance Costs Summary (millions of $)

	Program Cost	**Discretion-Specific Cost (subset of program cost)***
Operator Training	$8.50	$0.21
Delayed Training Deadline	-$0.005	-$0.005
Longer Allowed Training Time	-$0.001	-$0.001
Secondary Containment of Tanks and Pipes	$42.40	$42.40
Under-Dispenser Containment	$6.83	$6.83
Avoided Operator Training Costs • Designation to more than one operator class • Merging Class A and Class B operator training • Reciprocity for out-of-state training • Acceptance of prior in-state training • Avoided reporting costs	(qualitative cost reductions)	
Emergency Response and Signage • Presence of trained operators at manned facilities • Emergency signage at all facilities	(qualitative costs)	
TOTAL QUANTIFIABLE COSTS	**$57.72**	**$49.43**

*The Discretion-Specific Cost is Ecology's best attempt to quantify the costs associated only with Ecology's discretion (that is, those requirements not mandated by state or federal law). Where quantifying those costs was not possible, then the total program cost was used. It is a likely an overestimate of actual costs associated only with Ecology's discretion in this rulemaking.

CHAPTER 4: Likely Benefits of Adopted Rule Amendments

4.1 Introduction

Ecology analyzed the benefits of the adopted rule amendments compared to the baseline. These benefits are based on the adopted rule amendments' ability to reduce both the frequency and duration of releases of toxic substances to soils and groundwater. By reducing the number and duration of releases through operator training, secondary containment, and under-dispenser containment, Ecology expects the rule to benefit property owners, tank facility operators, and public and environmental health. To the extent possible, Ecology has quantified these impacts, and has otherwise described them qualitatively to include in overall assessment in benefits of the adopted rule amendments.

In some cases, the adopted rule amendments are mandated by law, but the specifics of how to administer them were determined by Ecology. For example, the law requires Ecology to have an operator training program, but Ecology decided to require that all Class C operators – not just one – be designated and trained.

However, Ecology was unable to separate the likely benefits of the adopted rule amendments into those mandated by law and those required by Ecology exercising its discretion under the law. Ecology could not, for example, quantify the benefits of its requirement that all Class C operators – not just one – be designated and trained. This chapter, therefore, only estimates the benefits of the overall program requirements.

To retain the ability to compare costs and benefits of the adopted rule amendments, Ecology has estimated the total costs and benefits of the program. Where it could, Ecology also estimated the subset of those costs (although not benefits) attributable to Ecology's exercise of discretion under the law to illustrate to the public the impacts of Ecology's decisions.

4.2 Affected parties

Ecology expects the adopted rule amendments to result in reduced quantity and duration of releases of toxic substances from USTs. This is likely to generate benefits in reduced:

- Property value impacts to owners of properties with USTs.
- Property value impacts to owners of properties adjacent to those with USTs.
- Cleanup costs to owners of properties with USTs.
- UST operator liability and insurance for releases.
- Product loss.
- Groundwater contamination.
- Vapor intrusion.

These benefits indicate the affected parties likely to experience positive impacts from the adopted rule amendments include:

- UST property owners.
- Owners of properties adjacent to properties with USTs.
- Communities surrounding and/or sharing groundwater with properties with USTs.

4.3 Forecasting the number of affected parties

To estimate quantifiable benefits, Ecology forecast the number of affected parties indirectly by forecasting the baseline number of likely releases in the next 20 years, and then using reasonable assumptions to determine how much those future releases would be reduced under the adopted rule amendments.

Ecology assumed conservatively that each release would occur on a different UST facility. Ecology extrapolated from estimates in the EPA Regulatory Impact Analysis (and associated appendices), the percentage reductions based on EPA expert responses due to operator training, secondary containment, and under-dispenser containment. Ecology used percentages of facilities and tanks and piping affected by each set of requirements as based on the adopted rule amendments for the state.

4.3.1 Operator training and avoided releases

For operator training, Ecology used EPA's Regulatory Impact Analysis expert survey data (US EPA, 2012b) to recalculate the percentage reductions in overall releases and certain release types under the adopted rule amendments. Data was not available to perform estimation based on only those components over which Ecology had discretion, so Ecology performed this analysis for overall program components of operator training, secondary containment, and under-dispenser containment. In the cost analysis (Chapter 3) Ecology has also provided estimates in these contexts for comparability.

For operator training, Ecology assumed 100 percent of facilities would be affected (to correspond to the cost analysis in Chapter 3), and that training would affect frequency of releases from piping, dispensers, tanks, and delivery problems. (Ecology did not quantitatively estimate the beneficial impacts of reductions in the duration or size of releases, but did include that information qualitatively in its analysis.) EPA experts with applicable response interpretations indicated an average reduction in frequency of releases due to operator training of 16.7 percent.

Based on EPA survey data of 500 releases, Ecology determined that piping-related releases are 31 percent of all releases. Of these, 45 percent are to soil and 55 percent are to water. Ecology calculated further from the data the percentages of all releases in large and small quantities to soil or water from piping systems. Ecology also calculated the impact of a 16.7 percent reduction in these releases due to operator training. These data are presented in Table 8.

Table 8: Piping Releases and Operator Training

	Percentage of All Releases	Percent Reduction in All Releases due to Operator Training
Piping Releases to Local Soil	12.56	2.10
Piping Releases to Large Area Soil	2.95	0.49
Piping Releases to Local Water	6.82	1.14
Piping Releases to Large Area Water	10.23	1.71

From the EPA data, Ecology determined that dispenser-related releases are 32 percent of all releases. Of these, 77 percent are to soil and 23 percent are to water. Ecology calculated further from the data the percentages of all releases in large and small quantities to soil or water from dispensers. Ecology also calculated the impact of a 16.7 percent reduction in these releases due to operator training. These data are presented in Table 9.

Table 9: Dispenser Releases and Operator Training

	Percentage of All Releases	Percent Reduction in All Releases due to Operator Training
Dispenser Releases to Local Soil	22.91	3.83
Dispenser Releases to Large Area Soil	1.73	0.29
Dispenser Releases to Local Water	3.1	0.52
Dispenser Releases to Large Area Water	4.26	0.71

From the EPA data, Ecology determined that tank-related releases are 16 percent of all releases. Of these, 48 percent are to soil and 52 percent are to water. Ecology calculated further from the data the percentages of all releases in large and small quantities to soil or water from tanks. Ecology also calculated the impact of a 16.7 percent reduction in these releases due to operator training. These data are presented in Table 10.

Table 10: Tank Releases and Operator Training

	Percentage of All Releases	Percent Reduction in All Releases due to Operator Training
Tank Releases to Local Soil	4.91	0.82
Tank Releases to Large Area Soil	2.77	0.46
Tank Releases to Local Water	2.83	0.47
Tank Releases to Large Area Water	5.49	0.92

From the EPA data, Ecology determined that delivery problem-related releases are 16 percent[1] of all releases. Of these, 61 percent are to soil and 39 percent to water. Ecology calculated further from the data the percentages of all releases in large and small quantities to soil or water from delivery problems. Ecology also calculated the impact of a 16.7 percent reduction in these releases due to operator training. These data are presented in Table 11.

Table 11: Delivery Problem Releases and Operator Training

	Percentage of All Releases	**Percent Reduction in All Releases due to Operator Training**
Delivery Problem Releases to Local Soil	9.47	1.58
Delivery Problem Releases to Large Area Soil	0.29	0.05
Delivery Problem Releases to Local Water	2.69	0.45
Delivery Problem Releases to Large Area Water	3.55	0.59

Combining operator training reductions in releases from piping, dispensers, tanks, and delivery problems, Ecology calculated overall impacts of operator training on local and large releases to soil and water. Table 12 summarizes these results by size and media type, and by release location.

Table 12: Percentage Release Reductions due to Operator Training, by Source

	Local Soil	**Large Area Soil**	**Local Water**	**Large Area Water**	**TOTAL**
Piping	2.10	0.49	1.14	1.71	**5.44**
Dispenser	3.83	0.29	0.52	0.71	**5.35**
Tanks	0.82	0.46	0.47	0.92	**2.67**
Delivery Problems	1.58	0.05	0.45	0.59	**2.67**
TOTAL	**8.33**	**1.29**	**2.58**	**3.91**	**4.48***

*Weighted total, accounting for percentage of total releases from each release source.

4.3.2 Secondary tank and piping containment and avoided releases

For secondary containment of tanks and piping, Ecology assumed 49 percent of tanks and piping would be affected (to correspond to the cost analysis in Chapter 3; data from WA Ecology, 2012a), and that secondary containment would affect frequency of releases from tanks and piping. EPA experts with applicable response interpretations indicated an average reduction in frequency of releases due to secondary containment of 22.3 percent.

From the EPA data, Ecology determined that tank-related releases are 16 percent of all releases. Of these, 48 percent are to soil and 52 percent are to water. Ecology calculated further from the data the percentages of all releases in large and small quantities to soil or

[1] The types of releases do not sum to 100% – this is because we did not include releases due to the Submersible Turbine Pump (STP) area in our analysis.

water from tanks. Ecology also calculated the impact of a 22.3 percent reduction in these releases due to secondary containment and the impact of applying this reduction to 49 percent of tanks. These data are presented in Table 13.

Table 13: Tank Releases and Secondary Containment

	Percentage of All Releases	Percent Reduction in All Releases due to Secondary Containment	Percent Reduction in All Releases due to 49% Secondary Containment
Tank Releases to Local Soil	4.91	1.09	0.54
Tank Releases to Large Area Soil	2.77	0.62	0.30
Tank Releases to Local Water	2.83	0.63	0.31
Tank Releases to Large Area Water	5.49	1.22	0.60

From the EPA data, Ecology determined that piping-related releases are 31 percent of all releases. Of these, 45 percent are to soil and 55 percent are to water. Ecology calculated further from the data the percentages of all releases in large and small quantities to soil or water from piping. Ecology also calculated the impact of a 22.3 percent reduction in these releases due to secondary containment and the impact of applying this reduction to 49 percent of piping. These data are presented in Table 14.

Table 14: Piping Releases and Secondary Containment

	Percentage of All Releases	Percent Reduction in All Releases due to Secondary Containment	Percent Reduction in All Releases due to 49% Secondary Containment
Piping Releases to Local Soil	12.56	2.80	1.37
Piping Releases to Large Area Soil	2.95	0.66	0.32
Piping Releases to Local Water	6.82	1.52	0.74
Piping Releases to Large Area Water	10.23	2.28	1.12

Table 15 summarizes the percent reductions in total releases occurring to various media and from tank and piping sources.

Table 15: Percentage Release Reductions due to Secondary Tank and Piping Containment, by Source

	Local Soil	Large Area Soil	Local Water	Large Area Water	TOTAL
Piping	0.54	0.30	0.31	0.60	**1.75**
Tanks	1.37	0.32	0.74	1.12	**3.55**
TOTAL	**1.91**	**0.62**	**1.05**	**1.72**	**2.36***

*Weighted total, accounting for percentage of total releases from each leak source.

4.3.3 Under-dispenser containment and avoided releases

For under-dispenser containment, Ecology assumed 35 percent of tanks would be affected (to correspond to the cost analysis in Chapter 3), and that under-dispenser containment would affect frequency of releases from only dispensers. EPA experts with applicable response interpretations indicated an average reduction in frequency of releases due to under-dispenser containment of 36.7 percent.

From the EPA data, Ecology determined that dispenser-related releases are 32 percent of all releases. Of these, 77 percent are to soil and 23 percent are to water. Ecology calculated further from the data the percentages of all releases in large and small quantities to soil or water from dispensers. Ecology also calculated the impact of a 36.7 percent reduction in these releases due to under-dispenser containment and the impact of applying this reduction to 35 percent of tanks. These data are presented in Table 16.

Table 16: Dispenser Releases and Under-Dispenser Containment

	Percentage of All Releases	Percent Reduction in All Releases due to Under-Dispenser Containment	Percent Reduction in All Releases due to 36.7% Under-Dispenser Containment
Dispenser Releases to Local Soil	22.91	8.41	2.94
Dispenser Releases to Large Area Soil	1.73	0.63	0.22
Dispenser Releases to Local Water	3.1	1.14	0.40
Dispenser Releases to Large Area Water	4.26	1.56	0.55

4.3.4 Summary of avoided release percentages

Ecology summarized percentage reductions in releases due to operator training, secondary containment, and under-dispenser containment in Table 17.

Table 17: Likely Percentage Reductions in Releases due to Adopted Rule Amendments

	% Avoided Releases to Local Soil	% Avoided Releases to Large Soil	% Avoided Releases to Local Water	% Avoided Releases to Large Water	TOTAL
Operator Training	8.33	1.29	2.58	3.91	4.48
Secondary Tank Containment	1.91	0.62	1.05	1.72	2.36
Under-Dispenser Containment	2.94	0.22	0.40	0.55	4.11
TOTAL	**13.18**	**2.13**	**4.03**	**6.18**	**10.95**

Ecology also extrapolated from this data that the adopted rule amendments are likely to result in a reduction of 0.10 percent of total releases as purely a reduction in large releases to soil, and a 4.42 percent reduction due to small ones. Similarly, Ecology extrapolated that the adopted rule amendments are likely to result in a reduction of 1.07 percent of total releases as purely a reduction in large releases to water, and a 0.45 percent reduction due to small ones.

4.3.5 Reduced releases in each forecast year

Ecology then applied these percentage reductions to the total releases forecast in Section 3.3.1. This calculation gave Ecology the number of avoided releases over the 20-year period under the adopted rule, in total quantity, and specific to small and large releases to soils and water.

The number of expected releases avoided each year in these categories is presented in Table 18. This calculation assumes that reductions in releases occur uniformly over time.

Table 18: Forecast Avoided Releases under Adopted Rule Amendments

Year	Forecast New Releases	Avoided Small Soil Releases	Avoided Large Soil Releases	Avoided Small Water Releases	Avoided Large Water Releases	Total Avoided Releases
2012	37	4.88	0.79	1.49	2.29	9.44
2013	35	4.61	0.75	1.41	2.16	8.93
2014	33	4.35	0.70	1.33	2.04	8.42
2015	31	4.09	0.66	1.25	1.92	7.91
2016	29	3.82	0.62	1.17	1.79	7.40
2017	28	3.69	0.60	1.13	1.73	7.15
2018	27	3.56	0.58	1.09	1.67	6.89
2019	26	3.43	0.55	1.05	1.61	6.64
2020	25	3.30	0.53	1.01	1.55	6.38
2021	24	3.16	0.51	0.97	1.48	6.12
2022	23	3.03	0.49	0.93	1.42	5.87
2023	23	3.03	0.49	0.93	1.42	5.87
2024	22	2.90	0.47	0.89	1.36	5.61
2025	22	2.90	0.47	0.89	1.36	5.61
2026	22	2.90	0.47	0.89	1.36	5.61
2027	21	2.77	0.45	0.85	1.30	5.36
2028	21	2.77	0.45	0.85	1.30	5.36
2029	21	2.77	0.45	0.85	1.30	5.36
2030	21	2.77	0.45	0.85	1.30	5.36
2031	21	2.77	0.45	0.85	1.30	5.36
TOTAL*	**512**	**67.48**	**10.91**	**20.63**	**31.64**	**130.66**

*Totals may not match summed percentages due to rounding.

4.4 Expected benefits

Ecology expects the adopted rules to result in a reduction in the number of releases, as well as the degree and duration of releases. These results are likely to result in reduced:

- Property value impacts to owners of properties with USTs, and adjacent properties.
- Cleanup costs to owners of properties with USTs.
- UST operator liability and insurance for spills.
- Product loss.
- Vapor intrusion.
- Groundwater contamination.
- Human health and ecological impacts.

Unit prices for avoided cleanup costs were taken from the EPA's Regulatory Impact Analysis for the federal proposed rule, Appendix I, Exhibit 1 (US EPA, 2011a and 2011b).

4.4.1 Reduced impacts to property values

Ecology estimated the adopted rule amendments' impact on avoided property value losses due to contamination based on individual studies and a survey of the literature addressing property value impacts of soil and groundwater contamination. (See: Dotzour, 1997; Patchin, 1994; Simons, Bower, and Sementelli, 1999; Jackson, 2001; Simons and Sementelli, 1997.) Models found reductions in assessed value and sale price resulting from contamination primarily in the range of 28 – 42 percent. All studies asserted some reduction in sales price, and some also found a reduction in financing available for development on commercial property in contaminated areas.

Ecology used assessed commercial property values from the WA Department of Revenue for years 2001 – 2007 (WA DOR, 2002–2008) to determine average property values for four regions in the state (northwest, southwest, central, and east), and weighted them by tank locations, to develop an average statewide property value of $473 thousand per commercial parcel. This value had an average annual growth rate of 3.5 percent. For this analysis, Ecology also assumed that the long-run commercial property market would rebound to an overall growth path, following the recession of 2008.

Ecology used its forecast avoided releases (see Table 18) to estimate the avoided property value loss range each year. Then using the discounted present value of these avoided property value losses, Ecology calculated the 20-year total present value of avoided property value impacts. This exercise is summarized in Table 19. The total avoided present value of property value losses is estimated to be $20.4 million – $30.6 million.

Table 19: Present Value Avoided Property Value Losses

Year	Present Value Total Avoided Property Value Loss (low)	Present Value Total Avoided Property Value Loss (high)
2012	$1,251,514	$1,877,271
2013	$1,206,241	$1,809,362
2014	$1,158,810	$1,738,215
2015	$1,109,154	$1,663,732
2016	$1,057,208	$1,585,812
2017	$1,040,046	$1,560,069
2018	$1,021,858	$1,532,787
2019	$1,002,611	$1,503,916
2020	$982,270	$1,473,406
2021	$960,803	$1,441,205
2022	$938,174	$1,407,260
2023	$955,906	$1,433,859
2024	$931,628	$1,397,441
2025	$949,237	$1,423,855
2026	$967,178	$1,450,768
2027	$940,666	$1,410,999
2028	$958,446	$1,437,668
2029	$976,562	$1,464,842
2030	$995,020	$1,492,530
2031	$1,013,827	$1,520,741
TOTAL	**$20,417,158**	**$30,625,737**

4.4.2 Reduced cleanup costs

Table 20 displays the relevant avoided unit costs from EPA's analysis (US EPA, 2011a and 2011b).

Table 20: Unit Costs for Avoided Cost Calculations

Category		LUST Site Size and Contamination Type			
		Small Soil	Large Soil	Small Groundwater	Large Groundwater
Cleanup -- Administrative Costs		$0	$0	$500	$3,700
Cleanup -- Response Costs		$10,000	$10,000	$10,000	$10,000
Cleanup -- Remediation Costs		$10,000 - $20,000	$56,000 - $150,000	$97,000 - $350,000	$219,000 - $2,500,000
Cleanup -- Oversight Costs		$500	$1,000	$1,500	$5,000
TOTAL CLEANUP	Low	$20,500 - $30,500	$67,000 - $161,000	$109,000 - $362,000	$237,700 - $2,518,700
	High				

Based on the unit costs of cleanup in Table 20, and the avoided releases in Table 18, Ecology calculated the total present value avoided cleanup cost under the adopted rule. Ecology discounted the avoided costs over time by 1.58 percent. The total present value costs over 20 years are summarized in Table 21. The low/high estimates in Table 21 correspond to the low/high estimates for total cleanup in Table 20. The estimated total avoided cleanup costs under the adopted rule are $7.8 million – $59.5 million.

Table 21: Total Avoided Cleanup Costs

	Low	**High**
Small Soil	$904,458	$1,345,656
Large Soil	$477,720	$1,147,954
Small Water	$1,470,451	$4,883,515
Large Water	$4,917,412	$52,105,534
TOTAL	**$7,770,040**	**$59,482,659**

4.4.3 Reduced liability and insurance

Ecology used Zurich Tank Pollution Insurance Underwriting Rules (Yin, 2005) from a leading international environmental damage insurance firm to estimate the impacts of the double-walled tank and piping requirement on insurance rates. Table 22 summarizes the median annual base rates per tank for single-walled and double-walled tanks and piping of different ages.

Table 22: Base Insurance Rates for Single- and Double-Walled Tanks and Piping

Age of Tank (years)	**Median Rate for Single-Walled Tanks and Piping**	**Median Rate for Double-Walled Tanks and Piping**	**Savings with Double-Walled Tanks and Piping**
New	$355	$231	$124
6	$467	$302	$165
11	$684	$385	$299
16	$1,077	$451	$626
21	$1,413	$541	$872
26	$1,789	$541	$1,248
31	$1,995	$631	$1,363
35	$2,109	$707	$1,402

To correspond with the cost analysis, Ecology assumed that of the 49.5 percent of existing tanks and piping that are single-walled, 236 would be replaced with double-walled tanks and piping each year. Ecology multiplied this number of tanks and piping each year by the avoided insurance costs range per tank, and discounted over time to find the present value of avoided insurance costs under the adopted rule amendments. Table 23 summarizes this exercise.

Table 23: Avoided Costs of Insurance Premiums

Year	Tanks and Piping Impacted	Total Insurance Savings (10-year old tanks and piping)	Present Value Total Insurance Savings (10-year old tanks and piping)
2012	236	$55,680	$55,680
2013	472	$213,575	$210,253
2014	708	$320,363	$310,474
2015	944	$427,150	$407,527
2016	1,180	$533,938	$501,485
2017	1,416	$640,725	$592,422
2018	1,652	$1,380,438	$1,256,515
2019	1,888	$1,563,348	$1,400,871
2020	2,124	$1,746,259	$1,540,434
2021	2,360	$1,929,170	$1,675,315
2022	2,596	$2,112,080	$1,805,628
2023	2,832	$3,227,566	$2,716,345
2024	3,068	$3,470,192	$2,875,114
2025	3,304	$3,712,818	$3,028,286
2026	3,540	$3,955,443	$3,175,998
2027	3,776	$4,198,069	$3,318,382
2028	4,012	$6,207,262	$4,830,240
2029	4,248	$6,523,186	$4,997,125
2030	4,484	$6,839,111	$5,157,650
2031	4,720	$7,155,035	$5,311,972
		TOTAL	$45,167,716

Ecology estimated the total present value avoided costs of insurance over 20 years as $45 million. Ecology could not confidently determine the initial age distribution specific to the tanks likely to be replaced over the next 20 years, and so made the simplifying assumption that tanks and piping were 10 years old at the beginning of the 20-year period, and then adjusted premiums as the remaining un-replaced tanks and piping aged.[2]

[2] Assuming an initial 10-year tank age among tanks likely to be replaced (single-walled tanks), Ecology used the insurance differential for tanks as they age, and as they're replaced, taking the baseline as paying insurance on single-walled tanks as they age. So, for the first three years of the adopted rule requirements:

In year 1, avoided cost = 236 * insurance differential for new double-walled tank vs. ten year old single-walled tank.

In year 2, avoided cost = 236 * insurance differential for new double-walled tank vs. 11 year old single-walled tank + 236 * insurance differential for a 1 year old double-walled tank vs. 11 year old single-walled tank

In year 3, avoided cost = 236 * insurance differential for new double-walled v. 12 year old single-walled + 236 * insurance differential for 1 year old double-walled v. 12 year old single-walled + 236 * 2 year old double-walled vs. 12 year old single-walled.

4.4.4 Reduced product loss

Based on the avoided releases in Table 18, Ecology calculated the total present value avoided product loss costs under the adopted rule. Ecology used a per-release cost range of $130 – $4,539. This range is based on the lower and upper bounds of 33 and 1,152 gallons per release, respectively, from the EPA's regulatory impact analysis (US EPA, 2011a and 2011b). Ecology used a state average gas price of $3.94 per gallon (AAA, 2012).

Ecology discounted the avoided costs over time by 1.58 percent. The total present value costs over 20 years under the adopted rule are $14.9 thousand – $521.5 thousand.

4.4.5 Reduced vapor intrusion

Based on the avoided releases in Table 18, Ecology calculated the total present value avoided vapor intrusion costs under the adopted rule. Using the EPA's assumptions, Ecology assumed a per-release cost of $27 – 52 thousand, in remediation costs. These costs are based on 1 percent and 10 percent of releases involving vapor intrusion, respectively, and information provided to the EPA by New Hampshire regarding costs of vapor intrusion remediation (US EPA, 2011a and 2011b).

Ecology discounted the avoided costs over time by 1.58 percent. The total present value costs over 20 years under the adopted rule are $31.0 thousand – $597.5 thousand.

4.4.6 Reduced groundwater contamination

Based on a survey of the economic literature (in Hardisty and Özdemiroglu, 2005) on the value of avoiding groundwater contamination, Ecology calculated the total present value of reduced groundwater contamination under the adopted rule. Of those analyses that estimated an annual value of willingness to pay to prevent groundwater contamination, and especially to keep groundwater safe for drinking, the median willingness to pay is estimated to be $571 per household, per year. The willingness to pay is a reflection of the value of avoiding prospective harm coming from groundwater contamination. As it is largely subjective, this valuation may also involve perceived replacement cost of clean groundwater as well.

Using our estimate of large UST releases to water avoided each year, Ecology calculated the annual and present value of the avoided releases, in terms of what households are willing to pay to avoid them.

Ecology made the highly conservative simplifying assumption that releases to groundwater affected Group A (15 or more connections) or Group B (2-14 connections) wells. Ecology also assumed that at least one well was impacted by each avoided large groundwater release. Ecology could not determine the degree to which more than one well might be affected. Ecology also conservatively assumed that households were only willing to pay to prevent groundwater contamination that affected them.

The results of Ecology's estimation are presented in Table 24. The low estimate corresponds to Group B wells (2 connections), and the high estimate corresponds to Group A wells (15 connections). The conservative present value willingness to pay to avoid the large groundwater releases that Ecology forecast to be avoided under the adopted rule amendments is $53.0 thousand - $397.6 thousand.

Table 24: Forecast Avoided Groundwater Contamination Value Loss

Year	Forecast Avoided Large Water Releases	Low Households Impacted	High Households Impacted	Low Present Value Willingness to Pay	High Present Value Willingness to Pay
2012	2.29	4.57	34.30	$5,971	$44,782
2013	2.16	4.33	32.45	$5,260	$39,449
2014	2.04	4.08	30.59	$4,603	$34,524
2015	1.92	3.83	28.74	$3,999	$29,992
2016	1.79	3.58	26.88	$3,445	$25,839
2017	1.73	3.46	25.96	$3,162	$23,713
2018	1.67	3.34	25.03	$2,894	$21,706
2019	1.61	3.21	24.10	$2,642	$19,815
2020	1.55	3.09	23.18	$2,405	$18,035
2021	1.48	2.97	22.25	$2,182	$16,363
2022	1.42	2.84	21.32	$1,972	$14,794
2023	1.42	2.84	21.32	$1,942	$14,564
2024	1.36	2.72	20.39	$1,749	$13,118
2025	1.36	2.72	20.39	$1,722	$12,913
2026	1.36	2.72	20.39	$1,695	$12,713
2027	1.30	2.60	19.47	$1,520	$11,403
2028	1.30	2.60	19.47	$1,497	$11,226
2029	1.30	2.60	19.47	$1,473	$11,051
2030	1.30	2.60	19.47	$1,451	$10,879
2031	1.30	2.60	19.47	$1,428	$10,710
			TOTAL	$53,011	$397,586

4.4.7 Reduced human health impacts

Reduced releases of toxic chemicals such as benzene (in gasoline) are likely to also benefit the public and the environment through reduced incremental increases in cancer and non-cancer risks to people, and risks to animal and plant populations. This is why there are higher insurance rates for tanks and piping with higher likelihood of leaks, why developers and lenders are less willing to do business or develop on contaminated land, and why people hold value in avoiding groundwater contamination; releases can be harmful to human and environmental health.

Ecology expects the adopted rule amendments to benefit human health through avoided exposure to harmful vapors (especially to employees at UST facilities), and through avoided exposure to contaminated soils and waters affected by releases.

In all, Ecology expects the adopted rule amendments to reduce human exposure to hazardous substances, thereby reducing both cancer and non-cancer illnesses. Non-cancer impacts of toxic substances might include developmental, endocrine, immune, and neurological impacts, deformity, and reproductive harm. All of these are likely to be avoided to some degree under the adopted rule amendments. These in turn will affect individual health care costs and decreased business productivity from diminished human capital.

In Section 4.4.6, Ecology quantitatively estimated the specific benefit of avoiding ground water contamination cause by large releases. That estimate is included in the total quantifiable benefits.

Ecology also attempted to quantitatively estimate the specific benefit of avoiding cancer illnesses. To do so, Ecology used the EPA's assumptions (US EPA, 2011a and 2011b) of mid-size releases and durations of release, and the associated cancer risk increases of between 32 cases in one-billion releases and 17 cases in 100-million releases.[3] Ecology also used the EPA's assumption of 20-year cancer latency (a 20-year delay in developing cancer after exposure). Ecology applied these increased cancer risks, multiplied by the forecast number of avoided large water releases in Table 18 (US EPA, 2011c), to calculate the avoided cases of cancer resulting from exposure to benzene in each year. The avoided cancers ranged between 1 millionth of a cancer case and 5 millionths of a cancer case, total over 20 years.

The value of statistical life (VSL) is an extrapolated measure used to estimate the value of avoiding a 100 percent risk of death. It is calculated by analyzing valuations people have for reducing mortality risks at lower levels (e.g., the willingness to pay for preventative medicine, or to live in healthier conditions), or for accepting increases in mortality risk (e.g., the differential in pay required to hire someone to have a more dangerous job), and then extrapolating the value of completely avoiding risk of death. Depending on the means of death, when it occurs, and any associated illness or stigma, the VSL can vary greatly. Ecology uses a range of $4 – 11 million per statistical life, to reflect the range in the literature.

Ecology multiplied the number of avoided cancer deaths in each year by the VSL to find the value of avoided cancers in each year, by assuming each avoided cancer case would have been fatal. After discounting by 1.58 percent in each year, and summing over 20 years, Ecology estimated that avoided benzene exposure resulting in cancer death would be worth $4 – $52.

[3] These estimates have changed from the Preliminary Cost-Benefit Analysis: Ecology Publication no. 12-09-043. This is due to a misunderstanding of the cancer risks cited from the EPA document. In the Preliminary Cost-Benefit Analysis, they were mistakenly used as incremental risks as a function of the population affected. This is inaccurate and has been corrected. As stated above, they are the incremental risks per release. The population affected per release is implicitly assumed in the cited cancer risk increases of 32 cases in one-billion releases, and 17 cases in 100-million releases.

The above estimate conservatively assumes that baseline cleanup requirements eliminate all exposure from a release immediately upon discovery. While the estimate does not account for the impact of large-scale releases (greater than 5,000 gallons), the impact of such releases is already accounted for in Section 4.4.6 – part of a household's willingness to pay for clean drinking water is to avoid cancer risk. Willingness to pay could also include the value of avoiding other perceived risks of contaminated groundwater, including non-cancer illness and environmental impacts. The estimate of avoided cancer risk is not included in the total quantifiable benefits.

4.4.8 Avoided ecological impacts

Much like avoided human health impacts, Ecology expects the adopted rule amendments to benefit animals and the environment in ways similar to the benefits to the human population. The adopted rule will likely reduce releases, and thereby reduce any harm that would have come to animals and the environment from carcinogens and non-carcinogenic hazardous substances. This might include cancer, reproductive, deformity, or mortality impacts in animal populations, or dysfunction or death of plant populations, or both.

4.5 Total expected benefits

Ecology estimated total present value benefits of the adopted rule amendments, in both quantitative and qualitative forms. Ecology quantified those values it could estimate with a high enough degree of certainty or with highly conservative assumptions to relieve uncertainty associated with less conservative assumptions. Table 25 summarizes the range of benefits Ecology estimated for the adopted rule amendments.

Table 25: Total Quantified Benefits Estimated for the Adopted Rule

Benefit	Low Estimate	High Estimate
Avoided Property Value Losses	$20,417,158	$30,625,737
Avoided Cleanup Costs	$7,770,040	$59,482,659
Reduced Insurance Rates	$45,167,716	$45,167,716
Reduced Product Loss	$14,900	$521,500
Reduced Vapor Intrusion	$31,022	$597,460
Reduced Groundwater Contamination	$53,011	$397,586
Avoided Human Health Impacts	(qualitative)	
Avoided Ecological Impacts	(qualitative)	
TOTAL QUANTIFIABLE BENEFITS	**$73,453,851**	**$136,792,710**

The total quantifiable estimated present value benefits of the adopted rule are approximately $74 million – $137 million. In addition, reduced releases of hazardous substances are likely to reduce human health impacts and ecological impacts to some degree, but Ecology could not confidently quantify these values.

This estimated benefits range is based on the total benefits of the adopted rule amendments (the program), irrespective of whether the requirements were mandated by law or were within Ecology's rulemaking discretion. Ecology was unable to separate the total benefits of

the adopted rule amendments into those mandated by law and those required by Ecology under its legal discretion.

Ecology estimated both costs and benefits in this fashion to have comparable contexts in which to compare cost and benefit estimates. If Ecology had compared costs and benefits coming from different parts of the adopted rule amendments, it would have been comparing apples to oranges, and could not meaningfully address the net benefits (benefits minus costs) of the amendments. In Chapter 3, where possible, Ecology identified the cost subsets for which it could quantify the costs specifically associated with Ecology's discretion. This illustrative information should give the public an additional degree of understanding of the proportion of benefits also due to those discretionary requirements, assuming a linear relationship.

CHAPTER 5: Cost-Benefit Comparison and Conclusions

5.1 Introduction

As discussed in Chapter 1, the Washington Administrative Procedure Act (RCW 34.05.328) requires Ecology to evaluate significant legislative rules to "[d]etermine that the probable benefits of the rule are greater than its probable costs, taking into account both the qualitative and quantitative benefits and costs and the specific directives of the statute being implemented."

5.2 Estimated costs

As described in Chapter 3, Ecology estimated the following costs associated with the adopted rule amendments. These costs are in present value terms, over 20 years.

Ecology calculated costs and benefits based on the overall program requirements that are different from the baseline, even if Ecology had little discretion in them, because (especially for benefits) the components of the adopted rule amendments in which Ecology had discretion were not necessarily separable from the overall program requirements. The Table 26 below reflects these different cost calculations.

Table 26: Estimated Compliance Costs Summary (millions of $)

	Program Cost	**Discretion-Specific Cost (subset of program cost)***
Operator Training	$8.50	$0.21
Delayed Training Deadline	-$0.005	-$0.005
Longer Allowed Training Time	-$0.001	-$0.001
Secondary Containment of Tanks and Pipes	$42.40	$42.40
Under-Dispenser Containment	$6.83	$6.83
Avoided Operator Training Costs • Designation to more than one operator class • Merging Class A and Class B operator training • Reciprocity for out-of-state training • Acceptance of prior in-state training • Avoided reporting costs	(qualitative cost reductions)	
Emergency Response and Signage • Presence of trained operators at manned facilities • Emergency signage at all facilities	(qualitative costs)	
TOTAL QUANTIFIABLE COSTS	**$57.72**	**$49.43**

*The Discretion-Specific Cost is Ecology's best attempt to quantify the costs associated only with Ecology's discretion (that is, those requirements not mandated by state or federal law). Where quantifying those costs was not possible, then the total program cost was used. It is a likely an overestimate of actual costs associated only

with Ecology's discretion in this rulemaking.

5.3 Estimated benefits

As described in Chapter 4, Ecology estimated the following benefits associated with the adopted rule amendments. These benefits are in present value terms, over 20 years.

Table 27: Total Quantified Benefits Estimated for the Adopted Rule (millions of $)

Benefit	Low Estimate	High Estimate
Avoided Property Value Losses	$20.4	$30.6
Avoided Cleanup Costs	$7.8	$59.5
Reduced Insurance Rates	$45.2	$45.2
Reduced Product Loss	$0.015	$0.522
Reduced Vapor Intrusion	$0.003	$0.597
Reduced Groundwater Contamination	$0.053	$0.398
Avoided Human Health Impacts	(qualitative)	
Avoided Ecological Impacts	(qualitative)	
TOTAL QUANTIFIABLE BENEFITS	**$73.5**	**$136.8**

5.4 Final comments and conclusion

Based on qualitative and quantitative assessment of the likely costs and benefits, Ecology concludes that there is reasonable likelihood that estimated benefits of the adopted rule amendments exceed their costs. The present value of the total quantifiable costs is less than the present value of the low estimate of the total quantifiable benefits. There is also an unquantifiable benefit of avoided exposure and increased risk of negative ecological and human health impacts that would otherwise result from releases of hazardous substances to soil and groundwater.

CHAPTER 6: Least Burdensome Alternative Analysis

RCW 34.05.328(1)(d) requires Ecology to "…[d]etermine, after considering alternative versions of the rule and the analysis required under (b) and (c) of this subsection, that the rule being adopted is the least burdensome alternative for those required to comply with it that will achieve the general goals and specific objectives stated under (a) of this subsection."

Ecology assessed alternatives to the adopted rule amendments, and determined whether they met the general goals and specific objectives of the authorizing statute. Of those that would meet these objectives, Ecology determined whether the adopted rule amendments were the least burdensome.

The authorizing statute is Chapter 90.76 RCW, Underground Storage Tanks, as amended by Substitute Senate Bill 5475 in 2007. This state law requires the UST rule to be at least as stringent as the applicable federal law and restricts some of the discretion allowed under federal law.

The applicable federal law is the Underground Storage Tank Compliance Act of 2005 (42 U.S.C. Sec. 15801 et seq., Energy Policy Act of 2005, P.L. 109-58, Title XV, subtitle B). That law amended Subtitle I of the Solid Waste Disposal Act (42 U.S.C. Chapter 82, Subchapter IX). The federal law requires compliance with the federal grant guidelines established by the U.S. Environmental Protection Agency (EPA).

6.1 Operator training

To limit the burden of the federal requirements, Ecology assessed and is adopting the following alternatives as part of the adopted rule amendments.

6.1.1 Multiple instead of individual class designations

The federal grant guidelines require that at least one Class A, Class B, and Class C operator be designated for each UST system or group of systems at an UST facility. To limit the burden of this requirement on businesses, Ecology is allowing an individual to be designated as an operator at more than one UST facility, without limitation. This means that one person can be, for example, a Class A operator at more than one facility. Ecology is also allowing an individual to be designated to more than one operator class. This means, for example, that one person can be both a Class A and Class B operator at the same facility. This added flexibility allows businesses to maintain control over their staffing decisions and limit the costs of operator training by limiting the number of people requiring training.

6.1.2 Timing of operator training

The federal grant guidelines require that, initially, all operators must be trained by August 8, 2012. Thereafter, Class A and B operators must be trained within 30 days of assuming duties of the operator class or within another reasonable period specified

by the state. To limit the burden on businesses, Ecology is extending the deadline for initial training by an additional four months (until December 31, 2012). Ecology is also allowing, thereafter, Class A and Class B operators to be trained within 60 days – instead of 30 days – of assuming the duties of the operator class. This means that businesses will have more time to comply with the training requirements. This added flexibility allows businesses to coordinate operations with training in the most efficient way. This flexibility also reduces the risk of non-compliance.

6.1.3 Combined instead of separate training

The federal grant guidelines require that both Class A and Class B operators be trained and establish minimum requirements regarding the scope of the training. The scope of training for the two classes differs by about 15 percent. The guidelines allow states to develop training approaches that encompasses training for more than one operator class. To limit the burden on businesses, Ecology is combining the training for Class A and Class B operators. This means that individuals designated to both classes (which is typical for small businesses) only have to be trained once instead of twice, which potentially reduces training costs for those individuals by up to half.

6.1.4 Types of training allowed

The federal grant guidelines require that Class A and B operators be trained and establish minimum requirements for the different types of training, including examinations and training programs. However, the guidelines provided states substantial discretion in determining what type of training to allow. Ecology used that discretion to limit the burden of complying with the training requirements.

Specifically, Ecology is allowing Class A and Class B operators to be trained by successfully completing a training program or passing an examination. Also, the training may be provided by the department, an UST system owner or operator approved by the department, or independent third-parties approved by the department, and may be classroom, computer, or field-based. Furthermore, the scope of the training may be facility-specific (that is, operators do not need to be trained in those areas which do not apply to their particular facility).

The different approaches have different costs and benefits associated with them. For example, training programs are often more useful for new or less experienced operators. Examinations are comparably cheaper than classroom training. And online approaches provide more flexibility in terms of the timing of the training. This extensive flexibility allows businesses to decide which approach works best for their specific business and operators.

Ecology is also allowing similar flexibility for Class C operators, except that examination-only approaches are not allowed. Ecology determined that training programs are necessary to ensure that Class C operators (who are the first responders to an emergency at an UST facility) are able to appropriately respond to emergencies.

To provide further flexibility, Ecology eliminated the requirement in the proposed rule that training of Class C operators had to be facility-specific. Ecology eliminated that requirement in the adopted rule because it determined that the provision was unnecessary to meet the general goals and specific objectives of the law. This determination was based in part on public comments on the proposed rule.

6.1.5 Reciprocity for out-of-state training

The federal grant guidelines allow states to develop a program that accepts operator training verification from other states. Ecology used that discretion to limit the burden of complying with the training requirements. Specifically, Ecology is accepting out-of-state training for Class A and Class B operators previously designated in another state or at a tribal UST facility regulated by EPA. Ecology is not requiring its approval of out-of-state training. This means Class A operators (usually owners) who own facilities in more than one state do not need to take additional training in this state. This also means that Class B operators working in another state (such as in Oregon or Idaho) can seek employment in this state without having to be trained again in Washington, thus limiting the costs to the business and facilitating the mobility of labor.

6.1.6 Acceptance of prior in-state training

As discussed above, Ecology is extending the compliance date for initial training until December 31, 2012. To further limit the burden of the training requirements on businesses, Ecology established an operator training program in April 2011 to provide businesses more time to get their operators trained. To provide regulatory certainty for businesses, Ecology is explicitly stating in the adopted rule that it will accept Ecology-approved in-state training for Class A and Class B operators completed prior to the effective date the rule amendments.

6.1.7 Retraining based on non-compliance

The federal grant guidelines require retraining of Class A and/or Class B operators if an UST facility, at a minimum, does not meet EPA's Significant Operational Compliance requirements (www.epa.gov/oust/cmplastc/soc.htm).

Ecology considered various enforcement policies. Ecology decided to retain its discretion to require retraining based on any violation; however, Ecology also decided to retain its discretion to determine on a case-specific basis whether retraining is necessary (as opposed to establishing categorical requirements), who must be retrained (the Class A and/or the Class B operator), and what subject areas must be covered in the retraining (all or just some subject areas). This means Ecology's inspectors will be able to work with the individual businesses to determine what steps make sense based on facility-specific factors. In addition, to limit the burden on businesses of retraining, Ecology is extending the time for getting retrained from 30 to 60 days.

6.1.7 Retraining of Class C operators

The federal grant guidelines do not require retraining of Class C operators. In the proposed rule, Ecology required retraining annually and whenever an operator changed facilities to ensure that Class C operators (who are the first responders at an UST facility) are able to appropriately respond to emergencies. In the adopted rule, Ecology removed this requirement because it determined that the provision was unnecessary to meet that objective.

6.1.8 Recordkeeping instead of reporting

The federal grant guidelines require states to establish a system for ensuring all operators are designated and trained, such as reporting or recordkeeping. Ecology chose the least burdensome alternative to meet that minimum federal requirement, which Ecology determined to be recordkeeping. For businesses, this means avoiding the costs of submitting reports to Ecology each time an operator was designated and trained. Ecology is also requiring records of only the currently designated operators (instead of all operators designated during the past three years).

6.2 Secondary containment – piping replacement

State law requires new or replaced tanks and piping to be secondarily contained. As explained in the federal grant guidelines, replaced piping only needs to be secondarily contained if the entire piping run is replaced. However, the guidelines also urged states to consider requiring secondary containment when less than an entire piping run is replaced. Under the proposed federal rule amendments (US EPA, 2001), if more than 50 percent of a piping run is replaced, the entire piping run must be replaced and the piping must be secondarily contained.

Ecology considered several different alternatives based on piping length and percentage of a piping run replaced, and consulted with inspectors and service providers regarding different piping run configurations and how much piping is typically replaced at one time. Based on those consultations, Ecology's adopted rule is consistent with EPA's current rule proposal, except that Ecology is retaining discretion to provide exceptions to address situations involving UST facilities with unique and extensive piping runs (such as those at bus barns). This means that such facilities can decide to upgrade portions of their extensive piping runs, which Ecology wants to encourage, without having to upgrade their entire facility at the same time.

6.3 Under-dispenser containment – operation and maintenance

The federal grant guidelines require that under-dispenser containment allow for visual inspection and access to the components in the containment system and/or be monitored. However, the guidelines do not require visual inspections of the containment system or how monitoring must be performed. In the proposed federal rule amendments (US EPA,

2001), EPA is establishing requirements for inspections and monitoring. But those requirements have not yet been adopted.

Ecology considered several different options, including specifying operation and maintenance (O&M) requirements in this rule-making. However, because the federal rule amendments have not yet been adopted, Ecology decided not to impose any O&M requirements in this rule adoption. Furthermore, because Ecology did not want to require something (monitoring) for which it did not provide standards, Ecology decided not to require monitoring at this time.

Consequently, to meet the minimum requirements in the federal grant guidelines, Ecology decided to only require accessibility to the components in the containment system. Ecology determined that, even if the containment system is monitored electronically, the system would still need to be accessible to test monitoring equipment and the integrity of the containment system, which EPA is also proposing as a requirement in the federal rule.

6.4 Financial responsibility

During this rule-making, Ecology considered, but did not include, amendments to the financial responsibility requirements to ensure that all releases from regulated UST systems are covered by financial assurances (that is, there are no gaps in coverage).

6.4.1 Deferral of regulatory changes

During the rule-making process, Ecology considered making the following changes to the financial responsibility requirements:

- Establishing a minimum period of coverage, starting from the date of system installation or the date of the last site assessment around the system, whichever is later.[9]
- Allowing suspension of coverage during temporary closure, provided the system is emptied and a site assessment is performed around the system.[10]
- Adding additional financial assurance mechanisms for local governments, which were added to the federal rule after the state rule was originally adopted.

[9] Under the existing rule, there is no minimum period of coverage. Owners and operators may therefore limit the period of coverage to just the current annual policy period. However, releases are often not discovered at the time of the release. The change would help ensure that most releases are discovered before coverage for those releases is lost.

[10] Under the existing rule, when owners temporarily close an UST system, they are arguably allowed to suspend financial responsibility without performing a site assessment or emptying the system. However, if a site assessment is not performed, previously unknown releases will not be discovered before coverage is lost. And if the system is not emptied, new releases may occur when there is no coverage.

The first two changes above were listed as rule-making options in a recent study by EPA on the effectiveness of insurance as a financial assurance mechanism for UST facilities (US EPA, 2001d).

However, Ecology ultimately decided not to proceed with those changes in this rule-making. As EPA discussed in its own analysis, while there are problems that need to be addressed (i.e., gaps in coverage), Ecology determined that more information and analysis was necessary to define the exact nature and extent of the problem.

6.4.2 Alternative actions

Both to help reduce gaps in coverage and support our analysis, Ecology is planning on taking the following actions:

- Data collection. Ecology plans on working with the Department of Revenue (which administers the licensing program for UST facilities) and the Pollution Liability Insurance Agency (which manages the pollution liability reinsurance program for UST facilities) to improve collection and tracking of relevant insurance data. For example, Ecology may use its existing regulatory authority to collect and compile information on insurance coverage gaps (difference between installation or ownership dates and retroactive dates), and the extent to which such gaps have resulted in situations where claims have been denied. Ecology may also use this information to identify which owners are not maintaining their retroactive dates, allowing Ecology to focus its education and outreach efforts.
- Education and outreach. Ecology also plans to work with stakeholders (such as the Washington Oil Marketers Association, the Pollution Liability Insurance Agency, and insurers) to increase UST owner awareness and understanding of basic insurance principles, including retroactive dates and reporting periods, and the importance of conducting environmental assessment before losing insurance coverage for releases or purchasing potentially contaminated properties. Ecology believes such efforts will help reduce gaps in coverage at many facilities and ensure more timely reporting of releases to insurers.

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Appendix A: Adopted Rule Amendments Analyzed

A.1 Operator training

A.1.1 Designation of Class C operators

- Baseline (EPA, 2007, p. 3): At least one Class C operator must be designated for each UST system or group of systems at an UST facility.
- Rule adoption (WAC 173-360-710(2)): Each individual who meets the definition of a Class C operator at an UST facility must be designated as a Class C operator.

A.1.2 Designation of individuals to more than one operator class

- Baseline (EPA, 2007, pp. 3-4): Separate individuals may be designated for each operator class or an individual may be designated to more than one operator class.
- Rule adoption (WAC 173-360-710(3)): Same as baseline.

A.1.3 Compliance date for training existing operators

- Baseline (EPA, 2007, pp. 3, 7): The guidelines require states to develop training requirements by August 8, 2009, and ensure operators are designated and trained in accordance with those requirements by August 8, 2012.
- Rule adoption (WAC 173-360-720(1)): Operators must initially be designated and trained by December 31, 2012.

A.1.4 Compliance date for training new Class A and B operators

- Baseline (EPA, 2007, p.7): Class A and Class B operators must be trained within 30 days of assuming duties of the operator class, or within another reasonable period specified by the state.
- Rule adoption (WAC 173-360-720(2)): Class A and Class B operators must be trained within 60 days of assuming duties of the operator class.

A.1.5 Training of Class A and B operators – combining

- Baseline (EPA, 2007, pp. 4, 5-6): The guidelines allow states to develop training approaches that encompasses training for more than one operator class. The guidelines specify which subject areas must be covered at a minimum for Class A and Class B operator training. The subject areas for the two classes are about 85 percent the same.
- Rule adoption (WAC 173-360-730(1)): The required subject areas for Class A and Class B operators are the same. In other words, the scope of the training program or examination for Class A and Class B operators must be the same.

A.1.6 Training of Class A and B operators – scope

- Baseline (EPA, 2007, pp. 5-6): The guidelines specify which subject areas must be covered at a minimum for Class A and Class B operator training.
- Rule adoption (WAC 173-360-730(1)): The adopted rule requires that Class A and Class B operator training cover the subject areas specified by the guidelines and some

additional subject areas. Most of the differences involve state requirements not included in the federal rule (i.e., they reflect differences in the state and federal programs).

A.1.7 Training of Class C operators – types

- Baseline (EPA, 2007, p.8): Class C operators may meet the training requirement by successfully completing a training program or examination. Training programs or examinations may be classroom, computer, or field-based. Training may be provided by Class A or Class B operators, in addition to the department and independent third-parties.
- Rule adoption (WAC 173-360-730(2)): Class C operators may meet the training requirement by successfully completing a training program. The training program may be classroom, computer, or field-based. Training may be provided by trained Class A or Class B operators, in addition to the department and independent third-parties.

A.1.8 Reciprocity for out-of-state training

- Baseline (EPA, 2007, p. 9): States may develop a program that accepts operator training verification from other states.
- Rule adoption (WAC 173-360-730(3)): Class A and Class B operators previously designated in another state or at a tribal UST facility regulated by EPA shall be deemed to meet the training requirements in subsection (1) of this section if: (a) They successfully completed a training program or examination meeting the requirements of that state or 40 CFR Part 280, as applicable; and (b) They possess the training records required under WAC 173-360-760(2) and the records identify the state where they were designated and trained.

A.1.9 Acceptance of prior in-state training

- Baseline (EPA, 2007, pp. 3, 7): The guidelines require states to develop training requirements by August 8, 2009, and ensure operators are designated and trained in accordance with those requirements by August 8, 2012.
- Rule adoption (WAC 173-360-730(4)): Ecology developed interim guidelines for operator training and had approved several training programs and examinations under those guidelines by April 2011. Under the adopted rule, operators must initially be designated and trained by December 31, 2012. To limit the impact of this requirement, Ecology will grandfather:
    - Class A and Class B operators who successfully completed an applicable training program or examination approved by the department before the effective date of the rule and who possess the training records required in WAC 173-360-760(2).
    - Class C operators who successfully completed a training program approved by the department or administered by a trained Class A or Class B operator before the effective date of the rule and possess the training records required in WAC 173-360-760(2).

A.1.10 Retraining of Class A and B operators – trigger

- Baseline (EPA, 2007, pp. 7-8): Retraining is required if an UST system is out of compliance. At a minimum, an UST system is out of compliance if it does not meet EPA's Significant Operational Compliance requirements (www.epa.gov/oust/cmplastc/soc.htm) or other requirements as determined by the state.
- Rule adoption (WAC 173-360-740(1)(a)): If the department determines the owners and operators of an UST system are not in compliance with regulatory requirements the state may require operator retraining.

A.1.11 Retraining of Class A and B operators – exemption

- Baseline (EPA, 2007, p. 8): States requiring at least annual operator training that covers all operator class requirements would meet retraining requirements in the guidelines.
- Rule adoption (WAC 173-360-740(1)(a)): Ecology does not require annual retraining of Class A and Class B operators. However, Ecology does categorically exempt from the retraining requirements in the rule those Class A and Class B operators who are retrained annually.

A.1.12 Retraining of Class A and B operators – compliance deadline

- Baseline (EPA, 2007, p. 8): Operators must be retrained within a reasonable time frame established by the state. The guidelines do not establish a minimum requirement.
- Rule adoption (WAC 173-360-740(1)(b)): Operators must be retrained within 60 days of receipt of Ecology's determination of non-compliance.

A.1.13 Retraining of Class A and B operators – scope

- Baseline (EPA, 2007, p. 8): At a minimum, retraining must include training of the areas determined not in significant compliance.
- Rule adoption (WAC 173-360-740(1)(b)): At a minimum, the retraining must cover the areas determined to be out of compliance.

A.1.14 Operation and maintenance plans

- Baseline (EPA, 2007, pp. 7-8): UST system owners and operators do not need to develop operation and maintenance plans if the system is out of compliance.
- Rule adoption (WAC 173-360-745): If the department determines the owners and operators of an UST system are not in compliance with regulatory requirements, the department may require the owners and operators to develop an operation and maintenance plan for each UST system at the facility where the non-compliant system is located.

A.1.15 Emergency response – presence

- Baseline (EPA, 2007, p. 4): The guidelines do not specifically require that a designated operator be present at an UST facility while it is manned.
- Rule adoption (WAC 173-360-750(1)): While an UST facility is manned, UST system owners and operators shall ensure at least one of the individuals manning the facility is a properly trained Class A, Class B, or Class C operator.

A.1.16 Emergency response – signage

- Baseline (EPA, 2007, p. 4; and International Fire Code (IFC), §2204.3.5, as adopted by the Washington State Building Code Council pursuant to Chapter 19.27 RCW): The federal grant guidelines do not require signage providing emergency response information. However, such signage is already required for some regulated UST facilities under the International Fire Code (chapter 51-54 WAC), as adopted by the Washington State Building Code Council pursuant to chapters 19.27 and 70.92 RCW. The applicable provision in the IFC (§2204.3.5) applies only to "unattended self-service motor fuel-dispensing facilities." The provision does not apply to attended self-service stations or other regulated UST facilities that are not service stations, such as facilities with emergency power generators. These codes were first adopted by reference by the Washington State Legislature in 1974. In 1985, the Legislature delegated the responsibility of adoption and amendment of these codes to the State Building Code Council. Any local jurisdiction may amend the State Building Code provided the amendments do not reduce the minimum performance standards of the codes.
- Rule adoption (WAC 173-360-750(2)): At each UST facility, UST system owners and operators shall post and maintain signage providing emergency response information.

A.1.17 Recordkeeping – general

- Baseline (EPA, 2007, p. 9): States must have a system in place for ensuring all operators are trained in accordance with these guidelines, such as reporting or recordkeeping.
- Rule adoption (WAC 173-360-760): Recordkeeping is used to document and determine compliance with operator training requirements.

A.1.18 Recordkeeping – scope

- Baseline (EPA, 2007, p. 9): Not specified. EPA confirmed that records of currently designated operators are necessary to document compliance with operator training requirements.
- Rule adoption (WAC 173-360-760): Records documenting all currently designated operators and the training received by those operators.

A.1.19 Recordkeeping – documentation

- Baseline (EPA, 2007, p. 9): Not specified. Records must contain information necessary to document compliance with operator training requirements.
- Rule adoption (WAC 173-360-760): Records must contain information necessary to document compliance with operator training requirements.

A.1.20 Recordkeeping – maintenance

- Baseline (EPA, 2007, p. 9): Records must be maintained at the UST site and immediately available for inspection by the implementing agency; or at a readily available alternative site and be provided for inspection to the implementing agency upon request.
- Rule adoption (WAC 173-360-760): Same as baseline.

A.2 Secondary containment of tanks

A.2.1 Containment requirements

- Baseline (EPA, 2006a, p. 6): Allows for different methods of secondary containment, and specifies what performance standards those methods must meet.
- Rule adoption (WAC 173-360-810(2)): Tanks must be secondarily contained by being double-walled. Double-walled tanks must meet specified performance standards. Those standards are the same as the more general standards in the grant guidelines, except they are focused on the specific method of containment.

A.3 Secondary containment of piping

A.3.1 Applicability – Limited exception for replaced piping

- Baseline (EPA, 2006a, p. 4 under definition of "replace"): States may determine the amount of piping connected to a single UST that triggers replacement by piping length, percent of piping replaced, percent of piping replacement cost, or some combination of these. At a minimum, states must consider a piping replacement to have occurred when 100 percent of the piping connected to a single underground tank is replaced. States are encouraged to consider variations in UST system layout, such as those having extensive piping runs, when determining piping replacement criteria.
- Rule adoption (WAC 173-360-820(1)(b)): If less than 50 percent of a piping run is replaced, then the piping is exempt from the secondary containment requirements. The term "piping run" is defined.

A.3.2 Piping replacement requirements

- Baseline (EPA, 2006a, p. 4 under definition of "replace"): States may determine the amount of piping connected to a single UST that triggers replacement by piping length, percent of piping replaced, percent of piping replacement cost, or some combination of these. At a minimum, states must consider a piping replacement to have occurred when 100 percent of the piping connected to a single underground tank is replaced. States are encouraged to consider variations in UST system layout, such as those having extensive piping runs, when determining piping replacement criteria.
- Rule adoption (WAC 173-360-820(2)): Unless otherwise approved or directed by the department, the entire piping run must be replaced when 50 percent or more of a piping run is replaced. The term "piping run" is defined. Ecology is retaining discretion to provide exceptions to address situations involving UST facilities with unique and extensive piping runs.

A.3.3 Containment requirements

- Baseline (EPA, 2006a, p. 6): Allows for different methods of secondary containment, and specifies what performance standards those methods must meet.
- Rule adoption (WAC 173-360-820(3)): Piping must be secondarily contained by being double-walled. The containment system may either be open or closed. Open systems require containment sumps. Both piping and containment sumps must meet specified performance standards. Those standards are the same as the more general standards in the grant guidelines, except they are focused on the specific method of containment.

A.4 Under-dispenser containment

A.4.1 Applicability – when only a dispenser (not the whole dispenser system) is replaced

- Baseline (state statute, RCW 90.76.020(1)(h); and EPA, 2006a, p. 8): Under-dispenser containment is not required when a dispenser is replaced, but not the transitional components. However, the statute provides Ecology the authority to require under-dispenser containment in this and other scenarios by rule.
- Rule adoption (WAC 173-360-830(1)(b)): Under-dispenser containment is required if a dispenser is replaced, but not the transitional components.

A.4.2 Applicability – when only the underground piping (not the connected dispenser system) is installed or replaced

- Baseline (state statute, RCW 90.76.020(1)(h); and EPA, 2006a, p. 8): Under-dispenser containment is not required when only the underground piping connected to an existing dispenser system is installed or replaced. However, the statute provides Ecology the authority to require under-dispenser containment in this and other scenarios by rule.
- Rule adoption (WAC 173-360-830(1)(c)): Under-dispenser containment is required when only the underground piping connected to an existing dispenser system is installed or replaced.

A.4.3 Performance standards

- Baseline (EPA, 2006a, definition of "under-dispenser containment," p. 5): Allow for visual inspection and access to the components in the containment system and/or be monitored.
- Rule adoption (WAC 173-360-830(2)): All under-dispenser containment must allow for visual inspection and access to the components in the containment system. Monitoring is not required.

Appendix B: Adopted Rule Amendments Not Analyzed

B.1 Delivery prohibition

- Baseline (state statute, RCW 90.76.020 and 90.76.050; and EPA, 2006): First, even before the statute was revised in 2007, Ecology had the statutory authority to prohibit the delivery of regulated substances to an UST facility if any system at that facility was not in compliance with regulatory requirements. This could be done by revoking either the facility's license or its compliance tag. This type of program is often referred to as a "green tag" program. Second, in accordance with the grant guidelines, the state statute was amended in 2007 to explicitly provide Ecology the authority to prohibit delivery of regulated substances to individual UST systems that are out-of-compliance. This type of program is often referred to as a "red tag" program. This type of authority provided Ecology greater flexibility in the exercise of its discretion: instead of prohibiting delivery to an entire facility, Ecology could prohibit delivery to just the system or systems at the facility that were out of compliance.
- Rule adoption (WAC 173-360-160 and 173-360-165): Consistent with the statute, the adopted rule allows Ecology to prohibit delivery of regulated substances to individual UST systems that are out-of-compliance. Terms, such as "facility compliance tag" and "red tag", are defined.

B.2 Operator training

B.2.1 Applicability

- Baseline (EPA, 2007, p. 3): Owners and operators of regulated UST systems must comply with operator training requirements. The requirements do not apply to exempt or deferred UST systems.
- Rule adoption (WAC 173-360-700): Same as baseline.

B.2.2 Designation of Class A and B operators

- Baseline (EPA, 2007, p. 3): At least one Class A and one Class B operator must be designated for each UST system or group of systems at an UST facility.
- Rule adoption (WAC 173-360-710(1)): Same as baseline.

B.2.3 Training of Class A and B operators – types

- Baseline (EPA, 2007, p.8): Class A and Class B operators may meet the training requirement by successfully completing a training program or examination. Training may be classroom, computer, or field-based. Training may be provided by the department and independent third-parties. EPA subsequently confirmed that training may also be provided by UST owners and operators, provided that there are quality assurance mechanisms.
- Rule adoption (WAC 173-360-730(1): Class A and Class B operators may meet the training requirement by successfully completing a training program or examination. Training may be classroom, computer, or field-based. Training may be provided by

the department, an UST system owner or operator approved by the department, and an independent third-party approved by the department.

B.2.4 Training of Class A and B operators – facility-specific

- Baseline (EPA, 2007, pp. 5-6): Class A operator training may be facility-specific (i.e., the training only needs to cover the subject areas applicable to the UST systems at the facility). While the guidelines are silent as to whether Class B operator training may be facility-specific, EPA has interpreted the guidelines to allow such training to be facility-specific.
- Rule adoption (WAC 173-360-730(1)): Class A and Class B operator training may be facility-specific (i.e., the training only needs to cover the subject areas applicable to the UST systems at the facility).

B.2.5 Training of Class C operators – facility-specific

- Baseline (EPA, 2007, p. 7): Class C operator training does not need to be facility-specific.
- Rule adoption (WAC 173-360-730(2)): Same as baseline.

B.2.6 Retraining of Class A and B operators – who must be retrained

- Baseline (EPA, 2007, pp. 7-8): When retraining is required at non-compliant facilities, states may determine whether both Class A and Class B operators are retrained, or if only one class of operator (either Class A or Class B) is retrained.
- Rule adoption (WAC 173-360-740(1)): The department may require retraining of both Class A operators and Class B operators, or only one of those classes of operators. Decisions are made on a case-specific basis.

B.2.7 Retraining of Class C operators

- Baseline (EPA, 2007, pp. 7-8): Class C operators do not need to be retrained.
- Rule adoption (WAC 173-360-740): Same as baseline.

B.3 Secondary containment of tanks

B.3.1 Applicability – containment vs. financial responsibility

- Baseline (state statute, RCW 90.76.020(1)(h); EPA, 2006a, p.1): The Legislature chose to require secondary containment and interstitial monitoring of tanks instead of financial responsibility by tank manufactures or installers and certification. Both were options for states under the federal grant guidelines.
- Rule adoption (WAC 173-360-810(1)): Same as baseline, which is the state statute.

B.3.2 Applicability – based on tank location

- Baseline (state statute, RCW 90.76.020(1)(h); EPA, 2006a, pp.5-6, 8-9): The federal grant guidelines require secondary containment of only those tanks located within a 1,000 feet of any existing community water system or any existing potable drinking water well. The Legislature chose to require secondary containment of tanks irrespective of where the tanks are located.
- Rule adoption (WAC 173-360-810(1)): Same as baseline, which is the state statute.

B.3.3 Applicability – new or replaced tanks

- Baseline (state statute, RCW 90.76.020(1)(h); EPA, 2006a, pp. 6-7): The federal grant guidelines require secondary containment for new or replaced tanks, not for existing tanks. The Legislature chose not to be more stringent than the federal requirements.
- Rule adoption (WAC 173-360-810(1): Same as baseline.

B.3.4 Release detection requirements

- Baseline (EPA, 2006a, p. 6): Requires interstitial monitoring in accordance with requirements in the current federal rule.
- Rule adoption (WAC 173-360-810(3)): Requires interstitial monitoring in accordance with requirements in the current state rule, which are the same as in the current federal rule. For certain interstitial monitoring methods, Ecology added a performance standard that EPA included in the proposed federal rule. Ecology determined that this standard does not have an impact. First, one does not have to use those particular interstitial monitoring methods. Second, if the interstitial monitoring method is unable to meet that standard, then it cannot work (cannot detect a leak), which means that it also does not meet existing leak detection requirements in the current rule.

B.4 Secondary containment of piping

B.4.1 Applicability – containment vs. financial responsibility

- Baseline (state statute, RCW 90.76.020(1)(h); EPA, 2006a, p.1): The Legislature chose to require secondary containment and interstitial monitoring of piping instead of financial responsibility by manufactures or installers and certification. Both were options for states under the federal grant guidelines.
- Rule adoption (WAC 173-360-820(1)): Same as baseline, which is the state statute.

B.4.2 Applicability – based on piping location

- Baseline (state statute, RCW 90.76.020(1)(h); EPA, 2006a, pp.5-6, 8-9): The federal grant guidelines require secondary containment of only those pipes located within a 1,000 feet of any existing community water system or any existing potable drinking water well. The Legislature chose to require secondary containment of piping irrespective of where the piping is located.
- Rule adoption (WAC 173-360-820(1)): Same as baseline, which is the state statute.

B.4.3 Applicability – new or replaced piping

- Baseline (state statute, RCW 90.76.020(1)(h); EPA, 2006a, pp. 6-7): The federal grant guidelines require secondary containment for new or replaced piping, not for existing piping. The Legislature chose not to be more stringent than the federal requirements.
- Rule adoption (WAC 173-360-820(1): Same as baseline.

B.4.4 Applicability – exemption for certain types of suction piping

- Baseline (EPA, 2006a, p. 7): States are not required to apply the secondary containment requirements to suction piping that meets the requirements at 40 CFR 280.41(b)(2)(i) – (v).
- Rule adoption (WAC 173-360-820(1)(a)): Suction piping meeting the requirements in WAC 173-360-350(2)(b)(i) through (v), is exempt from the secondary containment requirements. The requirements for suction piping are the same as in the federal rule.

B.4.5 Release detection requirements

- Baseline (EPA, 2006a, p. 6): Requires interstitial monitoring in accordance with requirements in the current federal rule.
- Rule adoption (WAC 173-360-820(4)): Requires interstitial monitoring in accordance with requirements in the current state rule, which are the same as in the current federal rule. Certain interstitial monitoring methods must meet an additional performance standard that EPA included in its proposed federal rule. As discussed above for tank release detection, Ecology determined that this standard does not have an impact. The adopted rule also requires that pressurized piping be equipped with an automatic line leak detector, as currently required under WAC 173-360-350(2)(a).

B.5 Under-dispenser containment

B.5.1 Applicability – containment vs. financial responsibility

- Baseline (state statute, RCW 90.76.020(1)(h); EPA, 2006a, p.1): The Legislature chose to require under-dispenser containment instead of financial responsibility by manufactures or installers and certification. Both were options for states under the federal grant guidelines.
- Rule adoption (WAC 173-360-830(1)): Same as baseline, which is the state statute.

B.5.2 Applicability – based on dispenser system location

- Baseline (state statute, RCW 90.76.020(1)(h); EPA, 2006a, pp.5-6, 8-9): The federal grant guidelines require under-dispenser containment of only those dispenser systems located within a 1,000 feet of any existing community water system or any existing potable drinking water well. The Legislature chose to require under-dispenser containment irrespective of where the dispenser system is located.
- Rule adoption (WAC 173-360-830(1)): Same as baseline, which is the state statute.

B.5.3 Applicability – when an entire dispenser system is installed or replaced

- Baseline (state statute, RCW 90.76.020(1)(h); EPA, 2006a, p. 8): The federal grant guidelines require under-dispenser containment for new or replaced dispenser systems, not for existing dispenser systems. The Legislature chose not to be more stringent than the federal requirements.
- Rule adoption (WAC 173-360-830(1)(a): Same as baseline.

B.5.4 Installation and reporting

- Baseline (WAC 173-360-305(4) and (5) and WAC 173-360-600 through 173-360-670): Specifies installation and reporting requirements for installation of UST system components.
- Rule adoption (WAC 173-360-830(3)): Clarifies that the installation and reporting requirements in the current rule also apply when installing under-dispenser containment.

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Appendix C: Sensitivity Analysis for Under-Dispenser Containment

Ecology analyzed two additional higher-end and lower-end scenarios for estimating the costs of under-dispenser containment (UDC). The assumptions were not appropriate for making an average assessment of Washington State. Ecology is including them for illustrative purposes, to provide the public additional information on the relationship between the percentage of dispensers without under-dispenser containment, the likelihood of replacing those dispensers in the next 20 years, and the total cost estimate.

C.1 Alternate scenario 1

Ecology based a highly low-end cost estimate on the input of a service provider. Assumptions included:

- 3602 facilities
- 2.65 tanks per facility (9545 total tanks)
- 2 dispensers per tank
- 40 percent of dispensers without under-dispenser containment
- 10 percent of UDC-less dispensers likely to be replaced in 20 years.

Table 28 summarizes the present value cost calculation for Scenario 1.

Table 28: Present Value Costs for Under-Dispenser Containment (Alternate Scenario 1)

Year	Number of Affected Dispensers	Cost	Present Value
2012	38	$4,500	$4,500
2013	76	$8,999	$8,859
2014	114	$13,499	$13,082
2015	152	$17,998	$17,172
2016	190	$22,498	$21,131
2017	228	$26,998	$24,962
2018	266	$31,497	$28,670
2019	304	$35,997	$32,256
2020	342	$40,496	$35,723
2021	380	$44,996	$39,075
2022	418	$49,495	$42,314
2023	456	$53,995	$45,443
2024	494	$58,495	$48,464
2025	532	$62,994	$51,380
2026	570	$67,494	$54,194
2027	608	$71,993	$56,908
2028	646	$76,493	$59,524
2029	684	$80,993	$62,045
2030	722	$85,492	$64,473
2031	760	$89,992	$66,811
		TOTAL	$776,983

C.2 Alternate scenario 2

Ecology based an extreme high-end cost estimate based on the EPA's assumptions in its analysis of the proposed federal rule. Assumptions included:

- 3602 facilities
- 2.65 tanks per facility (9545 total tanks)
- 2 dispensers per tank
- 96.98 percent of dispensers without under-dispenser containment.
- 100 percent of UDC-less dispensers likely to be replaced in 20 years.

While this scenario is not appropriate for Washington State (the EPA assumes most dispensers did not have under-dispenser containment because they were only affecting facilities in Indian Territory; Washington state has a significant percentage of under-dispenser containment already installed at existing dispensers), Ecology is including it as an extreme example of how very conservative assumptions would affect the total cost estimation for under-dispenser containment.

Table 29 summarizes the present value cost calculation for Alternate Scenario 2.

Table 29: Present Value Costs for Under-Dispenser Containment under Alternate Scenario 1.

Year	Number of Affected Dispensers	Cost	Present Value
2012	926	$109,648	$109,648
2013	1,852	$219,296	$215,885
2014	2,778	$328,944	$318,790
2015	3,704	$438,591	$418,442
2016	4,630	$548,239	$514,917
2017	5,556	$657,887	$608,290
2018	6,482	$767,535	$698,633
2019	7,408	$877,183	$786,018
2020	8,334	$986,831	$870,517
2021	9,260	$1,096,479	$952,196
2022	10,186	$1,206,126	$1,031,124
2023	11,112	$1,315,774	$1,107,366
2024	12,038	$1,425,422	$1,180,987
2025	12,964	$1,535,070	$1,252,049
2026	13,890	$1,644,718	$1,320,616
2027	14,816	$1,754,366	$1,386,746
2028	15,742	$1,864,014	$1,450,500
2029	16,668	$1,973,662	$1,511,935
2030	17,594	$2,083,309	$1,571,108
2031	18,520	$2,192,957	$1,628,074
		TOTAL	$18,933,840