Assessment Of The Potential Costs, Benefits, And Other Impacts Of The Final Revisions To EPA's Underground Storage Tank Regulations

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Acronyms And Terms

AHFDS – Airport hydrant fuel distribution system

ASTSWMO – Association of State and Territorial Solid Waste Management Officials

ATG – Automatic tank gauge / gauging – an automated process that monitors product level and provides inventory control

BLS – United States Bureau of Labor Statistics

BTEX – benzene, toluene, ethylbenzene, and xylenes

CFR – Code of Federal Regulations

CITLD – continuous in-tank leak detection

EGT – emergency generator tank

EPA – United States Environmental Protection Agency

EPAct – Energy Policy Act of 2005

FCT – field-constructed tank

Fill pipe – access by which a tank is filled

IRS – United States Internal Revenue Service

LLD – line leak detector / detection – a device that alerts the tank operator to the presence of a leak in underground piping by restricting or shutting off the flow of product through the piping, or by triggering an audible or visible alarm

LUST – leaking underground storage tank

MIDAS – modeling of infectious diseases agents study

NACS – National Association of Convenience Stores

NAICS – North American Industry Classification System

NRDA – natural resource damage assessment

OMB – United States Office of Management and Budget

OUST – Office of Underground Storage Tanks, United States Environmental Protection Agency

PAHs – polycyclic aromatic hydrocarbons

RFA – Regulatory Flexibility Act

SBA – United States Small Business Administration

SBREFA – Small Business Regulatory Enforcement Fairness Act of 1996

SIR – statistical inventory reconciliation – a leak detection method where inventory, delivery, and dispensing data is statistically analyzed

SISNOSE – significant impact on a substantial number of small entities

SPA – state program approval

SPCC – Spill Prevention, Control, and Countermeasure

Spill bucket – contained sump installed at the fill or vapor recovery connection points to contain drips and spills that can occur during delivery

Sump – subsurface area pit designed to provide access to equipment located below ground, and, when contained, to prevent liquids from releasing into the environment

SWDA – Solid Waste Disposal Act

TPH – total petroleum hydrocarbons

Turbine sump – sump designed to provide access to the turbine area above the tank

TVM – time value of money

UDC – under-dispenser containment – a device for collecting fluids spilled beneath a dispenser (pump) (e.g. dispenser pan)

UMRA – Unfunded Mandates Reform Act

UST – underground storage tank

WTP – willingness to pay

Contents

Executive Summary

Overview

In 1984, Congress responded to the increasing threat to groundwater from leaking underground storage tank (UST) systems by adding Subtitle I to the Solid Waste Disposal Act (SWDA). SWDA required the U.S. Environmental Protection Agency (EPA) to protect the environment and human health from UST releases by developing a comprehensive regulatory program for UST systems storing petroleum or certain hazardous substances. In 1986, Congress amended Subtitle I of SWDA and created the Leaking Underground Storage Tank Trust Fund (LUST Trust Fund) to oversee and pay for cleanups at sites where the owner or operator is unknown, unwilling to pay, or unable to pay.

EPA promulgated the UST regulation in 1988 (40 CFR Part 280). This regulation set minimum standards for new tanks and required owners and operators of existing tanks to upgrade, replace, or close them. The 1988 regulation set deadlines for owners and operators to meet the new requirements. In 1988, EPA also promulgated a regulation for state program approval (40 CFR Part 281). EPA has not significantly changed these regulations since 1988. In 2005, the Energy Policy Act (EPAct) further amended Subtitle I of SWDA. EPAct requires states that receive federal Subtitle I money from EPA to meet certain requirements. EPA developed grant guidelines for states regarding: operator training; inspections; delivery prohibition; secondary containment; financial responsibility for manufacturers and installers; public record; and state compliance reports on government UST systems.

After Congress passed EPAct, EPA decided to revise the 1988 UST regulation (at 40 CFR Part 280), primarily to ensure parity in Indian country. Key EPAct provisions (such as secondary containment and operator training) apply to all states receiving federal Subtitle I money, regardless of their state program approval status. However, these key provisions do not apply in Indian country (or in states and U.S. territories that do not meet EPA's operator training or secondary containment grant guidelines). In order to establish federal UST requirements similar to the UST secondary containment and operator training requirements of EPAct, EPA needed to revise the 1988 UST regulation. Without these changes, EPAct provisions will not apply in Indian country. These revisions will also fulfill the objectives of the EPA-Tribal UST Strategy (August 2006) in which both EPA and tribes recognized the importance of ensuring parity in implementing UST program requirements in states and territories, as well as in Indian country.[1]

EPA decided now is also an appropriate time to change the 1988 UST regulation to reflect technology improvements, address outdated requirements, and place a stronger emphasis on operations and maintenance. While EPA has issued many guidance documents and used various implementation approaches and techniques over the last 25 years, we have not made significant changes to the original 1988 UST regulation. Indeed, most states have passed requirements that go far beyond the 1988 UST regulation that provide greater environmental protection. These state regulations fully implement provisions of the EPAct and improve other

[1] See http://www.epa.gov./oust/fedlaws/Tribal%20Strategy_08076r.pdf.

important areas of the 1988 UST regulation that have become outdated. Furthermore, while information on sources and causes of releases show that releases from tanks are less common than they once were, releases from piping and spills and overfills associated with deliveries have emerged as more common problems.[2] Dispenser-related failures have also emerged as a leading source of releases. The lack of proper operation and maintenance of UST systems is a main cause of release from these areas. The final UST regulation places an emphasis on ensuring that equipment is properly maintained and working. It highlights the importance of operating and maintaining UST equipment so releases are prevented and detected early in order to avoid or minimize potential soil and groundwater contamination.

EPA worked diligently to ensure our regulatory development process was open and transparent. Over a two year period, we provided all stakeholders – state and tribal regulators; federal facilities; petroleum industry members, including representatives of owners and operators; equipment manufacturers; small businesses; local governments; and environmental and community groups – an opportunity to share their ideas and concerns through a variety of meetings, conference calls, and email exchanges. EPA thoroughly considered all input we received.

From this extensive stakeholder outreach, EPA compiled potential proposed changes to the UST regulation. EPA shared all ideas with stakeholders and gave them an opportunity to comment on each idea submitted. We then revised the list of potential changes and added items based on data, analysis, and consideration of costs and benefits. Ultimately, EPA identified the items in the proposed UST regulation as those which needed regulatory changes at the time; the proposed UST regulation was issued in November 2011 for a 90-day public comment period. EPA then extended this public comment period for an additional 60 days. EPA received submissions from over 190 commenters. Based on these comments, EPA has revised the 2011 proposed UST regulation and is now finalizing the UST regulation, as described below.

Regulatory Changes

EPA is revising the 1988 UST regulation to: establish federal requirements similar to certain key provisions of the EPAct; ensure owners and operators perform proper operation and maintenance; address UST systems deferred in the 1988 UST regulation; update the regulation to encompass current technology and practices; and make technical and editorial corrections. Specifically, EPA is requiring the following set of revisions (hereafter referred to as the Selected Option):

- Establish federal requirements for secondary containment and operator training similar to those established by EPAct for states that receive federal Subtitle I money

- Add operation and maintenance requirements

[2] U.S. Environmental Protection Agency, Office of Underground Storage Tanks, "Evaluation of Releases from New and Upgraded Underground Storage Tank Systems – Peer Review Draft," U.S. EPA, August 2004, and U.S. Environmental Protection Agency, Office of Underground Storage Tanks, "Petroleum Releases at Underground Storage Tank Facilities in Florida," Peer Review Draft, March 2005.

- Walkthrough inspections
- Overfill prevention equipment inspections
- Spill prevention equipment tests
- Containment sump tests
- Operability tests for release detection equipment

- Address UST systems deferred in the 1988 UST regulation[3]
  - Remove release detection deferral for emergency generator tanks (EGTs)
  - Remove deferrals for airport hydrant fuel distribution systems (AHFDSs) and UST systems with field-constructed tanks (FCTs)

- Provide for other changes to improve release prevention and detection and program implementation
  - Require testing after repairs to spill and overfill prevention equipment and secondary containment
  - Eliminate flow restrictors in vent lines as an overfill prevention option for all new tanks and when overfill prevention equipment is replaced
  - Require closure of lined tanks that cannot be repaired according to a code of practice
  - Address responses to interstitial monitoring alarms
  - Retain vapor monitoring and groundwater monitoring as methods of release detection for tanks and piping (for those installed before the effective date of today's final UST regulation) only if owners and operators demonstrate proper installation and performance through a site assessment
  - Require notification of ownership change
  - Establish requirements for demonstrating compatibility with fuels containing greater than E10 and greater than B20

- Make general updates to the UST regulation
  - Reference newer technologies, including explicitly adding statistical inventory reconciliation (SIR) and continuous in-tank leak detection (CITLD) as release detection methods
  - Update codes of practice listed in the UST regulation
  - Remove old upgrade and implementation deadlines
  - Make editorial and technical corrections

- Revise the state program approval regulation (40 CFR Part 281) to be consistent with the above revisions

[3] In the final UST regulation, EPA is also addressing the 1988 UST regulatory deferrals of wastewater treatment tank systems that are not part of a wastewater treatment facility regulated under sections 402 or 307(b) of the Clean Water Act, USTs containing radioactive material, and emergency generator UST systems at nuclear power generation facilities regulated by the Nuclear Regulatory Commission. However, because these regulatory changes will not result in any incremental costs to the regulated community, this RIA does not factor these systems into any part of the analysis.

In addition to the Selected Option, EPA considered two other regulatory alternatives, described as Alternative 1 and Alternative 2. Alternative 1 is overall more stringent than the Selected Option. Alternative 2 is overall less stringent than the Selected Option. **Exhibit ES-1** summarizes the requirements under each alternative.

Exhibit ES-1

Options Considered For The Final UST regulation

Requirement Description	Options		
	Selected	**Alternative 1**	**Alternative 2**
Release Prevention			
Walkthrough inspections	30-day	30-day (as proposed in Nov 2011)*	Quarterly
Overfill prevention equipment inspections	3 year	Annual	Not required
Spill prevention equipment tests	3 year	Annual	3 year
Containment sump testing	3 year	Annual	Not required
Testing after repairs to spill and overfill prevention equipment, and secondary containment	Required	Required	Required
Eliminate flow restrictors in vent lines for all new tanks and when overfill prevention equipment is replaced	Required	Required	No change from existing regulation
Release Detection			
Operability tests for release detection equipment	Annual (plus annual check of sumps)	Annual (as proposed in Nov 2011) *	Annual (plus annual check of sumps)
Add SIR/CITLD to regulation with performance criteria	Required	Required	Required
Response to interstitial monitoring alarms	Required	Required	Required
Groundwater and vapor monitoring for release detection	Continue to allow with site assessment	5-year phase out (as proposed in Nov 2011)*	No change from existing regulation
Remove release detection deferral for emergency generator tanks	Required	Required (as proposed in Nov 2011)*	Required
Other			
Require notification of ownership change	Required	Required	Required
Closure of lined tanks that cannot be repaired according to a code of practice	Required	Required	Required
Requirements for demonstrating compatibility with fuels >E10 and >B20	Required	Required (as proposed in Nov 2011)*	No change from existing regulation
Remove deferrals for airport hydrant fuel distribution systems and UST systems with field-constructed tanks	Regulate under alternative release detection requirements	Require AHS/FCT notify implementing agency and report releases (with no other requirements)	Maintain deferral
EPAct-related Provisions			
Operator training	Required	Required	Required
Secondary containment	Required	Required	Required

* In the 2011 proposed UST regulation, these changes generally consisted of more or stricter requirements than what is in the final UST regulation. For example, the 30-day walkthrough inspections in the 2011 proposed UST regulation included monthly check of sumps. Please see the 2011 proposed UST regulation for details.

EPA designed this assessment in accordance with the Office of Management and Budget's (OMB) requirements for regulatory review under Executive Order 12866 (as amended by Executive Order 13258), which applies to any significant regulatory action. This document also fulfills these requirements:

- Regulatory Flexibility Act, as amended by Small Business Regulatory Enforcement Fairness Act of 1996
- Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*
- Executive Order 13045, *Protection of Children From Environmental Health Risks and Safety Risks*
- Unfunded Mandates Reform Act of 1995
- Executive Order 13175, *Consultation and Coordination With Indian Tribal Governments*
- Executive Order 13132, *Federalism*
- Executive Order 13211, *Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use*

Summary Of Findings

Within the constraints of data availability, EPA in this analysis identified all quantifiable and qualitative impacts for the UST regulation. EPA obtained sufficient data to identify, by state, the number of units likely to be affected by each change in the final UST regulation. In our analysis, we use these data to assess the compliance costs imposed upon units and relevant state governments. In conducting these analyses, EPA also assessed the sensitivity of outcomes to key assumptions. Separately, the analysis monetizes a number of impacts of the final UST regulation including: avoided costs generated by avoided releases and reduction in severity of releases; avoided product loss; and avoided vapor intrusion damages. This analysis quantifies, but does not value, groundwater impacts. Finally, due to data and resource limitations, EPA was unable to quantify or value in this analysis human health benefits or ecological impacts, but addresses these qualitatively.

In addition to identifying costs and positive impacts, EPA in this analysis also examined the economic and distributional impacts of the final UST regulation. The economic impact analysis includes the final UST regulation's effect on facility closures, employment, and energy output and cost. In the analysis of the final UST regulation's distributional impacts, we examined small business impacts, effects on minority and low-income populations, impacts on children's health, and potential impacts on state financial assurance funds. Finally, EPA's analysis considered the final UST regulation's impacts related to certain executive orders and statutes, including the Unfunded Mandates Reform Act, tribal governments, and federalism.

The main conclusions of this analysis are:

- **Compliance costs**[4] – EPA estimates $160 million in annual compliance costs for the final UST regulation, including costs of $130 million for conventional UST systems and EGTs; $10 million for AHFDSs; $11 million for FCTs; $5.5 million

[4] Compliance costs include direct compliance costs and state oversight costs. For this regulatory impact analysis, direct compliance costs and state oversight costs provide a reasonable proxy to assess the final UST regulation's social costs. See Chapter 3.1 for further discussion.

for owners and operators to read the final UST regulation; and less than $1.0 million in state government administrative costs. Compliance costs range from approximately $70 million under Alternative 2 to $290 million under Alternative 1.

- **State and local government costs** – Annual state and local government costs, including compliance costs to UST systems owned or operated by state and local governments, state program approval costs, state costs for processing ownership changes, and one-time notification costs for previously deferred systems, are approximately $6.8 million. These costs range from approximately $3.6 million under Alternative 2 to $14 million under Alternative 1.[5]

- **Avoided costs** – Avoided remediation costs associated with conventional UST systems form the majority of positive impacts from the final UST regulation.[6] EPA estimates that the final UST regulation will avoid total costs of $310 million per year (range: $120 million per year to $530 million per year) under the Selected Option. This includes: $300 million (range: $110 million to $510 million) in avoided remediation costs from avoided releases and avoided groundwater contamination incidents; $4.5 million (range: $1.7 million to $7.9 million) in avoided vapor intrusion remediation costs; and $3.1 million (range: $860,000 to $6.5 million) in avoided product loss. Total avoided costs are $450 million (range: $210 million to $670 million) under Alternative 1 and $230 million (range: $45 million to $420 million) under Alternative 2.[7]

- **Benefits** – Due to data and resource constraints, EPA was unable to quantify or monetize many of the final UST regulation's benefits, including human health and ecological benefits. EPA estimates that the final UST regulation could potentially protect 50 billion to 240 billion gallons of groundwater each year.[8] Categories of nonmonetizable or nonquantifiable benefits that are qualitatively discussed in this analysis include: avoidance of human health risks, mitigation of acute exposure

[5] If all applicable state and local government costs were incurred in the first year, rather than annualized and discounted, state and local governments would incur approximately $3.8 million in costs under the Selected Option. This includes $0.2 million for states to apply for state program approval and to read the regulations, $0.2 million for states to process one-time notifications of AHFDSs and FCTs and ownership changes that occur in the first year, and $3.6 million for state and local government owners and operators of UST systems to comply with requirements that come into effect in the first year (approximately 80 percent of which would be for state and local government owners and operators to read the final UST regulation).

[6] For purposes of this analysis, "avoided remediation costs" include avoided administrative, response, remediation, and oversight costs.

[7] Note that due to modeling and data limitations, EPA was unable to estimate avoided remediation costs associated with avoided releases and avoided groundwater contamination from AHFDSs and FCTs. In addition, EPA's estimates of avoided remediation costs do not include non-use values that individuals may place on the existence of uncontaminated water supply.

[8] See chapter 4.10 for details on how this estimate was derived.

events and large-scale releases (e.g., releases from AHFDSs and FCTs[9]), protection of ecological biota, and avoided property devaluation.

- **Compliance costs and avoided costs under the alternative baseline** – Under the alternative baseline scenario that assumes declines in the universes of both UST systems and releases over time, EPA estimates $160 million in annual compliance costs for the final UST regulation. Estimated costs do not change substantially under the alternative baseline scenario and range from $70 million under Alternative 2 to $290 million under Alternative 1. EPA also estimates total avoided costs of $210 million (range: $81 million to $360 million) under the Selected Option in the alternative baseline scenario. These avoided costs range from $160 million (range: $31 million to $290 million) under Alternative 2 to $310 million (range: $140 million to $460 million) under Alternative 1.

- **Average economic impacts** – Motor fuel retailers, which account for roughly 80 percent of UST systems, are expected to bear approximately 70 percent of the total costs under the Selected Option. To establish how the final UST regulation may impact the market, EPA examined whether the final UST regulation imposes a cost greater than the average after-tax profit margin of 1.8 percent for motor fuel retailers.[10] Using this benchmark, we estimate approximately 19 firms may exit the market if they cannot pass costs through to customers. This number represents less than 0.1 of one percent of the total universe of 148,000 facilities. In comparison, between 2005 and 2013, the number of gas station facilities decreased by an average of 2,024 stations per year.

- **State financial assurance funds** – Decreases in release frequency and severity may decrease payments required of state financial assurance funds by $160 million or more per year under the Selected Option.[11] To the extent that these funds are maintained by taxes other than those assessed on UST operators, decreases in these payments effectively represent a reallocation of costs from public entities to the private entities responsible for releases.

[9] For example, an estimated 300,000 to 500,000 gallons of fuel were released from a 2.1 million gallon underground FCT at a fuel depot in Portsmouth, VA. Free product was found within 20 feet of a nearby creek in 1987. The release was attributed to tank or piping failures. Another example is Pease Air Force Base, where jet fuel was delivered to the runway apron via an underground fueling system. Historical leakage from the system contaminated soil and groundwater, forming groundwater plumes at many sites along the system. A site release study identified 60 to 70 release points with varying degrees of severity along the refueling system line with free product found under the apron at closure.

[10] When costs exceed facility profits, it is likely that in the long-term, the facility would exit the market. After-tax profit margin based on 2009 data reported to the IRS (see chapter 5.2.3).

[11] See chapter 5.2.4 for details on how this estimate was derived.

Assessment Of Compliance Costs

For this regulatory impact analysis, direct compliance costs and state oversight costs provide a reasonable proxy to assess the final UST regulation's social costs for the following reasons:

- The regulatory requirements generally focus on additional testing and inspection of existing equipment and do not reflect large-scale investments in equipment or significant changes to operations at the facility level. In addition, the facilities affected by the final UST regulation are distributed with relative geographic uniformity for consumers and producers.

- Given the small per-facility costs (approximately $715 per year for the average facility), closures or changes in market structure represent an unlikely response to the final UST regulation. According to the 2007 Economic Census, average revenues in the retail motor fuel sales sector were approximately $3.8 million; the corresponding cost-to-sales ratio for the average facility is less than one-tenth of one percent. Therefore, it is unlikely that significant changes to production or consumer behavior will affect social costs.

- The short- and long-run impacts of the final UST regulation are not likely to differ significantly. Testing and inspection requirements may offer some opportunities for owners and operators to reduce costs by learning over time, but they are not likely to reduce costs enough to facilitate large-scale equipment upgrades.

EPA's calculation of total incremental compliance costs for UST facilities reflects two key components: identifying specific measures necessary for compliance at individual facilities and calculating costs associated with each of these measures. To estimate these costs, EPA developed a compliance cost model that identifies incremental equipment and labor requirements for an individual system. Based on the baseline equipment use profile, existing state regulations, and anticipated responses to the final UST regulation, the model then generates system-specific estimates of compliance costs. Compliance costs include labor and capital costs associated with new equipment and installation, inspection, testing, and recordkeeping. The model also includes other compliance costs, such as those associated with more frequent detection of equipment failure and repair of equipment. Some component costs are specific to individual UST system configurations – for example, AHFDSs or FCTs – while others are consistent across all system types. **Exhibit ES-2** summarizes the findings of our analysis of compliance costs.

Exhibit ES-2

Total Annual Compliance Costs[a,b]

Category	Selected Option ($ millions)	Alternative 1 ($ millions)	Alternative 2 ($ millions)
Conventional UST systems[c]	$130	$280	$63
Emergency Generator Tanks (EGTs)	$2.0	$2.3	$2.0
Airport Hydrant Fuels Distribution Systems (AHFDSs)	$10	$0.017	$0.0
UST systems with Field-Constructed Tanks (FCTs)	$11	$0.066	$0.0
Cost to Owners/Operators to Read Regulation	$5.5	$5.5	$5.5
State Government Administrative Costs[d]	$0.12	$0.12	$0.12
Total Annual Compliance Costs[e]	**$160**	**$290**	**$70**

[a] Cost estimates were derived using a seven percent discount rate.

[b] Compliance costs include direct compliance costs and state oversight costs. For this regulatory impact analysis, direct compliance costs and state oversight costs provide a reasonable proxy to assess the final UST regulation's social costs. See Chapter 3.1 for further discussion.

[c] Conventional UST systems include all systems that are not AHFDSs, FCTs, or EGTs.

[d] The costs for UST systems directly owned or operated by local, state, and federal government entities are included in the estimates of compliance costs within the other categories (see Exhibit ES-6). Costs shown here reflect the administrative costs for state governments to read the final UST regulation, apply for state program approval, process notifications of ownership changes, and process one-time notifications of EGT, AHFDS, and FCT existence.

[e] Totals may not add up due to rounding.

Assessment Of Cost Savings And Benefits

Avoided remediation costs among conventional UST systems and EGTs provide the basis for a substantial portion of the beneficial impacts associated with the final UST regulation. Avoided remediation costs of the final UST regulation represent cost savings that accrue to owners, operators, and public entities charged with remediating releases at regulated facilities. EPA obtained remediation costs from a survey of state UST cleanup programs and estimates of the distribution of releases by UST system area from internal research.[12] EPA identified four UST technical experts who provided professional judgment regarding the final UST regulation's effects on reduction in release frequency (number of releases per year) and release severity (as measured by groundwater incidents averted). This body of knowledge allowed EPA to estimate total avoided costs, as well as avoided costs per requirement. EPA also estimated avoided costs associated with vapor intrusion and product loss, though these avoided costs are not allocated across requirements.[13] Finally, the analysis provides qualitative discussion of avoided acute events and exposure (including large-scale releases, such as those from AHFDSs and FCTs), avoided human health risks, ecological benefits, and avoided property devaluation. These findings are summarized in **Exhibit ES-3** below.

[12] U.S. Environmental Protection Agency Office of Underground Storage Tanks, "Evaluation of Releases from New and Upgraded Underground Storage Tank Systems – Peer Review Draft," U. S. EPA, August 2004.

[13] These costs were not allocated because we did not ask the experts to estimate quantitatively how different regulatory requirements would specifically affect vapor intrusion or product loss. Vapor intrusion frequency and cost data rely on general information we received from several states and are typically recorded as additional remedial activities at some groundwater sites. The likelihood of vapor intrusion, however, is driven by proximity of receptors and by geology and is not predictably related to the size or age of a plume. Product loss estimates rely on data from Florida and other sources for typical release sizes and are mapped to the estimates of avoided releases.

Exhibit ES-3

Summary Of Positive Impacts

SELECTED OPTION						
Type Of Impact	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Average**	**Range**
Monetized Avoided Costs Associated With Conventional USTs And EGTs ($ millions, present value 2012$)[a]						
Releases and groundwater incidents[b]	$330	$110	$260	$510	$300	$110 - $510
Vapor intrusion	$4.3	$1.7	$4.1	$7.9	$4.5	$1.7 - $7.9
Product loss	$2.3	$0.86	$2.9	$6.5	$3.1	$0.86 - $6.5
Total[c]	**$330**	**$120**	**$270**	**$530**	**$310**	**$120 - $530**
Non-Monetized Impacts[d]						
Groundwater protected (billion gallons)	130	50	120	240	130	50 - 240
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)[e]	n/e	n/e	n/e	n/e	n/e	n/e
Ecological benefits[e]	n/e	n/e	n/e	n/e	n/e	n/e
Human health risks[e]	n/e	n/e	n/e	n/e	n/e	n/e
ALTERNATIVE 1						
Type Of Impact	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Average**	**Range**
Monetized Avoided Costs Associated With Conventional USTs And EGTs ($ millions, present value 2012$)[a]						
Releases and groundwater incidents[b]	$490	$200	$410	$650	$440	$200 - $650
Vapor intrusion - low assumptions	$5.9	$2.5	$5.9	$9.1	$5.9	$2.5 - $9.1
Product loss	$2.6	$0.78	$4.1	$7.6	$3.8	$0.78 - $7.6
Total[c]	**$500**	**$210**	**$420**	**$670**	**$450**	**$210 - $670**
Non-Monetized Impacts[d]						
Groundwater protected (billion gallons)	180	74	180	270	170	74 - 270
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)[e]	n/e	n/e	n/e	n/e	n/e	n/e
Ecological benefits[e]	n/e	n/e	n/e	n/e	n/e	n/e
Human health risks[e]	n/e	n/e	n/e	n/e	n/e	n/e
ALTERNATIVE 2						
Type Of Impact	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Average**	**Range**
Monetized Avoided Costs Associated With Conventional USTs And EGTs ($ millions, present value 2012$)[a]						
Releases and groundwater incidents[b]	$210	$44	$220	$410	$220	$44 - $410
Vapor intrusion - low assumptions	$2.6	$0.56	$3.2	$6.0	$3.1	$0.56 - $6.0
Product loss	$1.5	$0.36	$2.5	$5.2	$2.4	$0.36 - $5.2
Total[c]	**$220**	**$45**	**$220**	**$420**	**$230**	**$45 - $420**
Non-Monetized Impacts[d]						
Groundwater protected (billion gallons)	78	17	96	180	92	17 - 180
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)[e]	n/e	n/e	n/e	n/e	n/e	n/e
Ecological benefits[e]	n/e	n/e	n/e	n/e	n/e	n/e
Human health risks[e]	n/e	n/e	n/e	n/e	n/e	n/e

[a] Avoided remediation costs from releases and groundwater incidents are the costs related to site remediation. Avoided vapor intrusion costs include additional avoided costs associated with the remediation of vapor intrusion cases; the RIA does not address human health risk associated with vapor intrusion. Avoided product loss costs are also separate and additive.

Exhibit ES-3 **Summary Of Positive Impacts**
[b] Expert 2 provided responses that generate benefits that are relatively low compared to estimated costs, unlike the other three experts. Conversations with this expert indicated that this discrepancy may be due to his assumptions about partial noncompliance. See Section 4.5.3 and Appendix H for additional discussion. [c] Totals may not add up due to rounding. Cost estimates were derived using a seven percent discount rate. [d] Due to data and resource constraints, EPA was unable to monetize some of the positive impacts of the final UST regulation. Chapter 4 provides a qualitative discussion of these benefits. [e] Benefits not estimated are denoted by n/e.

Comparison Of Compliance Costs And Positive Impacts

Exhibit ES-4 summarizes the compliance costs and positive impacts of the final UST regulation. The majority of measurable positive effects occur as avoided remediation costs. As discussed in Chapter 4, avoided costs provide a reasonable measure of the positive effects of the final UST regulation.

Exhibit ES-4

Comparison Of Annual Compliance Costs And Cost Savings[f,d]

	Selected Option (2012$ millions)	**Alternative 1 (2012$ millions)**	**Alternative 2 (2012$ millions)**
Annual Avoided Costs[a]			
Releases and groundwater incidents: average value *(range of all values in italics)*	$300 *($110-$510)*	$440 *($200-$650)*	$220 *($44-$410)*
Vapor intrusion: average value *(range of all values in italics)*	$4.5 *($1.7-$7.9)*	$5.9 *($2.5-$9.1)*	$3.1 *($0.56-$6.0)*
Product loss *(range of all values in italics)*	$3.1 *($0.86-$6.5)*	$3.8 *($0.78-$7.6)*	$2.4 *($0.36-$5.2)*
Annual Compliance Costs			
Conventional UST systems[b]	$130	$280	$63
Emergency generator tanks (EGTs)	$2.0	$2.3	$2.0
Airport hydrant fuel distribution systems (AHFDSs)	$10	< $0.1	N/A
UST systems with field-constructed tanks (FCTs)	$11	< $0.1	N/A
Cost to owners/operators to read UST regulation	$5.5	$5.5	$5.5
State government administrative costs[c]	$0.12	$0.12	$0.12
Total Annual Avoided Costs *(range of all values in italics)*	**$310** *($120-$530)*	**$450** *($210-$670)*	**$230** *($45-$420)*
Total Annual Compliance Costs[d]	**$160**	**$290**	**$70**
Net Cost (Savings) To Society[d,g] **[Total Compliance Costs *Less* Total Avoided Costs]** *(range of all values in italics)*	**($160)** *$39 - ($370)*	**($160)** *$81 - ($380)*	**($160)** *$25 - ($350)*
Non-Monetized Benefits[e]			
Groundwater protected (billion gallons)	130 (50-240)	170 (74-270)	92 (17-180)
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)	Not estimated	Not estimated	Not estimated
Ecological benefits	Not estimated	Not estimated	Not estimated
Human health risks	Not estimated	Not estimated	Not estimated

[a] Avoided costs are estimated for conventional UST systems and emergency generator tanks only. Avoided remediation costs from releases and groundwater incidents are the costs related to site remediation. Avoided vapor intrusion costs include additional avoided costs associated with the remediation of vapor intrusion cases; the RIA does not address human health risk associated with vapor intrusion. Avoided product loss costs are also separate and additive.
[b] Conventional UST systems include all systems that are not AHFDSs, FCTs, or EGTs.
[c] The costs for UST systems directly owned or operated by local, state, and federal government entities are included in the estimates of compliance costs within the other categories. Costs shown here reflect the administrative costs for state

Exhibit ES-4 **Comparison Of Annual Compliance Costs And Cost Savings**[f,d]
governments to read the final UST regulation, apply for state program approval, process notifications of ownership changes, and process one-time notifications of existence for AHFDS and UST systems with FCTs. [d] Compliance costs include direct compliance costs and state oversight costs. For this regulatory impact analysis, direct compliance costs and state oversight costs provide a reasonable proxy to assess the final UST regulation's social costs. See Chapter 3.1 for further discussion. [e] Due to data and resource constraints, EPA is unable to monetize some of the positive impacts of the final UST regulation. Chapter 4 of this document provides a qualitative discussion of these benefits. [f] Totals may not add up due to rounding. Cost estimates were derived using a seven percent discount rate. [g] The results show that all but one of the four estimates of cost savings for conventional systems exceed total regulatory costs (including FCT and AHFDS systems). As explained in Chapter 4 and Appendix H, one of the four experts provided estimates of avoided releases and averted groundwater incidents that do not result in net cost savings to society from the Selected Option. However, this expert also assumed a high level of noncompliance with the final UST regulation that is not consistent with the assumption of 100 percent compliance in the cost estimates. As a result, this low-end estimate of potential cost savings likely understates the cost savings that would be associated with a consistent, 100 percent compliance scenario. See Chapter 4 and Appendix H for detailed discussion of how these assumptions affect net benefits of the final UST regulation as calculated using responses from Expert 2.

Exhibit ES-5 summarizes the compliance costs and positive impacts of the final UST regulation under an alternative baseline where universes of UST systems and releases are assumed to decrease at a declining rate over time. Compliance costs do not change substantially under the alternative baseline, while estimates of avoided costs decrease by approximately 31 percent, as the universe of releases contracts substantially under the alternative baseline. In this scenario, annual net savings to society for the Selected Option average $60 million per year.

Exhibit ES-5

Comparison Of Annual Compliance Costs And Cost Savings Under Alternative Baseline[c,e]

	Selected Option (2012$ millions)	**Alternative 1 (2012$ millions)**	**Alternative 2 (2012$ millions)**
Total Annual Avoided Costs[a,b] *(range of all values in italics)*	$220 *($81-$360)*	$310 *($140-$460)*	$160 *($31-$290)*
Total Annual Compliance Costs[c]	$160	$290	$70
Net Cost (Savings) To Society[c,d] **[Total Compliance Costs *Less* Total Avoided Costs]** *(range of all values in italics)*	**($60)** *$74 - ($210)*	**($25)** *$140 - ($170)*	**($87)** *$39 - ($220)*

[a] Avoided costs are estimated for conventional UST systems and emergency generator tanks only.
[b] Due to data and resource constraints, EPA is unable to monetize some of the positive impacts of the final UST regulation. Chapter 4 of this document provides a qualitative discussion of these benefits.
[c] Compliance costs include direct compliance costs and state oversight costs. For this regulatory impact analysis, direct compliance costs and state oversight costs provide a reasonable proxy to assess the final UST regulation's social costs. See Chapter 3.1 for further discussion.
[d] The results show that all but one of the four estimates of cost savings for conventional systems exceeded total regulatory costs (including FCT and AHFDS systems). As explained in Chapter 4 and Appendix H, one of the four experts provided estimates of avoided releases and averted groundwater incidents that do not result in net cost savings to society from the Selected Option. However, this expert also assumed a high level of noncompliance with the final UST regulation that is not consistent with the assumption of 100 percent compliance in the cost estimates. As a result, this low-end estimate of potential cost savings likely understates the cost savings that would be associated with a consistent, 100 percent compliance scenario. See Chapter 4 and Appendix H for detailed discussion of how these assumptions affect net benefits of the final UST regulation as calculated using responses from Expert 2.
[e] Totals may not add up due to rounding. Cost estimates were derived using a seven percent discount rate.

Economic Impacts

EPA's assessment of the economic impacts associated with this final UST regulation focused on the retail motor fuels sector, which accounts for approximately 80 percent of UST owners or operators. In this analysis, EPA describes supply and demand dynamics within the retail motor fuels market and the likely economic responses to increased compliance costs. Our screening assessment finds that average estimated facility-level costs of $715 may result in the market exit of approximately 19 firms, if these firms cannot pass any regulatory costs through to customers. This represents less than 0.1 of one percent of existing retail motor fuel facilities, and an even smaller fraction of all facilities affected by the final UST regulation.[14] In comparison, approximately 2,024 facilities per year closed over the period between 2005 and 2013.

To address uncertainty related to the distribution of costs among UST facilities, we also constructed a worst-case sensitivity analysis, which identified the maximum number of facilities that could face significant economic impacts due to regulatory costs. We defined the worst case as the scenario where the highest possible cost occurred for the smallest facilities. We found that up to 4,500 facilities may exit the market in this unlikely worst-case scenario, representing 3 percent of existing retail motor fuel facilities and a similar rate to annual historical market exits. The limited magnitude of impacts even in the worst-case scenario suggests that the final UST regulation will not affect existing consolidation trends in the retail motor fuels industry, retail motor fuel prices, or consumption.

In addition, EPA's analysis suggests that the final UST regulation could result in a reallocation of costs from the public to private parties responsible for releases.[15] Preventing releases under this UST regulation would increase compliance costs to facility owners, but the avoided releases would in many cases reduce remediation demand for taxpayer-funded state funds. This is likely to improve behavioral incentives, as the parties most likely to cause releases will also be responsible for preventing them. As discussed in Chapter 5, this reallocation could result in savings to state financial assurance funds in excess of $160 million per year.

Other Regulatory And Distributional Issues

As part of our analysis, we assessed the final UST regulation's potential impacts related to:

- **Energy impacts** – The final UST regulation will not have significant adverse effects on energy supply, distribution, or use, including impacts on price and foreign supplies. It is, therefore, not a significant energy action under Executive Order 13211, *Actions Concerning Regulations That Affect Energy Supply, Distribution, or Use* (May 18, 2001).

[14] Census data on number of facilities per firm indicate that virtually all firms earning less than $250,000 per year in 2007 had only one facility. We therefore use "firm" and "facility" interchangeably in this context. See chapter 5.2.3 for details.

[15] For additional information regarding this issue, see Chapter 5.

- **Regulatory flexibility** – EPA's analysis determined that approximately 634 small entities (less than 1 percent of the universe of affected small entities) may experience economic impacts that exceed 1 percent of revenues, but only 19 of these entities would exit the market as a result of incurring costs greater than or equal to total profits. For various reasons, and especially due to different system configurations for smaller facilities, the actual number of affected entities is likely to be even fewer than the number estimated by the analysis. In comparison, this number is smaller than the recent industry consolidation rate of approximately 2,024 facilities per year in the retail motor fuels sector. The final UST regulation is unlikely to have a significant economic impact on a substantial number of small businesses or small governments.

- **Small government impacts** – The final UST regulation is not expected to have significant small government impacts. EPA's assessment of costs to state and local governments indicated that no government-owned UST facilities will experience costs that exceed 1 percent of revenues.

- **Impacts on minority and low-income populations** – Because the final UST regulation would increase regulatory stringency and reduce the number and size of releases, the final UST regulation is not expected to have any disproportionately high and adverse human health or environmental effects on minority or low-income populations, or on any community.

- **Children's health protection** – Because the final UST regulation is expected to reduce exposure to contaminated groundwater by reducing the number and size of releases, EPA does not expect the final UST regulation to have a disproportionate environmental health risk effect on children, as defined in Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (62 FR 19885, April 23, 1997). Moreover, while the risk assessment did not specifically measure exposure to children, it is unclear that children are disproportionately affected in the baseline. For example, adults could be the more sensitive receptor for cancer effects of contaminated groundwater due to the longer potential exposure from showering (inhalation of vapors) compared to children (ingestion of water while bathing), particularly those under age 5 who are assumed to take more baths and fewer showers.

- **Regulatory planning and review** – Pursuant to the terms of Executive Order 12866 (58 FR 51735, October 4, 1993), EPA determined the final UST regulation is an economically significant regulatory action because it may have an annual effect on the economy of $100 million or more, as defined under part 3(f)(1) of the Order. Findings of the regulatory cost analysis in Chapter 3 indicate the final UST regulation is projected to result in aggregate annual compliance costs of approximately $160 million under the Selected Option, $290 million under Alternative 1, and $70 million under Alternative 2.

- **Unfunded mandates analysis** – The final UST regulation is subject to the requirements of sections 202 and 205 of the Unfunded Mandates Reform Act (UMRA), because it contains federal mandates that may result in the expenditure by state, local, and tribal governments or by the private sector of $100 million or more in any one year. **Exhibit ES-6** provides references for EPA's analyses responding to UMRA requirements under which this final UST regulation is subject.

Exhibit ES-6

Location Of Analyses Responding To UMRA Requirements

Requirement	**Location In This Document**
Identification of provision of federal law under which rule is being promulgated	Chapter 1
Assessment of costs and benefits to state, local, and tribal governments and the private sector	Chapters 3 and 4
Assessment of the effect on health, safety, and the natural environment	Chapter 4
Assessment of the extent to which such costs may be paid with federal financial assistance	Chapter 3; no Federal assistance is anticipated
Assessment of the extent to which there are available federal resources to carry out this mandate	Chapter 3; no Federal resources are anticipated
Estimates of future compliance costs	Chapter 3
Estimates of disproportionate budgetary effects on any type of government or private sector segment	Chapter 5
Estimates of the effect on the national economy	Chapters 3 and 5

- **Federalism** – Executive Order 13132, *Federalism* (64 FR 43255, August 10, 1999), defines policies that have federalism implications to include regulations with substantial direct effects on states, on the relationship between the federal government and states, or on the distribution of power and responsibilities among the various levels of government. EPA typically considers a policy to have federalism implications if it results in aggregate expenditures by state or local governments of $25 million or more in any one year. As **Exhibit ES-7** below indicates, EPA does not expect any of the regulatory options to have significant federalism implications.

Exhibit ES-7

Summary Of Annual State And Local Government Costs[b]

Element	**Selected Option ($ millions)**	**Alternative 1 ($ millions)**	**Alternative 2 ($ millions)**
Local Compliance Costs[a]	$5.4	$11.0	$2.8
State Compliance Costs[a]	$1.3	$2.9	$0.70
State Government Administrative Costs	$0.12	$0.12	$0.12
Total State And Local Governments Costs[c]	**$6.8**	**$14.0**	**$3.6**

[a] State and local government compliance costs are included in the total compliance costs presented in Exhibit ES-2.
[b] Cost estimates were derived using a seven percent discount rate.
[c] Total may not sum due to rounding.

- **Tribal governments analysis** – Executive Order 13175, *Consultation and Coordination With Indian Tribal Governments* (65 FR 67249, November 9, 2000), requires EPA to develop an accountable process to ensure meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications. EPA consulted with tribal officials early in the process of developing this UST regulation to welcome meaningful and timely input into its development. EPA began its consultation with tribes on possible changes to the UST regulation shortly after the passage of the Energy Policy Act of 2005. In addition to our early consultation with tribes, EPA again reached out to the tribes as we started the official regulatory process and throughout the development of the UST regulation. EPA sent letters to leaders of over 500 tribes, as well as to tribal regulatory staff, inviting their participation in developing the regulation. EPA heard from both tribal officials who work as regulators as well as representatives of owners and operators of UST systems in Indian country. The tribal regulators raised concerns about ensuring parity of environmental protection between states and Indian country. The changes to the UST regulation are needed to ensure parity between UST systems in states and in Indian country. This final UST regulation will ensure installed equipment is working properly and protects the environment from potential releases.

  As part of this analysis, EPA concluded that the final UST regulation will have tribal implications to the extent that tribally-owned entities with UST systems on Indian country would be affected. However, it will neither impose substantial direct compliance costs on tribal governments, nor preempt tribal law. Total costs to owners and operators of tribally-owned UST systems are approximately $0.67 million.

- **Joint impacts of regulations** – Facilities in the UST system universe are affected by a number of existing regulations, including state regulations and Spill Prevention, Control, and Countermeasure (SPCC) regulations. At the time of the 1988 UST regulation, completely buried tanks greater than 42,000 gallons and located near navigable waters of the United States or adjoining shorelines were subject to both the UST regulation and SPCC regulation. Currently, a subset of UST systems in the universe is regulated by SPCC; these include EGTs, AHFDSs, and FCTs. To the extent that the requirements imposed on these UST systems via the final UST regulation are more or less stringent than the SPCC regulation currently governing them, the final UST regulation may cause an increase or a reduction in overall inspection and monitoring requirements and costs for these UST systems. To account for this, EPA generated baseline assumptions for these systems using information from the Department of Defense, the owner of the majority of all AHFDSs and FCTs. EGTs are assumed to incur all incremental costs beyond state regulatory baseline costs; to the extent that these systems are regulated under SPCC, this may overstate costs. EPA does not believe that the final UST regulation creates a serious inconsistency or interferes with any other actions planned or undertaken by other agencies.

Chapter 1. Introduction

This document presents an analysis by the U.S. Environmental Protection Agency (EPA) Office of Underground Storage Tanks (OUST) of the costs, benefits, and economic impacts of the final targeted changes to the underground storage tank (UST) regulation. The final UST regulation serves the purpose of strengthening the existing UST regulation by increasing the emphasis on proper operation and maintenance of UST systems and improved maintenance of release detection equipment. The changes anticipated under this final UST regulation also acknowledge improvements in technology over the last 25 years, including the ability to perform release detection for many tank systems that were previously deferred.

1.1 Background

In 1984, Congress responded to the increasing threat to groundwater from leaking UST systems by adding Subtitle I to the Solid Waste Disposal Act (SWDA). SWDA required EPA to protect the environment and human health from UST releases by developing a comprehensive regulatory program for UST systems storing petroleum or certain hazardous substances. In 1986, Congress amended Subtitle I of SWDA and created the Leaking Underground Storage Tank Trust Fund (LUST Trust Fund) to oversee and pay for cleanups at sites where the owner or operator is unknown, unwilling to pay, or unable to pay.

EPA promulgated the UST regulation in 1988 (40 CFR Part 280). This regulation set minimum standards for new tanks and required owners and operators of existing tanks to upgrade, replace, or close their existing tanks. The 1988 regulation set deadlines for owners and operators to meet the new requirements. By 1998, owners and operators had to meet new UST system requirements, upgrade their existing UST systems, or close them. Owners and operators who chose to upgrade had to ensure that every UST system had spill prevention equipment (e.g., spill buckets), overfill prevention equipment, and was protected from corrosion. In addition, owners and operators were required to monitor their UST systems for releases using release detection (phased in during the 1990s depending on the year of installation of each UST system). Finally, owners and operators were required to have financial responsibility (phased in through 1998) to ensure that they are financially able to pay for any releases that occur. No significant changes have been made to these requirements since 1988.

In 1988, EPA also promulgated a regulation for state program approval (40 CFR Part 281). Since states are the primary implementers of the UST program, EPA wanted to set up a process where state programs could operate in lieu of the federal program if certain requirements were met. This regulation describes the minimum requirements states must meet to have their regulations operate in lieu of the federal regulation.

In 2005, the Energy Policy Act (EPAct) further amended Subtitle I of SWDA. The EPAct requires states that receive federal Subtitle I money from EPA to meet certain requirements. EPA developed grant guidelines for states regarding: operator training; inspections; delivery prohibition; secondary containment; financial responsibility for manufacturers and installers; public record; and state compliance reports on government UST systems.

1.2 Need for Regulatory Action

After Congress passed EPAct, EPA decided to revise the 1988 UST regulation (at 40 CFR Part 280), primarily to ensure parity in Indian country. Key EPAct provisions (such as secondary containment and operator training) apply to all states receiving federal Subtitle I money, regardless of their state program approval status; but these key provisions do not apply in Indian country (or in states and U.S. territories that do not meet EPA's operator training or secondary containment grant guidelines). In order to establish federal UST requirements similar to the UST secondary containment and operator training requirements of EPAct, EPA decided to revise the 1988 UST regulation. Without these changes, EPAct provisions will not apply in Indian country. These revisions will also fulfill the objectives of the EPA-Tribal UST Strategy (August 2006) in which both EPA and tribes recognized the importance of ensuring parity in implementing UST program requirements in states and territories, as well as in Indian country.[16]

EPA decided that this is also an appropriate time to change the 1988 UST regulation to reflect technology improvements, address outdated requirements, and place a stronger emphasis on operations and maintenance. While EPA has issued many guidance documents and used various implementation approaches and techniques over the last 25 years, we have not made significant changes to the original 1988 UST regulation. Indeed, most states have passed requirements that go far beyond the 1988 UST regulation that provide greater environmental protection. These state regulations fully implement provisions of the EPAct and improve other important areas of the 1988 UST regulation that have become outdated.

Furthermore, while information on sources and causes of releases show that releases from tanks are less common than they once were, releases from piping and spills and overfills associated with deliveries have emerged as more common problems.[17] In addition, failures of equipment and operations at the dispenser have emerged as one of the leading sources of releases. The lack of proper operation and maintenance of UST systems is a main cause of release from these areas. Data also indicate that release detection equipment only detects about one quarter of all releases.[18] While some of those releases occur in areas not required to have release detection equipment, other releases that should be detected are not because of problems with the operation and maintenance of the release detection equipment.

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[16] See: U.S. Environmental Protection Agency, Office of Underground Storage Tanks. Strategy for an EPA/Tribal Partnership to Implement Section 1529 of the Energy Policy Act of 2005. August 2006. Accessed at: http://www.epa.gov./oust/fedlaws/Tribal%20Strategy_08076r.pdf.

[17] U.S. Environmental Protection Agency, Office of Underground Storage Tanks. "Evaluation of Releases from New and Upgraded Underground Storage Tank Systems (peer review draft)." August 2004; and U.S. Environmental Protection Agency, Office of Underground Storage Tanks. "Petroleum Releases at Underground Storage Tank Facilities in Florida." March 2005.

[18] About 50 percent of all releases go undetected because they occur in areas where release detection is not required (and therefore is not designed to detect a release). Approximately half of the remaining 50% that should be detected still go undetected partly because of issues with operation and maintenance of the release detection equipment. (U.S. Environmental Protection Agency, Office of Underground Storage Tanks. "Petroleum Releases at Underground Storage Tank Facilities in Florida." March 2005. p. 26.)

Since the beginning of the UST program, preventing petroleum releases into the environment has been one of the program's primary goals. EPA and our partners have made major progress in reducing the number of new releases, but over 5,000 releases are still discovered each year. Because existing publicly-funded mechanisms and institutions frequently cover at least part of the costs of release remediation, many owners and operators of UST systems do not bear the full costs of their actions. Petroleum releases thus represent a negative externality caused by UST system operators, as the individuals and firms that cause releases do not bear their full costs. This represents a failure of the market to fully internalize the cost to society of operating an UST system: private costs do not equal social costs.[19] A combination of revised technical standards and inspection and testing requirements represents the most appropriate method for reducing the number of future releases and mitigating the impact of existing negative externalities.

In revising the 1988 regulation, EPA wanted to make sure the regulation development process was open and transparent and that all stakeholders had an opportunity to share their ideas as well as their concerns. From the beginning of this process, EPA recognized the concerns about costs on owners and operators and was committed to limiting the requirements for retrofits. We reached out to all stakeholders, including state and tribal regulators, federal facilities, members of the petroleum industry including representatives of owners and operators as well as equipment manufacturers, small businesses, local governments, and environmental and community groups. Over a two-year period, we held conference calls, solicited comments and provided multiple opportunities for stakeholders to share their ideas as well as for us to keep them informed of where we were in the process.

From this extensive stakeholder outreach, EPA compiled potential proposed changes to the UST regulation. EPA shared all ideas with stakeholders and gave them an opportunity to comment on each idea. We then revised the list of potential changes and added items based on data, analysis, and consideration of costs and benefits. Ultimately, EPA identified the items in the proposed UST regulation as those which needed regulatory changes at the time; the proposed UST regulation was issued in November 2011 for a 90-day public comment period. EPA then extended this public comment period for an additional 60 days. EPA received submissions from over 190 commenters. Based on these comments, EPA revised the 2011 proposed UST regulation and is now finalizing the UST regulation, as described below.

1.3 Summary of the Final UST regulation

EPA is revising the UST regulation to: establish federal requirements that are similar to certain key provisions of the Energy Policy Act; ensure owners and operators perform proper operation and maintenance; address UST systems deferred in the 1988 UST regulation; update the regulation to current technology and practices; and make technical and editorial corrections.

[19] We refer here to mechanisms other than those whose specific purpose is to fund remediation for new releases from UST systems. For example, if owners and operators in a particular state are compelled to participate in a fund operated by a public (or private) entity, and the contributions made directly by the owners and operators are equal to all the remediation costs, such a policy overcomes the market failure. However, when taxpayers are required to cover any portion of remediation costs through general funds or revenues obtained for other purposes, the negative externality will not be rectified.

Specifically, EPA is requiring the following set of revisions (hereafter referred to as the Selected Option):

- Establish federal requirements for secondary containment and operator training similar to those established by EPAct for states that receive federal Subtitle I money

- Add operation and maintenance requirements
  - Walkthrough inspections
  - Overfill prevention equipment inspections
  - Spill prevention equipment tests
  - Containment sump tests
  - Operability tests for release detection equipment

- Address UST systems deferred in the 1988 UST regulation [20]
  - Remove release detection deferral for emergency generator tanks
  - Remove deferrals for airport hydrant fuel distribution systems (AHFDSs) and UST systems with field-constructed tanks (FCTs)

- Provide for other changes to improve release prevention and detection and program implementation
  - Require testing after repairs to spill and overfill prevention equipment, and secondary containment
  - Eliminate flow restrictors in vent lines as an overfill prevention option for all new tanks and when overfill prevention equipment is replaced
  - Require closure of lined tanks that cannot be repaired according to a code of practice
  - Address responses to interstitial monitoring alarms
  - Retain vapor monitoring and groundwater monitoring as methods of release detection for tanks and piping (for those installed before the effective date of today's final UST regulation) only if owners and operators demonstrate proper installation and performance through a site assessment
  - Require notification of ownership change
  - Establish requirements for demonstrating compatibility with fuels containing greater than E10 and greater than B20

- Make general updates to the UST regulation

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[20] In the final UST regulation, EPA is also addressing the 1988 regulatory deferrals of wastewater treatment tank systems that are not part of a wastewater treatment facility regulated under sections 402 or 307(b) of the Clean Water Act, USTs containing radioactive material, and emergency generator UST systems at nuclear power generation facilities regulated by the Nuclear Regulatory Commission. However, because these regulatory changes will not result in any incremental costs to the regulated community, this RIA does not factor these systems into any part of the analysis.

  - Reference newer technologies, including explicitly adding statistical inventory reconciliation (SIR) and continuous in-tank leak detection (CITLD) as release detection methods
  - Update codes of practice listed in the UST regulation
  - Remove old upgrade and implementation deadlines
  - Make editorial and technical corrections

- Revise the state program approval regulation (40 CFR Part 281) to be consistent with the above revisions

1.4 Alternative Regulatory Options

In addition to assessing the impacts of the Selected Option, this document assesses the costs, benefits, and economic impacts of two regulatory alternatives, as outlined in **Exhibit 1-1.** Please refer to the preamble for a discussion of the rationale behind the development of these two alternatives.

While some of the regulatory requirements remain constant across all alternatives, EPA evaluated variations in the subset of proposed requirements that change across alternatives. The differences between the three regulatory options considered in this regulatory impact analysis are described in **Exhibit 1-1**.

Note that each option (i.e., Selected, Alternative 1, and Alternative 2) considered by EPA contains a set of new requirements that does not vary across these options. EPA believes the requirements in this set represent, at a minimum, changes that need to be included in the final UST regulation. Specifically, these requirements are:

- Testing after repairs to spill and overfill prevention equipment, and interstitial spaces

- Adding SIR/CITLD to regulation with performance criteria

- Reporting and testing for interstitial alarms

- Removing the deferral for release detection for emergency generator tanks

- Notification of ownership change

- Closure of lined tanks that cannot be repaired according to a code of practice; and

- Requiring operator training and secondary containment[21]

[21] As explained in the introduction, operator training and secondary containment are being finalized in order to ensure parity in program implementation among states and in Indian country.

Exhibit 1-1

Options Considered For The Final UST regulation

Requirement Description	Options		
	Selected	**Alternative 1**	**Alternative 2**
Release Prevention			
Walkthrough inspections	30-day	30-day (as proposed in Nov 2011)	Quarterly
Overfill prevention equipment inspections	3 year	Annual	Not required
Spill prevention equipment tests	3 year	Annual	3 year
Containment sump testing	3 year	Annual	Not required
Testing after repairs to spill and overfill prevention equipment, and secondary containment	Required	Required	Required
Eliminate flow restrictors in vent lines for all new tanks and when overfill prevention equipment is replaced	Required	Required	No change from existing regulation
Release Detection			
Operability tests for release detection equipment	Annual (plus annual check of sumps)	Annual (as proposed in Nov 2011)	Annual (plus annual check of sumps)
Add SIR/CITLD to regulation with performance criteria	Required	Required	Required
Response to interstitial monitoring alarms	Required	Required	Required
Groundwater and vapor monitoring for release detection	Continue to allow with site assessment	5-year phase out (as proposed in Nov 2011)	No change from existing regulation
Remove release detection deferral for emergency generator tanks	Required	Required (as proposed in Nov 2011)	Required
Other			
Require notification of ownership change	Required	Required	Required
Closure of lined tanks that cannot be repaired according to a code of practice	Required	Required	Required
Requirements for demonstrating compatibility with fuels >E10 and >B20	Required	Required (as proposed in Nov 2011)	No change from existing regulation
Remove deferrals for airport hydrant fuel distribution systems and UST systems with field-constructed tanks	Regulate under alternative release detection requirements	Require AHS/FCT notify implementing agency and report releases (with no other requirements)	Maintain deferral
EPAct-related Provisions			
Operator training	Required	Required	Required
Secondary containment	Required	Required	Required

* In the 2011 proposed regulation, these changes generally consisted of more or stricter requirements than what is in the final UST regulation. For example, the 30-day walkthrough inspections in the 2011 proposed UST regulation included monthly check of sumps. Please see the 2011 proposed UST regulation for details.

Many of the requirements in the final UST regulation will not immediately impose new costs upon UST owners or operators. For example, new requirements for periodic testing of equipment do not require owners or operators to perform those tests at the time the regulation comes into effect; depending on the requirement, owners or operators may have up to three years to satisfy the new requirements.[22] EPA's analysis accounts for this delay in its estimate of costs by discounting the costs associated with each requirement as shown in **Exhibit 1-2**. EPA

[22] Please refer to the preamble section for each requirement for a discussion of the implementation periods.

assumes that the monetized positive impacts associated with these requirements accrue at the end of the year in which costs occur since some beneficial impacts may lag requirements.[23]

Exhibit 1-2

Years Until Final Requirements Become Effective

Requirement	Number of years until effective
Release Prevention	
Walkthrough inspections	3[a]
Overfill prevention equipment inspections	3
Spill prevention equipment tests	3
Containment sump testing[7]	3
Release Detection	
Operability tests for release detection methods	3[b]
Remove deferral for emergency generator tanks	3[c]
Other	
Remove deferral for airport hydrant fuel distribution systems (Subparts B, C, D and H)[24]	3
Remove deferral for UST systems with field-constructed tanks (Subparts B, C, D and H)[9]	3
EPAct-related Provision	
Operator training	3

Please refer to the preamble section for each requirement for a discussion on the rationale behind the delayed implementation periods.

[a] This requirement is effective immediately under Alternative 1.
[b] This requirement is effective after one year under Alternative 1. In addition, under Alternative 1, groundwater and vapor monitoring are eliminated as release detection methods and must be phased out within five years.
[c] This requirement is effective after one year under Alternative 1.

Finally, EPA is including a set of revisions and clarifications that are not expected to have any economic impact, due to either the nature of the requirement or the interaction between the new UST regulation and existing regulation. The only cost associated with these clarifications and changes is the cost of reading the new regulation. These revisions include:

- Updating the regulation to reference newer technologies
- Updating the codes of practice listed in the regulation

[23] EPA does not have data to suggest any particular length of lag for each requirement; for this analysis, we assume that benefits accrue at the end of the year in which costs occur. Chapters 3 and 4 provide detailed descriptions of the methods used to assess costs and beneficial impacts.

[24] Removing deferrals for airport hydrant fuel distribution systems and field-constructed tanks will require these systems to comply with Subpart B, C, D, E, G, H, and J of 40 CFR Part 280 (as described in Subpart K). The final UST regulation requires these systems to comply with Subparts B, C, D, H, and J after 3 years, while compliance with Subparts E and G would be required immediately.

- Updating the regulation to remove old upgrade and implementation deadlines
- Updating the regulation for editorial and technical corrections
- Revising the State Program Approval regulation (40 CFR Part 281) to be consistent with the above revisions

1.5 Scope of Analysis

Within the constraints of data availability, this analysis attempts to capture all quantifiable and qualitative impacts of the final UST regulation. EPA obtained sufficient data to identify, by state, the number of units likely to be affected by each change in the regulation. The analysis uses these data to assess the compliance costs on these units and relevant state governments. In conducting these analyses, EPA also assessed the sensitivity of outcomes to key assumptions. Separately, the analysis monetizes a number of positive impacts of the regulation, including the avoided costs generated by avoided releases and reduction in severity of releases, avoided product loss, and avoided vapor intrusion damages. This analysis quantifies, but does not value, groundwater impacts. Finally, due to data and resource limitations, this analysis was unable to quantify or value human health benefits or ecological impacts, but addresses these qualitatively.

In addition to identifying costs and the positive impacts of the regulation, this analysis also examines the economic and distributional impacts of the regulation. The economic impact analysis includes the final UST regulation's effect on facility closures, employment, and energy output and cost. The analysis of the distributional impacts of the regulation examines the effect of a reduction in releases on state financial assurance funds, impacts on children's health, small business impacts, and impacts on low-income and minority populations. Finally, this analysis considers the final UST regulation's impacts related to certain executive orders and statutes, including the Unfunded Mandates Reform Act, tribal governments, and federalism.

1.6 Report Organization

To support the development of the final UST regulation, EPA designed and conducted this analysis of the regulation's costs, benefits, and economic impacts consistent with the requirements of Executive Order 12866, and OMB Circular A-4.[25] Data, methods, and results of this analysis are presented in the following chapters:

- ***Chapter 2: Universe of UST Systems Affected by the Final UST regulation.*** This chapter identifies a profile of the entities that may be affected by the final UST regulation.
- ***Chapter 3: Assessment of Compliance Costs.*** This chapter summarizes the methods employed by EPA to assess the cost impacts of the final UST regulation.

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[25] Executive Order 12866. "Regulatory Planning and Review." October 4, 1993; and U.S. Office of Management and Budget. Circular No. A-4. September 17, 2003.

- ***Chapter 4: Assessment of Benefits and Cost Savings.*** This chapter presents estimates of the benefits and avoided costs of the final UST regulation.

- ***Chapter 5: Distributional Impacts and Considerations.*** This chapter summarizes the assessment of distributional impacts of the final UST regulation, including economic and energy impacts, effects on small businesses and governments, impacts on low-income and minority populations, and children's health effects.

- ***Chapter 6: Other Statutory and Executive Order Analyses.*** This chapter summarizes analyses required by certain statutes or executive orders, including regulatory planning and review, impacts created by unfunded mandates, federalism implications, effects on tribal governments, and joint impacts of the final UST regulation in the context of existing regulations.

- ***Chapter 7: Comparison of Costs, Benefits, and Other Impacts.*** This chapter summarizes and compares the costs, cost savings, and benefits of the final UST regulation.

- ***Appendices.*** We present the details of methods and assumptions we employ in a number of appendices.

Chapter 2. Universe of UST Systems Affected by the Final UST regulation

This regulatory impact analysis addresses the effects of the final regulatory changes on four types of UST systems: conventional UST systems with prefabricated tanks that store and dispense petroleum products; emergency generator tank systems that store fuel for occasional use; UST systems with field-constructed tanks that are typically designed to store large volumes of fuel; and airport hydrant fuel distribution systems that provide large volumes of fuel to aircraft using underground distribution systems.

This chapter describes the universe of systems, facilities, firms, and sectors that are likely to be affected by the final regulatory changes, and documents the extent to which state regulations already require compliance with the final UST regulation.

2.1 Types of Entities Affected by the Final UST regulation

The four types of UST systems that are potentially affected by the final UST regulation are characterized as follows:

- **Conventional UST systems (conventional USTs):** These systems include the universe of facilities and tanks that are currently subject to existing regulations, along with ancillary equipment (e.g., piping, dispensers, sumps, spill prevention equipment, and release detection equipment). The majority of these systems store and dispense petroleum products and are typically found at gas stations. A limited number store other hazardous substances, but the regulatory impact analysis does not consider these UST systems separately.[26] These UST systems are subject to all requirements under 40 CFR Part 280.

- **Emergency generator tank systems (EGTs):** Emergency generator tank systems refer to the tanks and piping for systems that provide longer-term storage of fuel for occasional use as a back-up fuel supply. These tanks are currently deferred from 40 CFR Part 280 Subpart D (release detection) but are subject to all other requirements under 40 CFR Part 280. The final UST regulation does not address emergency tanks at nuclear power plants, which are regulated by the Nuclear Regulatory Commission under 10 CFR Part 50, appendix A.[27]

- **UST systems with field-constructed tanks (FCTs):** Field-constructed tanks are underground bulk storage tanks that are built on-site because they are too large to be pre-fabricated. All identified field-constructed tanks currently in operation are owned by federal facilities and mainly serve operations at military bases. These tanks are currently deferred from all regulation under 40 CFR Part 280, except for Subparts A and F, but are typically subject to regulation under the Oil Pollution

[26] Because tanks storing hazardous substances are also currently subject to the 1988 UST regulation under 40 CFR Part 280, this analysis assumes that incremental costs and benefits associated with the final UST regulation will be comparable to the costs and benefits associated with other conventional UST systems. Although hazardous substance tanks are not included in the total number of active petroleum UST systems, EPA roughly estimates that less than one percent of all active regulated UST systems contain hazardous substances.

[27] See 40 CFR 280.10 Subpart A – Applicability.

Act of 1990, 40 CFR Part 112 (EPA's Spill Prevention, Control, and Countermeasure regulation).

- **Airport Hydrant Fuel Distribution Systems (AHFDSs):** Airport hydrant fuel distribution systems are systems that include one or more tanks (either above-ground or underground), underground piping, and underground ancillary equipment used to fuel aircraft. These systems do not typically have a dispenser at the end of the piping run, but instead have a pressurized hydrant (fill stand). Large commercial and military airports employ these systems, but most commercial systems have only above-ground storage tanks and are thus not affected by the final UST regulation.[28] These systems are currently deferred from all regulation under 40 CFR Part 280, except for Subparts A and F, but are typically subject to regulation under 40 CFR Part 112.

2.2 Configuration of Average Conventional UST System

Conventional UST systems reflect a relatively consistent configuration of standard equipment. While facility size and complexity vary significantly, this analysis assumes that a typical (average) conventional UST system is configured as follows (**Exhibit 2-1**):[29]

Exhibit 2-1

Assumed Average Configuration For A Conventional UST System

System Component	Configuration
Pipes per tank	1
Feet per pipe	100
Fill pipes (per tank)	1
Spill prevention equipment (per fill pipe)	1
Under-Dispenser Containment (UDC) (per tank)	2
Turbine sumps (per tank)	1

These assumptions best characterize motor fuel retailers, which represent approximately 80 percent of the 577,981 conventional UST systems in operation in 2013.[30] EGT systems and other conventional UST systems used to store fuel or hazardous substances are likely to have

[28] Industrial Economics, Inc. "Preliminary Assessment and Scoping of Data Related to Potential Revisions to the UST Regulations." Work Assignment 1-25, Tasks 2-4 November 20, 2008.

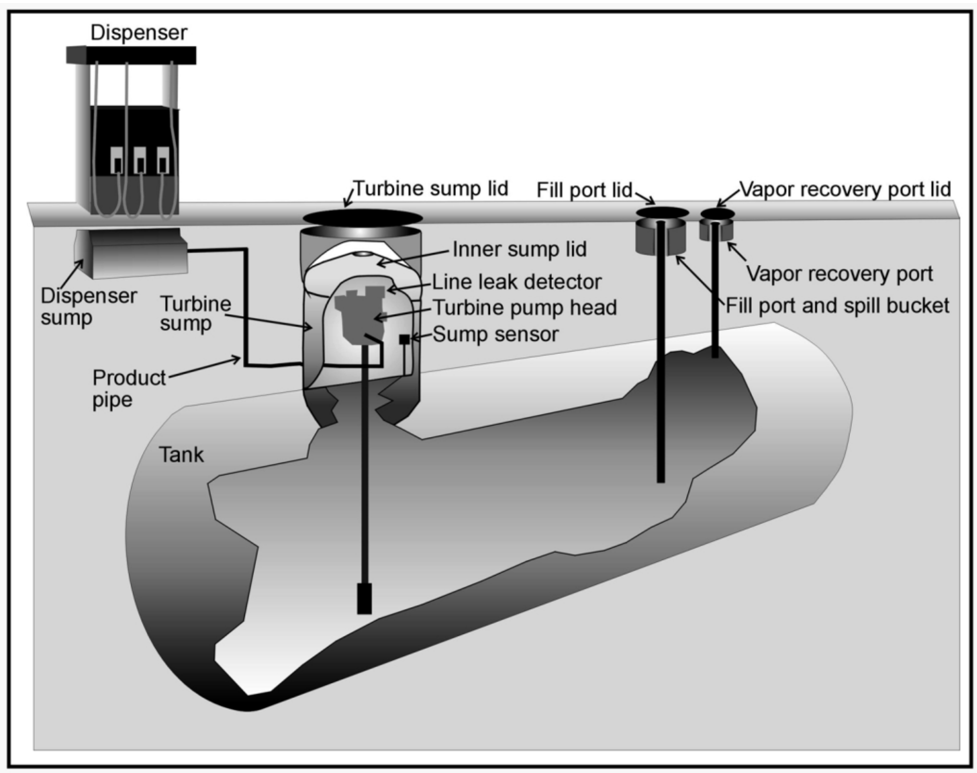
[29] Assumptions based on data collected from pipe installation companies, state data, and EPA professional judgment. See: Industrial Economics, Inc. "Methodology for Secondary Containment for Piping." Work Assignment 1-19, Task 5, October 3, 2008; and E^2, Incorporated. Memoranda and analyses submitted under Contract EP-W-05-018, "U.S. Environmental Protection Agency. Underground Storage Tanks/Leaking Underground Storage Tanks Analytical and Technical Support." Where gaps existed in the analyses, EPA used the best professional judgment of its UST system technical experts. All supporting materials not included in the appendices can be found in the docket for the final UST regulation.

[30] The remaining 20 percent of conventional UST systems consist of EGTs and tanks used for storing and dispensing fuel in commercial settings, hospitals, manufacturing, transportation, communications and utilities, and agriculture. See Exhibit 2-3 for details.

systems with similar components but less complex dispenser systems. The configurations of FCTs and AHFDSs are considered separately, and are described in detail in Appendix A. **Exhibit 2-2** provides an illustration of an UST system at a retail motor fuel establishment. Note that in this exhibit, the "dispenser sump" is a specific form of under-dispenser containment, and the "spill bucket" is an example of spill prevention equipment.

Exhibit 2-2

Configuration of Retail Motor Fuel UST System



2.3 UST Universe Size and Distribution Across Sectors

The December 2013 *Semi-Annual Report of UST Performance Measures* reports a universe of 577,981 active petroleum tanks (UST systems) in the United States and its territories.[31,32] This total includes conventional UST systems and emergency generator tank systems. Estimates based on state data suggest that approximately 3.0 percent, or 17,339 of the 577,981 active UST systems, are emergency generator tanks.[33]

In addition to EGT and conventional UST systems, the final UST regulation addresses UST systems with FCTs and AHFDSs. While these two types of systems are deferred under current EPA regulation, a subset may be regulated by individual states and included in the total estimate of tanks provided by those states. For the purpose of this analysis, however, these two universes are considered to be separate from the 577,981 tanks identified in the 2013 EPA report. The total universe of UST systems with FCTs and AHFDSs includes approximately 334 UST systems with FCTs, and 74 AHFDSs (each hydrant system is supported by an average of roughly eight linked tanks) operated by the U.S. Department of Defense (DoD), 12 FCTs operated by the U.S. Department of Energy (DoE) and 10 AHFDSs operated at commercial airports.[34]

Most UST systems in the United States are located at motor fuel retail establishments (i.e., gas stations), and virtually all retail motor fuel establishments use UST systems. Approximately 148,000 (147,902) retail fueling sites operated in the United States in 2013.[35] Of these, approximately 127,000 included convenience stores.[36]

An analysis of state data by EPA concludes that the average retail motor fuel establishment has 3.07 tanks (UST systems).[37] Assuming approximately 3.07 UST systems per

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[31] U.S. Environmental Protection Agency, Office of Underground Storage Tanks. *Semi-Annual Report of UST Performance Measures End of Fiscal Year 2013 – As Of September 2013.* Accessed at: http://www.epa.gov/oust/cat/ca-13-34.pdf. State and territory underground storage tank programs report to EPA periodically throughout the year with data on their UST performance. EPA compiles the data for all states, territories, and Indian country and makes the data publicly available at http://www.epa.gov/OUST/cat/camarchv.htm.

[32] Data indicate that the universe of UST systems has declined steadily over the past two decades. To consider the impacts of declining universe sizes on the results of this analysis, we construct and evaluate an alternative baseline for compliance costs and avoided costs in Chapters 3.4.1 and 4.4.1, respectively.

[33] See: Industrial Economics, Inc. "Detailed Assessment of UST Universe by Tank Use and Industry Sector," Work Assignment 1-25, Task 6, January 23, 2009. The number of EGTs is assumed to be approximately 3.0 percent of all active UST systems based on the weighted average from four state databases.

[34] Based on a meeting with Department of Defense in March 2013 and supplemental information provided to EPA in April 2013. In addition, EPA identified 10 commercial airports with AHFDSs subject to the final UST regulation. DoE FCTs were identified from: U.S. Department of Energy. "U.S. Department of Energy Underground Storage Tank (UST) Compliance Strategy Report," July 31, 2006. This report identifies 12 DoE FCTs in South Carolina. See Appendix A for additional information.

[35] National Association of Convenience Stores. *Who Sells America's Fuel?* Accessed at: http://www.nacsonline.com/YourBusiness/FuelsReports/GasPrices_2014/Retail-Operations/Pages/Who-Sells-Americas-Fuel.aspx. According to NACS, there were 152,995 total retail motor fuel sites in the United States in 2013. Of these, 5,093 were "hypermarketers," which are big-box stores and other merchandisers that also sell motor fuels.

[36] Ibid.

[37] A 2006 analysis of 13 state UST databases performed for EPA estimated that the average retail motor fuel establishment (i.e., facility) has 3.13 tanks. Adjustments to reconcile various estimates of the current universe of USTs with industry estimates of the number of UST systems currently in place at retail motor fuel facilities further decreases the number of tanks per UST system operating in retail motor fuel settings to 3.07 tanks per retail motor

facility and 147,902 facilities, 454,774 UST systems, or 79 percent of all active UST systems, are associated with retail motor fuel establishments.

In addition to traditional motor fuel retailers, big-box retailers, or hypermarkets, represent a growing segment of the retail motor fuel seller market. This category (NAICS code 452910) includes stores operated by Wal-Mart, Costco, and other large companies. Collectively, these firms operate approximately 5,100 filling stations; each station is likely to have at least three UST systems.[38]

Other industry sectors that report use of UST systems include agriculture (crop production and animal production), commercial (wholesale trade, retail trade, accommodation, and food services), communications and utilities (wired telecommunications carriers and electric power generation, transmission, and distribution), hospitals, manufacturing, transportation, local and state government operations, and federal facilities run by the U.S. Departments of Defense and Energy. Collectively these sectors comprise approximately 120,000 UST systems, including those in the government sector (**Exhibit 2-3**). In many cases, firms in these sectors use UST systems for fueling fleets of vehicles such as school buses, delivery trucks, or rental cars. In other cases, UST systems store fuel for operations or emergency use, used oil, or hazardous substances.

Facilities in sectors other than retail motor fuel have, on average, between 1.5 and 2.0 UST systems at the facilities that use UST systems. The actual number of UST systems at a specific facility, however, is likely to vary significantly depending on facility size and focus.[39]

Results of an analysis of public UST records of 54 states and territories performed for EPA suggest that the average number of UST systems per facility (across all sectors that use conventional UST systems or EGTs), is approximately 2.71.[40]

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fuel facility. See: Industrial Economics, Inc. "Small Entities Screening Analysis of UST Universe by Industry Sector." Work Assignment 3-25, Task 4, February 4, 2010.

[38] National Association of Convenience Stores. *Who Sells America's Fuel?* Accessed at: http://www.nacsonline.com/YourBusiness/FuelsReports/GasPrices_2014/Retail-Operations/Pages/Who-Sells-Americas-Fuel.aspx.

[39] E^2, Incorporated. Review of state databases, "Draft Industry and Facility Profiles," Task Order No. 1010 – General Technical and Programmatic Support in Implementing the Energy Policy Act of 2005. December 18, 2006.

[40] Skeo Solutions. "Summary of Key Data from State Public Record Postings," Work Order 1006, Table 1, October 25, 2013.

Exhibit 2-3

Summary Of Universe Of UST Systems By Sector

Industry Sector	NAICS	2009 [a] Number of Facilities with UST Systems	2009 [a] Number of UST Systems	2013 [b] Number of Facilities with UST Systems	2013 [b] Number of UST Systems
Retail Motor Fuel Sales	447	161,768	481,108	147,902	454,774
Commercial (wholesale trade, retail trade, accommodation, and food services)	42, 44-45, 72 (excluding 447)	21,652	49,793	27,356	47,068
Institutional (hospitals only)	622	2,220	3,631	2,098	3,432
Manufacturing	31-33	8,822	14,536	8,339	13,740
Transportation (air, water, truck, transit, pipeline, and airport operations)	481, 483-486, 48811	8,153	14,422	7,707	13,633
Communications and Utilities (wired telecommunications carriers; and electric power generation, transmission, and distribution)	5171, 2211	6,641	9,738	6,278	9,205
Agriculture (crop and animal production)	111, 112	847	1,534	801	1,450
Local governments [c]	Government jurisdiction	n/e	24,458	n/e	23,119
State governments [c]	Government jurisdiction	n/e	6,114	n/e	5,780
Federal government [c]	Government jurisdiction	n/e	6,114	n/e	5,780
Total: Conventional UST systems and EGTs		**210,103[d]**	**611,449**	**200,480[d]**	**577,981**
FCTs: Department of Defense	Government jurisdiction	239	239	334	334
FCTs: Department of Energy	Government jurisdiction	--	--	12	12
AHFDSs: Department of Defense	Government jurisdiction	162	1,296[e]	71	592[e]
AHFDSs: Commercial Airports	4581	--	--	10	64
Total: FCTs and AHFDSs		**401**	**1,535**	**430**	**1,002**

[a] Analysis based on E², Incorporated. Review of state databases, "Draft Industry and Facility Profiles," Task Order No. 1010 – General Technical and Programmatic Support in Implementing the Energy Policy Act of 2005, Amendment 1, TDD #11. December 18, 2006. Estimate of 168,987 retail motor fuel facilities with UST systems from "2005 U.S. motor fuel station count: 168,987," *National Petroleum News*, May 19, 2005 (annual survey of states to collect data on number of stations), adjusted to reflect 2009 universe of 611,449 UST systems. All sector adjustments proportional except retail motor fuel sales, which reflects the 2008 estimate of 161,768 facilities with UST systems from National Petroleum News. "MarketFacts 2008 Overview." August 2008, used as a proxy for the number of such facilities in 2009. (See also: Industrial Economics, Inc. "Preliminary Assessment and Scoping of Data Related to Potential Revisions to the UST Regulations." Work Assignment 1-25, Tasks 2-4 November 20, 2008.)

[b] Analysis based on 2009 column (see note a above), adjusted to reflect 2013 universe of 577,981 UST systems. All sector adjustments proportional except retail motor fuel sales, which reflects the 2013 estimate of 147,902 facilities with UST systems from *National Association of Convenience Stores*. *Who Sells America's Fuel?* Accessed at: http://www.nacsonline.com/YourBusiness/FuelsReports/GasPrices_2014/Retail-Operations/Pages/Who-Sells-Americas-Fuel.aspx. The NACS Retail Fuels report noted 152,995 total facilities dispensing motor fuel commercially, of which 5,093 are hypermarketers and not included in the retail motor fuel sales category. (See also: Industrial Economics, Inc. "Preliminary Assessment and Scoping of Data Related to Potential Revisions to the UST Regulations." Work Assignment 1-25, Tasks 2-4 November 20, 2008.)

[c] See: ICF. "Economic Impact Analysis of Additional Mechanisms for Local Government Entities to Demonstrate Financial Responsibility for Underground Storage Tanks." December 1992. Exhibit 3-1. Estimates of local government UST systems adjusted using the 1987 Census of Governments. Consistent with this analysis, the number of government UST systems is assumed to be two percent of all 2013 UST systems owned by state and federal governments and four percent of all 2013 UST systems owned by local governments.

[d] The totals shown are the sum of the number of facilities of the rows above. These estimates are used only to establish distribution of facilities across sectors based on available data.

[e] This number assumes that there are eight tanks per AHFDS. For more detail on assumptions for AHFDSs, see Appendix A.

2.4 Universe of Facilities and Systems Potentially Affected by Final UST regulation

EPA expects that all facilities or UST systems in the universe of conventional UST systems will be required to comply with one or more regulatory changes in the final UST regulation, but the number of facilities and systems affected by each specific regulatory change will vary depending on the extent of current (baseline) state regulations and the type of equipment currently in use.

To estimate the number of systems that will be required to comply with each regulatory change, EPA reviewed publicly available data about state regulations, combined with data from a limited sample of states and equipment providers about the use of different technologies for release prevention and detection.[41]

Exhibit 2-4 identifies the total number of UST systems that could potentially be affected by each regulatory change in the final UST regulation, based on the baseline technology currently in place in the universe of systems. **Exhibit 2-4** identifies the number of UST systems or facilities with relevant technologies, the type of system (i.e., conventional UST and EGT systems, facilities with conventional UST systems or EGTs, AHFDSs, or FCTs), the proportion of the relevant universe of UST systems with the technology, a summary of the assumptions that define the number of affected units, and the source of those assumptions. Note that changes for AHFDSs, EGTs, and FCTs affect only those universes of facilities, and EPAct-related provisions affect only facilities and UST systems in Indian country.[42] See Appendix B for detailed descriptions of the values and sources used in each calculation. The estimates in **Exhibit 2-4** do not reflect baseline state regulations (e.g., whether a state already requires spill prevention equipment testing). As discussed later in this chapter, some baseline state requirements satisfy requirements of the final UST regulation.

[41] E^2, Incorporated. Memoranda and analyses submitted under Contract EP-W-05-018, "U.S. Environmental Protection Agency. Underground Storage Tanks/Leaking Underground Storage Tanks Analytical and Technical Support." Where gaps existed in the analyses, EPA used the best professional judgment of its UST system technical experts. All supporting materials not included in the appendices can be found in the docket for the final UST regulation.

[42] EPA assumes that all states have adopted EPAct-related provisions in the baseline, consistent with existing guidance.

Exhibit 2-4

Potential Number And Type Of Units Affected By Each Requirement

Regulatory Change	Universe	Proportion of Total Universe Affected Annually	Number of Potentially Affected Systems (Annual) [a]	Assumptions	Source
Release Prevention					
Walkthrough inspections	Facilities with Conventional UST systems and EGTs	100.0%	213,277 facilities	All facilities require periodic walkthrough inspections.	Not applicable – all facilities require inspections.
Overfill prevention equipment inspections	Conventional UST systems and EGTs	100.0%	577,981 systems	Percentage of UST systems with overfill prevention equipment.	E[2], Incorporated, Task Order No. 3003, TDD #7: across 10 states, 99.8% of systems had overfill prevention equipment; EPA conservatively assumes all UST systems have overfill prevention equipment.
Spill prevention equipment tests	Conventional UST systems and EGTs	90.0%	520,183 systems	One-to-one spill prevention equipment to tank ratio; 10 percent have self-monitoring mechanism and do not need monitoring.	EPA estimate based on information discussions with service contractors and inspectors.
Containment sump testing	Conventional UST systems and EGTs	18.3%	105,771 systems	Pipes that use interstitial monitoring and do not use continuous sensors, pressure, vacuum, or liquid-filled leak detection monitoring mechanisms.	E[2], Incorporated, Task Order No. 3003, TDD #5, Table 13.
Spill prevention equipment inspection after repair	Conventional UST systems and EGTs	2.5%	14,450 systems	Spill prevention equipment requires fix once every four years; repairs are used as the fix 10 percent of the time.	E[2], Incorporated, Task Order No. 3003, TDD #7: across 10 states, 99.8% of systems had overfill prevention equipment; EPA conservatively assumes all UST systems have overfill prevention equipment; repair/replace frequencies are EPA assumptions.
Overfill prevention equipment test after repair	Conventional UST systems and EGTs	2.0%	11,560 systems	Overfill prevention equipment requires fix once every five years; repairs are used as the fix 10 percent of the time.	EPA estimated that only a small (10%) percentage of overfill devices were repaired rather than replaced based on verbal conversations with service contractors. PEI provided the five-year estimate based on information compiled from their members. This was also supported by answers from 3 vendors dated 11/8/12.
Secondary containment test after repair	Conventional UST systems and EGTs	3.3%	19,324 systems	Tanks and pipes that use interstitial monitoring and do not use continuous sensors, pressure, vacuum, or liquid-filled leak detection monitoring mechanisms. Includes five percent of tanks and 90 percent of piping that use interstitial monitoring. Assumes 20 percent of pipes and five percent of tanks require repair every year.	E[2], Incorporated, Task Order No. 3003, TDD #5, Table 13; repair/replace frequencies are EPA assumptions.

Exhibit 2-4

Potential Number And Type Of Units Affected By Each Requirement

Regulatory Change	Universe	Proportion of Total Universe Affected Annually	Number of Potentially Affected Systems (Annual) [a]	Assumptions	Source
Eliminate flow restrictors in vent lines for all new tanks and when overfill prevention equipment is replaced	Conventional UST systems and EGTs	13.5%	78,256 systems[b]	13 percent of new UST systems would have installed flow restrictors in vent lines, and 13 percent of existing UST systems with replaced overfill prevention equipment would have installed flow restrictors in vent lines. Assumes five percent turnover of UST systems, a 19 percent test fail rate for flow restrictor, and that 90 percent of fixes require replacement of the flow restrictor.	Information on number of new UST systems that would install flow restrictors provided by Robert Penkes, PEI, in August 2009; remainder from E^2, Incorporated, Task Order No. 3003, TDD #21.
Release Detection					
Operability tests – ATG	Conventional UST systems and EGTs	33.7%	194,548 systems	UST systems that use automatic tank gauges.	E^2, Incorporated, Task Order No. 3003, TDD #5, Table 11.
Operability tests – interstitial monitoring	Conventional UST systems and EGTs	18.8%	108,499 systems	UST systems that use interstitial monitoring (excluding five percent that conduct manual testing of the interstice).	E^2, Incorporated, Task Order No. 3003, TDD #5, Table 11.
Operability tests – line leak detection	Conventional UST systems and EGTs	27.5%	159,221 systems	Pressurized piping systems that use electronic line leak detectors.	E^2, Incorporated, Task Order No. 3003, TDD #5, Table 11.
Operability tests – groundwater and vapor monitoring	Conventional UST systems and EGTs	4.5%	25,968 systems	UST systems that use vapor monitoring and/or groundwater monitoring as their sole release detection method(s).	E^2, Incorporated, Task Order No. 3003, TDD #5.
Eliminate groundwater and vapor monitoring as release detection methods (Alternative 1 only)	Conventional UST systems and EGTs	4.5%	25,968 systems	UST systems that use vapor monitoring and/or groundwater monitoring as their sole release detection method(s). Universe affected phases in over five years.	E^2, Incorporated, Task Order No. 3003, TDD #5.
Add SIR/CITLD to regulation with performance criteria	Conventional UST systems and EGTs	0.5%	2,809 systems	13 percent of UST systems use SIR; 15 percent of these use qualitative methods. Of these, 25 percent are assumed to incur costs to comply.	E^2, Incorporated, Task Order No. 3003, TDD #5, Table 11.
Response to interstitial monitoring alarms	Conventional UST systems and EGTs	2.4%	14,003 systems	Weighted average annual percentage of UST systems and piping that experience an interstitial monitoring alarm. Assumes 20 percent of tanks and 18 percent of pipes use interstitial monitoring, and that three percent of tanks and 10 percent of pipes experience an alarm in a given year.	E^2, Incorporated, Task Order No. 3003, TDD #5, Tables 11 and 13.
Remove release detection deferral for emergency generator tanks	EGTs	3.0%	17,339 systems	UST systems assumed to be emergency generator tanks.	Based on review of over 15 state databases and discussions with several state UST program representatives.
Other					

Exhibit 2-4

Potential Number And Type Of Units Affected By Each Requirement

Regulatory Change	Universe	Proportion of Total Universe Affected Annually	Number of Potentially Affected Systems (Annual) [a]	Assumptions	Source
Remove deferral for airport hydrant fuel distribution systems	AHFDSs	100.0%	81 facilities	All airport hydrant fuel distribution systems, including 71 DoD systems and 10 commercial airport systems.	Meeting with U.S. Department of Defense (DoD) in March 2013 and supplemental information provided to EPA in April 2013, plus information based on public comments and additional EPA research to identify commercial airport systems potentially affected. See Appendix A for additional information.
Remove deferral for UST systems with field-constructed tanks	FCTs	100.0%	346 systems	All UST systems with field-constructed tanks, including 334 DoD systems and 12 DoE systems.	Meeting with U.S. Department of Defense (DoD) in March 2013 and supplemental information provided to EPA in April 2013 and U.S. Department of Energy, "U.S. Department of Energy Underground Storage Tank (UST) Compliance Strategy Report," August 2006, p. A-32 to A-34. See Appendix A for additional information.
Require notification of ownership change	Facilities with Conventional UST systems and EGTs	10.1%	21,505 facilities	Annual number of facilities that change ownership.	E^2, Incorporated, Task Order No. 3003, TDD #27.
Closure of lined tanks that cannot be repaired according to a code of practice	Conventional UST systems and EGTs	<0.1%	80 systems	Annual number of lined UST systems that cannot be repaired	E^2, Incorporated, Task Order No. 3003, TDD #17, Table 1 and E^2, Incorporated, Task Order No. 3003, TDD #5.
Requirements for demonstrating compatibility with fuels > E10 and > B20	Conventional UST systems and EGTs	0.04%	234 systems	0.4 percent of conventional UST systems and EGTs use fuels E >10 or B > 20, assume 10 percent can demonstrate compatibility	Based on the count of UST systems from OUST's mid-year and end-year reports, plus the U.S. Department of Energy's (DoE's) Alternative Fuels Data Center listing the amount of stations selling E85 fuel.
EPAct-related Provisions					
Operator training	UST Facilities in Indian country	100.0%	966 facilities	All facilities in Indian country.	Not applicable – applies to all facilities in Indian country.
Secondary containment - new and replaced tanks	UST systems in Indian country	36.2%	947 systems[b]	Approximately 72.4 percent of systems in Indian country are single-walled. Analysis assumes midpoint of time horizon until all units are	E^2, Incorporated, Tribal Data Analysis, July 2007.

Exhibit 2-4

Potential Number And Type Of Units Affected By Each Requirement

Regulatory Change	Universe	Proportion of Total Universe Affected Annually	Number of Potentially Affected Systems (Annual) [a]	Assumptions	Source
				replaced (year 10, 50 percent of universe affected).	
Threshold for pipe replacement rather than repair	UST systems in Indian country	30.2%	789 systems[b]	Piping replaced every five years, where 60.3% are single-walled. Analysis assumes midpoint of time horizon until all units are replaced (year 10, 50 percent of universe affected).	E[2], Incorporated, Tribal Data Analysis, July 2007.
Under-dispenser containment for all new dispensers	UST systems in Indian country	48.5%	1,270 systems[b]	Approximately 97 percent of systems require under-dispenser containment. Analysis assumes midpoint of time horizon until all units are replaced (year 10, 50 percent of universe affected).	E[2], Incorporated, Tribal Data Analysis, July 2007, Industrial Economics, "Preliminary Assessment and Scoping of Data Related to Potential Revisions to the UST Regulations; Tasks 2-4, Work Assignment 1-25," November 20, 2008, Appendix A, and OUST End-of-Year reports.

[a] Figures in this column are calculated assuming that the average number of UST systems per facility is approximately 2.71, per: Skeo Solutions. "Summary of Key Data from State Public Record Postings," Work Order 1006, Table 1, October 25, 2013.

[b] The affected universes presented for these items reflect 50 percent of ultimately affected systems or facilities. Because these requirements take effect over time and future costs are discounted, we present the universe affected at year 10 as a central estimate. In addition, we adjust unit costs to reflect the fact that the total cost of these requirements grows as the number of affected systems or facilities increases.

2.5 Facilities and Systems Affected by Final UST regulation

Many states currently have baseline regulations consistent with one or more requirements in the final UST regulation. As a result, only a portion of the universe of potentially affected facilities will be required to change practices to comply with each regulatory change. Whereas **Exhibit 2-4** displays the number of units that may potentially be subject to each requirement, **Exhibit 2-5** identifies, based on EPA's review of baseline state regulations, the number of units that will be subject to these requirements as a result of the final UST regulation. For nearly all requirements, some portion of the potentially affected universe is already in compliance with the final regulatory changes. For example, in cases where a state's regulatory baseline already requires activities commensurate with the regulatory requirement under a given regulatory option of this final regulation, UST systems within that state are not considered to be "systems affected" by the regulatory option in question, because these systems would not incur any incremental requirements or associated costs under the final regulation. Section B.2 of Appendix B, and the tabular summary of state regulatory requirements on pages B-10 through B-16, contain the complete set of information on state regulatory baselines as they pertain to the regulatory requirements of the final regulation, and provide an accounting of which states are considered by the cost estimation modeling in this RIA to have state regulatory baselines in full, partial, or noncompliance with each regulatory requirement of the final regulation. The tabular summary on pages B-10 through B-16 of Appendix B indicates the frequency or presence of the regulatory requirement according to each state's regulatory baseline. As indicated above, by comparing these frequencies or requirements with those in each regulatory option of the final regulation (as shown in **Exhibit 1-1**), it is possible to determine whether UST systems in a given state are subject to a particular regulatory requirement under a given regulatory option, based on whether the regulatory baseline of the state in question accords with the regulatory requirement under that regulatory option. If the state regulatory baseline is as stringent, or more stringent, than what is required under the regulatory option (**Exhibit 1-1**), then UST systems in that state are not considered affected by that particular regulatory requirement (and appear in **Exhibit 2-4** but not in the "systems affected" column of **Exhibit 2-5**). Otherwise, the systems are considered to be affected (and appear in both **Exhibit 2-4** and the "systems affected" column of **Exhibit 2-5**).

Alternative Option 2 will affect the smallest number of systems. Among the specific regulatory changes, walkthrough inspections and spill prevention equipment tightness testing affect the largest number of UST systems in all scenarios.[43] In contrast, several regulatory changes (e.g., closure of irreparable lined tanks and pipe replacement requirements) are likely to affect only a small number of systems.

The distribution of incremental impacts of the regulation also depends on the distribution of baseline technologies across states with different baseline regulations. Facilities and systems in states with fewer current regulations may bear a greater proportion of costs and benefits than facilities and systems in states with extensive baseline regulations. A key limitation of available baseline data is that baseline technology data is not available at the state level. For example, it is possible that facilities and systems with specific release detection technologies (e.g., automatic tank gauges (ATGs)) may not be distributed evenly across all states. However, estimates of the percentage of systems using ATGs are available only at the national level. As a result, the regulatory scenarios in Chapters 3 (Compliance Costs) and Chapter 4 (Benefits and Cost Savings) reflect regulatory changes required by an "average" facility in a state under the final UST regulation, assuming that all systems reflect the national profile of existing technologies. Analyses of economic impacts and small businesses in Chapter 5 (Distributional Analyses) assess the possible distribution of compliance impacts related to this uncertainty.

[43] Walkthrough inspections are estimated at a facility level; the number of UST systems estimated as affected by these regulations is 555,003. Note that even those states that currently require walkthroughs do so on a monthly basis, rather than a 30-day basis. This RIA considers facilities in those states to be affected by this regulatory requirement; however, it applies to these facilities only the incremental cost between conducting monthly inspections over a one-year period and conducting 30-day inspections over a one-year period (i.e., a fraction of the cost of one inspection).

Exhibit 2-5

Estimated Systems Not Currently Regulated By States

Description	Universe of Potentially Affected Systems	Systems Affected by Selected Option	Systems Affected by Alternative Option 1	Systems Affected by Option Alternative Option 2
Release Prevention				
Walkthrough inspections [a]	213,277 (facilities)	204,798 (facilities)	204,798 (facilities)	128,986 (facilities)
Overfill prevention equipment inspections [a]	577,981	354,769	395,802	N/A
Spill prevention equipment tests [a]	520,183	388,641	418,547	388,641
Containment sump testing	105,771	80,324	95,366	N/A
Spill prevention equipment inspection after repair	14,450	14,306	14,306	14,306
Overfill prevention equipment test after repair	11,560	11,280	11,280	11,280
Secondary containment test after repair	19,324	14,426	14,426	14,426
Eliminate flow restrictors in vent lines for all new tanks and when overfill prevention equipment is replaced [b]	78,256	63,818	63,818	N/A
Release Detection				
Operability tests – ATG [c]	194,548	190,854	190,854	190,584
Operability tests – interstitial monitoring [c]	108,499	106,438	106,438	106,438
Operability tests – line leak detection [c]	159,221	156,197	156,197	156,197
Operability tests – groundwater and vapor monitoring [c]	25,968	25,475	N/A	25,475
Eliminate groundwater and vapor monitoring as release detection methods [c, d]	25,968	N/A	25,968	N/A
Add SIR/CITLD to regulation with performance criteria	2,809	2, 756	2,756	2,756
Response to interstitial monitoring alarms	14,003	10,634	10,634	10,634
Remove release detection deferral for emergency generator tanks	17,339	10,977	10,977	10,977
Other				
Remove deferral for airport hydrant fuel distribution systems	81 [e]	56	56	N/A
Remove deferral for UST systems with field-constructed tanks	346	198	198	N/A
Require notification of ownership change	21,505 (facilities)	3,220 (facilities)	3,220 (facilities)	3,220 (facilities)
Closure of lined tanks that cannot be repaired according to a code of practice	80	57	57	57
Requirements for demonstrating compatibility with fuels > E10 and > B20	234	234	577,981[f]	N/A
EPAct-related Provisions				
Operator training	966 (facilities)	966 (facilities)	966 (facilities)	966 (facilities)
Secondary containment - new and replaced tanks [b]	947	947	947	947
Threshold for pipe replacement rather than repair [b, g]	789	0	0	0
Under-dispenser containment for all new dispensers [b]	1,270	1,270	1,270	1,270

[a] The universe of affected systems for these requirements varies because some states have current requirements that differ in frequency and ensure baseline compliance in some regulatory scenarios but not others.

[b] The affected universes presented for these items reflect 50 percent of ultimately affected systems or facilities. Because these requirements take effect over time and future costs are discounted, we present the universe affected at year 10 as a central estimate. In addition, we adjust unit costs to reflect the fact that the total cost of these requirements grows as the number of affected systems or facilities increases.

[c] The number of affected systems differs from the universe of *potentially* affected systems for this requirement; however, as indicated in Appendix B, this RIA does not apply state baseline regulatory requirements to any system for this requirement. The number of affected systems is smaller than the number of potentially affected systems because some systems to which this requirement applies are EGTs, and the application of regulatory requirements to these systems is covered in the

Exhibit 2-5

Estimated Systems Not Currently Regulated By States				
Description	**Universe of Potentially Affected Systems**	**Systems Affected by Selected Option**	**Systems Affected by Alternative Option 1**	**Systems Affected by Option Alternative Option 2**

requirement for removing the release detection deferral for EGTs, and affects the numbers shown for this requirement as well.

[d] Universe affected phases in over five years.

[e] The universe of potentially affected units is 81 systems, or 632 tanks (at eight tanks per system for the 71 DoD-owned systems, plus an additional 64 tanks at the 10 commercial airport systems).

[f] As part of the requirements for demonstrating compatibility with fuels > E10 and > B20 proposed in November 2011, all UST systems must maintain equipment records. While 234 represents the number of UST systems subject to demonstrating compatibility with fuels > E10 and >B20 under the Selected Option, all (577,981) UST systems would are subject to the requirement to maintain equipment records under Alternative Option 1.

[g] EPA's screening analysis shows that a requirement to replace piping if more than 50 percent of it requires repairs would likely generate no net costs, as owners or operators would ordinarily pursue replacement under those circumstances. See Appendix C for details.

Chapter 3. Assessment of Compliance Costs

3.1 Introduction

This chapter describes EPA's analysis of the social costs associated with the final UST regulation. OMB guidance suggests that an analysis that relies on measures of opportunity cost and willingness to pay provides a holistic basis for assessing the total cost of any regulation. Specifically, a social cost analysis should focus on measuring changes in consumer and producer surplus by considering the market responses to compliance costs (e.g., changes in demand and supply). Along with the administrative costs incurred by the government, changes in producer and consumer surplus reflect the true cost to society of adopting a set of regulatory measures.

For this regulatory impact analysis, EPA uses a combination of direct compliance costs and state oversight costs to approximate social costs. In this context, compliance costs represent a reliable indicator of social costs for the following reasons:

- The regulatory requirements generally focus on additional testing and inspection of existing equipment, and do not reflect large-scale investments in equipment or significant changes to operations at the facility level. In addition, the facilities affected by the regulation are distributed with relative geographic uniformity for consumers and producers.

- Given the small per-facility costs of the regulation (approximately $715 for the average facility, as documented in this chapter), closures or changes in market structure represent an unlikely response to the regulation. Therefore, it is unlikely that significant changes to production or consumer behavior will affect social costs.

- The short- and long-run impacts of the regulation are not likely to differ significantly. Testing and inspection requirements under the regulation may offer some opportunities for owners and operators to reduce costs by learning over time, but they are not likely to reduce costs enough to facilitate large-scale equipment upgrades.

For these reasons, compliance costs are likely to be a reasonable approximation of social costs over both the short- and long-run. This chapter presents EPA's compliance cost methodology and results, and summarizes the calculation of government oversight costs. The chapter also provides a discussion of key uncertainties and several brief sensitivity analyses. An analysis of the potential economic impacts of the final UST regulation is presented in Chapter 5, and a sensitivity analysis that evaluates the effects of alternative interest rates is presented in Chapter 7.

3.2 Compliance Cost Methodology

In this chapter, EPA presents its methodology for estimating incremental compliance costs of the final UST regulation beyond the current baseline costs of existing federal and state regulation of underground storage tanks. EPA's analysis focuses on the specific incremental costs that occur as a consequence of the regulation.[44] Throughout this chapter, the analysis distinguishes between three types of costs:

- System-level: Costs that occur at the individual UST tank level, including ancillary equipment.
- Facility-level: Costs that occur at the level of a facility that owns several USTs; typically 2.71 times the system-level cost to reflect UST ownership by the average facility.
- Unit costs: System-level costs related to a particular requirement. For example, the requirement to provide notification of ownership change has a unit cost of approximately $14.

Calculation of total incremental compliance costs for UST facilities reflects two key steps: identifying specific measures necessary for compliance at individual facilities, and calculating costs associated with each of these measures. To estimate these costs, EPA developed a compliance cost model that identifies incremental equipment and labor requirements for an individual system. Based on the baseline equipment, existing state regulations, and anticipated responses to the regulation, the model then generates system-specific estimates of compliance costs. Compliance costs include the labor and capital costs associated with new equipment and installation, inspection, testing, and recordkeeping. The model also includes other compliance costs, such as those associated with more frequent detection of equipment failure and repair of equipment. Some component costs are specific to individual UST system configurations – for example, airport hydrant fuel distribution systems or UST systems with field-constructed tanks – while others are consistent across all system types.

We calculate the compliance costs of the final UST regulation by measuring three factors: the proportion of facilities or UST systems with specific technologies (i.e., the portion of systems that require specific types of upgrades or tests, described in Exhibit 2-4 and Section B.1 of Appendix B); the regulations already in place in each state (i.e., baseline regulations, described in Exhibit 2-5 and Section B.2 of Appendix B); and, the unit cost to comply with each element of the regulation (described in this Chapter, specifically Exhibit 3-1, as well as Appendix D).

An important limitation of our analysis is that we do not have data on the distribution of UST technologies. Consider the following from **Exhibit 2-5**: under the Selected Option, we estimate that overfill prevention tests will be a new requirement for 354,769 systems, and spill prevention equipment tests will be a new requirement for 388,641 systems. These requirements could together affect as few as 388,641 systems if all systems that are affected by overfill

[44] For this final UST regulation, EPA does not specifically attempt to measure baseline regulatory costs. However, costs identified in the 1988 EPA regulation that set original technical standards under 40 CFR Part 280 provide an indication of baseline costs. The 1988 RIA calculated per-tank costs of $28,770, equivalent to $55,836 in 2012 dollars. See: U.S. Environmental Protection Agency. "Regulatory Impact Analysis of Technical Standards for Underground Storage Tanks." August 24, 1988. Volume 1, page ES-7, Exhibit ES-1.

prevention testing are a subset of the systems that are affected by spill prevention testing. In the absence of additional information, it is equally plausible that these two requirements affect the entire universe of USTs if they overlap as little as possible.

EPA has not identified any information that could allow us to reliably narrow the universe of affected USTs to a number smaller than the entire universe. Further, EPA's review of state data suggests that facilities in all states will be subject to some cost under the final UST regulation.[45] Consequently, when considering the average cost of the regulation on a facility or UST system basis, we divide the total cost by the number of facilities or systems in the entire universe.[46]

3.2.1 Categories of Compliance Costs Analyzed

This analysis includes the following categories of compliance costs: operation and maintenance costs; capital costs; and implicit capital costs, or "time value of money costs" associated with earlier detection of equipment failure. Because the final UST regulation focuses on operational improvements, operation and maintenance costs constitute the majority of the compliance costs identified in this analysis. These costs are relatively frequent, recurring costs that mainly involve a service activity. Operation and maintenance activities include the labor and materials costs associated with maintenance of equipment, routine testing, and inspection (whether performed by the owner, operator, or a contractor). This analysis assumes that UST

[45] The discounted cost per UST system ranges from less than $100 in one state to over $310, with costs in 20 states and territories falling between $290 and $320, costs in another 17 states and territories falling between $230 and $270, and costs in another six states and territories between $210 and $230. The remaining 13 states and territories have per-system costs between $75 and $200, with all but two states or territories having costs upwards of $130 per system. These costs are calculated by considering the regulatory baseline in each state, and the unit costs of each regulatory requirement not already required by the regulatory baseline in a given state. From the example above, states with low per-UST system costs are those with regulatory baselines that substantially overlap with the requirements of the final regulation, while those with the highest costs are those where most or all of the requirements of the final regulation are not already required by the state. Note that the figures presented here assume an average distribution of technologies across states, such that the only variant in UST system costs per state is the existing extent of each state's regulatory baseline.

[46] We address uncertainty in the distribution of technology and costs with a set of sensitivity analyses in section 3.5 of this chapter, and we consider the economic impacts of different distributions of costs in Chapter 5. Our analysis indicates that approximately 81 percent of all facilities incur costs below the average per-facility cost (calculated by dividing total costs by total facilities) and 18 percent of facilities incur per-facility costs in excess of 110 percent of this calculation of average per-facility cost. The remaining one percent of facilities incur costs within the range of 100-110 percent of average per-facility costs.

The cost estimates reported in the RIA and used in the analysis in this footnote do not incorporate high-end technology costs; they reflect the market costs for widely available technologies. The analysis in this footnote represents a worst-case cost scenario only as relates to impacts on small facilities, in order to consider potential business and employment impacts (see Section 5.2.3). To do this, it examines the combined impact of two distinct, high-cost assumptions: 1) that a given subset of UST systems are located in the state or states with the state regulatory baselines that overlap or accord *least* with the final regulation, and thus incur the highest compliance costs; and 2) that this *same subset* of UST systems has or uses the technologies for which regulatory costs are highest. The analysis concludes that even under this bounding scenario in which the smallest, oldest facilities are universally located in states with low baseline regulatory requirements, employment and business impacts are limited. The Chapter 3 cost analysis assumes that the technology distribution of UST systems is similar across states, reflecting standard turnover in facilities and equipment.

facility owners and operators pay in full for these costs when they occur (that is, they do not obtain financing and pay over time).[47] Some of the operation and maintenance activities included in the final UST regulation take the form of recurring requirements occurring less frequently than once per year: for example, overfill prevention equipment inspections are required every three years under the Selected Option. We calculate the total incremental annual cost of these recurring requirements by assuming that an equivalent portion of the universe incurs the cost associated with each such recurring requirement every year: for overfill prevention equipment inspections, we assume one third of the affected universe of UST systems must undergo this inspection each year, such that all UST systems have complied within each three-year inspection period.[48]

Because the final UST regulation does not focus on broad equipment requirements, capital costs represent a small portion of the total compliance costs for this regulation. Capital costs address the purchase and installation of new equipment, such as installing a new double-walled UST or under-dispenser containment. Total capital costs typically include installation, labor, and initial service required to ensure the new equipment is fully functioning. EPA assumes that UST owners and operators finance these compliance costs over the life of the equipment; all capital costs are calculated over a regulatory time horizon of 20 years.[49] The following examples characterize the three types of capital cost calculations that are relevant to this regulatory analysis:

Existing equipment replacements: An UST system owner or operator must upgrade an existing system with new equipment to comply with a requirement under the regulation (e.g., facilities with EGTs may be required to install release detection equipment when the deferral is removed). The incremental compliance cost is the total cost of the new equipment and installation (including removal of existing equipment).[50] Any additional (incremental) operation and maintenance costs are also included.

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[47] Certain one-time costs that occur only once over the regulatory time horizon (e.g., one-time spending on initial operator training for personnel at existing facilities) are also annualized over 20 years.

[48] As noted in Exhibit 1-2, a number of recurring operations and maintenance requirements will not immediately impose costs on UST owners and operators as they may have up to three years (depending on the requirement) to comply with the initial testing or inspection requirement. Where applicable, we discount the annual cost associated with each such requirement by the length of this implementation delay at a seven percent discount rate (consistent with OMB's guidance on discount rate), to account for the fact that owners and operators are not required to conduct the first test or inspection immediately. Chapter 7 also presents results for the Selected Option using a three percent discount rate.

[49] Due to a lack of data on the distribution of ages of UST systems and planned retirements/replacements of existing systems, EPA assumes that owners and operators amortize all capital costs over a 20-year expected regulatory horizon to be consistent with the 20-year expected lifetime of an UST system. Note that this annualization timeframe specifically applies only to UST system (i.e., tank) components; for other associated equipment with a lifetime other than 20 years, EPA assumes that a proportion of the universe is affected per year. For example, EPA assumes that piping is replaced every five years; i.e., one-fifth of the universe must replace it every year. The central analysis uses a seven percent discount rate, consistent with: U.S. Office of Management and Budget. Circular No. A-94. Revised October 29, 1992. Other discount rates are considered in Chapter 7.

[50] This approach may overstate costs, as it does not account for the age of existing equipment (depreciation). Owners and operators typically plan for new capital expenditures over the lifetime of existing equipment, recording depreciation as operations consume its usefulness over time. If an owner or operator is close to

New equipment requirements: An operator is installing new or replacement equipment as an ordinary business expense. Under baseline regulations, *Equipment A* is compliant. However, new regulations require a higher level of compliance for new tank systems that can be satisfied at lowest cost by *Equipment B*. The incremental compliance cost to the operator of the equipment is the additional cost (if any) of purchasing, installing and operating *Equipment B* instead of *Equipment A*. The costs of this requirement reflect the timing of the normal replacement cycle for all equipment in the universe. For example, owners and operators installing new UST systems will be required to use technologies other than flow restrictors to ensure release prevention.

Time value of money (TVM) costs: Under baseline regulations, the average UST system requires inspection every three years. EPA estimates that the baseline three-year inspection, on average, identifies a hypothetical repair or replacement cost of $100 associated with certain equipment. For example, under the final UST regulation, a new annual test could discover the same issue sooner and require repair or replacement two years earlier than it would have been discovered in the baseline. In this example, while the repair expense is the same, the regulation generates a time value of money cost by requiring an owner or operator to incur the repair expenditure sooner.[51]

Costs to Regulated Universe to Review Regulation: This analysis assumes that all facility operators in the universe will be required to read the final UST regulation in order to comply with it. For conventional USTs and EGTs, we estimate that reading and understanding the final UST regulation will require 4.75 hours of labor from a manager at each facility. This equates to a one-time cost of approximately $271 for each facility, or $58 million. This is equivalent to an annual cost of $5.5 million under each regulatory option. For FCTs and AHFDSs, we assume these costs are subsumed in the management costs for these systems (see Appendix A for details).

EPA estimates that the final UST regulation will impose capital costs on the following components due to earlier detection of problems as a result of the new testing requirements:

- Overfill prevention equipment;
- Spill prevention equipment;
- Interstitial areas; and

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replacing certain equipment and is required to replace that equipment when the final UST regulation becomes effective, he or she incurs a lower incremental cost than an owner or operator who only recently installed that equipment. By not attempting to adjust for this factor, EPA assumes that owners and operators replace brand new equipment, a conservatism that results in a higher cost. Using this approach, these annualized one-time costs comprise approximately 10 percent of annual costs under the Selected Option, approximately six percent of annual costs under Alternative 1, and approximately nine percent of annual costs under Alternative 2.

[51] There is significant uncertainty regarding whether total expenditures would increase or decrease over time. More frequent inspections may lead to more frequent repairs and replacements but may also reduce the severity and cost of the problems discovered.

- ATGs, interstitial monitors, vapor monitors, groundwater monitors, and line leak detectors.

The final UST regulation requires testing, in addition to inspections, for several UST system components. EPA assumes that testing adds value to baseline release prevention strategies in two ways: first, testing detects issues with an UST system that may not be detectable in inspections. Second, in some cases, testing will occur more frequently than baseline inspections and therefore may identify issues that occur between inspections. This analysis therefore considers two types of increased capital costs. First, EPA assumes that additional testing required under the final UST regulation will identify malfunctions that prior inspections would have overlooked, and will therefore mandate additional, incremental compliance costs related to equipment repair and replacement. Second, some baseline compliance costs will occur earlier than they would in the baseline, creating time value of money costs as owners and operators incur compliance costs earlier and forgo the use of such funds for other investments. The time value of money cost of incurring a repair sooner is estimated at seven percent, consistent with OMB's guidance on discount rate. The use of a seven percent discount rate for these time value of money costs maintains consistency with the discount rates used for other cost and benefit calculations presented in this RIA, including amortization of capital costs and discounting costs associated with regulatory requirements with delayed implementations. For comparison, Chapter 7 presents results for the Selected Option using a three percent discount rate. See Appendix D for the detailed cost methodology.

The cost estimation methodology in this RIA focuses exclusively on the compliance costs incurred to comply with the regulatory requirements of the final regulation. This differs from the benefit estimation methodology (see Chapter 4), where benefits are monetized based on an estimated number of avoided releases, and the avoided remediation costs associated with those releases.

3.2.2 Estimation of System-Level Compliance Costs for UST Systems

Estimates of system-level compliance costs for each part of the final UST regulation are based on publicly available data on equipment, installation, and testing costs, information collected from professionals in industries that provide relevant equipment and services, and EPA's professional judgment.[52] Costs are estimated to occur according to the regulation implementation schedule identified in **Exhibit 1-2**; we use an annual discount rate of seven percent to adjust costs with compliance windows of more than one year.

Labor costs used in this analysis reflect labor-hour estimates from EPA Information Collection Request 1360.08 and EPA Information Collection Request 1360.12 for specific inspection and recordkeeping tasks. The cost of labor is based on Bureau of Labor Statistics (BLS) labor rates for skill categories appropriate to the retail sector and technical requirements of

[52] E^2, Incorporated. Memoranda and analyses submitted under Contract EP-W-05-018, "U.S. Environmental Protection Agency. Underground Storage Tanks/Leaking Underground Storage Tanks Analytical and Technical Support." Where gaps existed in the analyses, EPA used the best professional judgment of its UST system technical experts. All supporting materials not included in the appendices can be found in Docket EPA-HQ-UST-2011-0301.

the final UST regulation.[53] In particular, EPA selected labor rates that correspond to categories of labor employed in the retail motor fuels sector (NAICS 447). EPA does not expect regulated entities to employ higher skilled workers to comply with this regulation.

The analysis adjusts these rates using a 12 percent overhead factor and a fringe benefits factor of 28.8 percent, which is specific to service-providing industries.[54] For requirements that are likely to be satisfied by third-parties, such as testing, labor costs are included in the market prices (costs) of those services.

A broad explanation of the functionality of the compliance cost estimation model is provided below:

- First, for each regulatory requirement of the rule, the model identifies the number of UST systems are affected. Systems are affected if they have the proper technical components affected by the requirement (seen in **Exhibit 2-4**) *and* are located within a state where compliance with this requirement is not already part of the regulatory baseline (seen in **Exhibit 2-5**). To the extent that UST systems are located in states whose regulatory baselines are in partial compliance with the rule, the cost model makes an appropriate adjustment such that the correct set of incremental costs are applied.

- Then, the cost model derives a set of unit costs for compliance with each regulatory requirement. These costs include labor costs as well as O&M (equipment) costs, and are broken down by one-time costs that are amortized versus annually-occurring costs. As described on page 3-2, some costs apply at the UST-system level, and others apply at the broader facility level (a facility may have more than one UST system). These costs can be seen in **Exhibit 3-1**.

- To estimate costs, the model then applies unit costs for each regulatory requirement to each applicable system. In some cases, the unit costs in **Exhibit 3-1** for a given regulatory requirement are simply applied to the set of affected systems or facilities for that requirement in **Exhibit 2-5**. However, in many cases, state regulatory baselines interact with the regulation's requirements in complex ways, such that this methodology must be adjusted. For example, UST facilities in states that require semiannual walkthrough inspections under their regulatory baselines incur lower costs than UST facilities in states that currently require no walkthrough inspections; the compliance cost model tracks these cases and applies the appropriate incremental cost as necessary.[55]

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[53] Labor rates reflect: U.S. Bureau of Labor Statistics. "Occupational Employment and Wages." May 2011. See Appendix D for the particular Standard Occupational Classification codes used. EPA does not use the costs in its Information Collection Request 1360.08 because those labor rates reflect all industries and do not represent typical costs to the majority of UST owners and operators.

[54] The overhead factor of 12 percent comes from: U.S. Office of Management and Budget. Circular No. A-76. p. D-7. Although this rate reflects government overhead rates, we believe it is also representative of the low-overhead structure of the retail motor fuels sector. The fringe benefits factor is from: U.S. Bureau of Labor Statistics. "Employer Costs for Employee Compensation." December 2012. See Table 10: All workers, service-providing industries.

[55] For additional information on the derivation of the affected universe for each regulatory requirement, see Appendix B. Similarly, Appendix D contains derivations of the unit costs for each regulatory requirement, as well as

While the regulation's impacts are not significant enough ($1 billion per year) to require a quantitative assessment of uncertainty, the RIA considers the uncertainty associated with key variables. However, the regulatory requirements modeled in this RIA generally do not lend themselves to a probabilistic assessment of uncertainty because most requirements consist of a task, such as an inspection or test, that has an established cost and must be performed according to a given schedule. Correspondingly, the system is not subject to broad uncertainty related to options for compliance. Moreover, the regulation requires that each such task be performed with a given frequency. Probabilistic uncertainty analyses, which best apply in cases where one of multiple outcomes may occur with a different probability weight for each outcome, do not directly apply to the requirements of this regulation.

To the extent that certain aspects of the cost estimation methodology are uncertain, this RIA includes various sensitivity analyses to address these:

- Input cost uncertainties are addressed by the analysis of alternative labor rates (**Exhibit 3-6**);
- Universe uncertainties, especially regarding the interaction between the uncertainty in which systems contain certain UST system components and which systems are located in states that do not currently require testing/inspection of those components, are addressed by the analysis of compliance cost scenarios (**Exhibit 3-7**); and
- Uncertainties regarding the potential of the rule to result in small business impacts are addressed via a "worst-case scenario" sensitivity analysis where the smallest (i.e., least-revenue) firms are assumed to be located in the states with the least-rigorous state regulatory baselines (i.e., thus incurring the highest incremental costs) (Section 5.2.3).

Because of the deterministic nature of the regulation in requiring each UST system meeting a given criterion to perform a certain task or undergo a certain inspection, probabilistic assessments of uncertainty are not directly applicable.

In addition, specific requirements under the final UST regulation are addressed as follows:

- For regulatory changes that take effect over time as equipment ages, the analysis assumes a constant rate of equipment replacement, and calculates a constant annual payment for the net present value of 20 years of replacement. Appendix D discusses the specific assumptions made in the analysis.
- To identify the total system-level compliance cost of removing deferrals from airport hydrant fuel distribution systems (AHFDSs) and field-constructed tanks

broader descriptions of how the compliance cost model handles labor costs, time value of money costs, and other items of specific relevance to cost estimation for this regulation.

(FCTs), the analysis calculates both the direct costs of removing the deferral of these systems from the regulation under 40 CFR Part 280, and the additional costs of complying with other new regulatory options that apply to all systems (and become relevant when deferrals are removed). For example, under the final UST regulation, owners and operators of these systems must perform annual bulk line testing at prescribed rates or use an automatic tank gauge at prescribed leak rates. Appendix A discusses specific assumptions related to these tank populations.

- To estimate the total system-level compliance cost of removing the deferral from emergency generator tanks, the analysis calculates the cost of complying with specific changes that apply to the broader universe of conventional UST systems and become relevant when the deferral is removed. Removal of the deferral under the final UST regulation means that EGTs must comply with release detection requirements at 40 CFR Part 280, Subpart D.

Exhibit 3-1 presents the unit-level costs for the individual requirements in the final UST regulation.[56]

[56] See Appendix D for a detailed discussion of these costs.

Exhibit 3-1

Unit Costs For The Requirements In The Final UST regulation (Selected Option)[a]

	ONE-TIME [b] ($)	O&M [c] ($)	REPAIR/REPLACEMENT COST [d] ($)
Release Prevention			
Walkthrough inspections	$0.00	$16.99	$0.14
Overfill prevention equipment inspections	$0.00	$228.91	$67.07
Spill prevention equipment tests	$0.00	$138.38	$37.53
Containment sump testing	$0.00	$669.32	$86.97
Spill prevention equipment inspection after repair	$0.00	$363.42	$0.00
Overfill prevention equipment test after repair	$0.00	$400.71	$0.00
Secondary containment test after repair	$0.00	$188.23	$0.00
Eliminate flow restrictors in vent lines for all new tanks and when overfill prevention equipment is replaced	$420.37	$0.00	$0.00
Release Detection			
Operability tests – ATG	$0.00	$61.41	$9.40
Operability tests – interstitial monitoring	$0.00	$10.83	$9.73
Operability tests – electronic LLDs	$0.00	$61.41	< $0.01
Operability tests – vapor monitoring	$0.00	$10.83	$1.20
Operability tests – groundwater monitoring	$0.00	$10.83	$0.62
Site assessment – vapor monitoring [e]	$1,111.17	$0.00	$0.00
Site assessment – groundwater monitoring [e]	$935.56	$0.00	$0.00
Add SIR/CITLD to regulation with performance criteria	$10.66	$0.00	$0.00
Response to interstitial monitoring alarms[f]	$0.00	$0.00	$0.00
Remove release detection deferral for emergency generator tanks [g]	$296.94	$193.41	
Other			
Remove deferral for airport hydrant fuel distribution systems [h]	$128,828.95		
Remove deferral for UST systems with field-constructed tanks [h]	$30,744.57		
Require notification of ownership change	$0.00	$14.27	$0.00
Closure of lined tanks that cannot be repaired according to a code of practice	$41,802.90[i]	$0.00	$0.00
Requirements for demonstrating compatibility with fuels > E10 and > B20	$1.93 [j]	$0.00 [j]	$0.00
Cost to owners/operators to read regulation	$271.12	$0.00	$0.00
EPAct-related Provisions			
Operator training	$303.64	$139.36	$0.00
Secondary containment - new and replaced tanks	$8,413.90	$0.00	$0.00
Threshold for pipe replacement rather than repair [k]	$0.00	$0.00	$0.00
Under-dispenser containment for all new dispensers	$1,914.27	$0.00	$0.00

[a] Cost estimates were derived using a seven percent discount rate.

[b] One-time costs presented here are not shown in annual terms. For the purposes of estimating total annual costs for the final UST regulation, these one-time expenditures are annualized over 20 years at a seven percent interest rate.

Exhibit 3-1

Unit Costs For The Requirements In The Final UST regulation (Selected Option)[a]

[c] Operation and maintenance costs presented here are not shown in annual terms, but rather on per-incident terms. In other words, the cost for walkthrough inspections above is the unit cost per walkthrough inspection; the annual cost is the total cost conducting 30-day walkthrough inspections over an annual period.

[d] Time value of money costs due to earlier repair and replacement of equipment reflect costs of repair or replacement sooner than would have occurred in the baseline. For most requirements, these are costs that would occur and be identified by annual tests, i.e., they reflect one year's worth of accumulated issues that require equipment repairs or replacements. Three requirements represent exceptions. TVM costs for overfill prevention and containment sump testing, which occur every three years under the Selected Option, represent the repairs and replacements over three years. In addition, TVM costs for walkthrough inspections represent the repairs and replacements identified on a monthly basis to match the requirement under the Selected Option. See Appendix D for additional details.

[e] The one-time cost presented is the cost of conducting a site assessment or well verification, weighted by the relatively likelihoods that a site assessment or well verification would be necessary to continue using vapor or groundwater monitoring as release detection. Note that a site assessment or well verification would be necessary for fewer than 25 percent of systems using vapor monitoring, and for fewer than 30 percent of systems using groundwater monitoring; the one-time costs presented here do not downward adjust the unit cost estimate to account for the possibility that a site assessment or well verification may not be necessary.

[f] The cost associated with this requirement would be the incremental cost difference between a tightness test (required in the baseline) and an interstitial integrity test (required by the final UST regulation). However, because the cost of an interstitial integrity test is less than the cost of a tightness test, we do not assign any cost to this requirement. See Appendix D for additional information.

[g] Because different subsets of EGTs are subject to different requirements, we present average unit costs that divide the total cost to the affected universe by the total number of affected units. O&M costs include any TVM costs associated with operability tests. See Appendix D for additional details.

[h] Because different subsets of AHFDSs are subject to different requirements, and because different requirements applicable to AHFDSs and FCTs include various types of one-time and O&M costs, we present average unit costs that divide the total cost to the affected universe by the total number of affected units. These costs include any TVM costs associated with operability tests. See Appendix A for additional details.

[i] We assume that this cost occurs in full for the systems that require closure of lined tanks in a given year, rather than annualizing it as described in note b above. See Appendix D for additional details.

[j] This includes an annualized cost of $0.01 related to the cost of storing records for the life of the UST system.

[k] We assume all facilities exceeding the 50 percent threshold for piping replacement would opt to replace piping in the baseline; costs are therefore zero. See Appendix C for detailed calculations.

3.3 Calculation of Incremental Compliance Costs

This analysis estimates the compliance cost of the final UST regulation by calculating the incremental cost of each regulatory change on the population of tank systems in every U.S. state and territory. This procedure relies on national estimates of the number of systems employing specific baseline technologies, as well as EPA's assessment of the baseline regulatory requirements in each state and territory.[57] The analysis categorizes compliance costs into one-time or operation and maintenance costs and amortizes one-time compliance costs over the 20-year regulatory time horizon.[58] As a final step, it discounts annual compliance costs associated with several of the regulatory changes to delayed compliance horizons specified in the final UST regulation (e.g., overfill prevention equipment inspections must be performed within three years of the date the final UST regulation becomes effective).

[57] For details regarding these assumptions, see Appendix B.

[58] See footnote 49 for an explanation of the use of a 20-year time horizon.

To calculate compliance costs, EPA employs a number of assumptions, some of which likely overstate compliance costs:

- **Time value of money costs**. This analysis does not assume the rate at which problems occur in UST systems will decline as a result of the final UST regulation. The number and severity of problems will likely fall due to more frequent testing and inspections, but the rate of decline is uncertain and the analysis does not attempt to adjust for these changes. This likely causes the analysis to overestimate the costs of the final UST regulation.

- **Size of universe**. EPA's analysis assumes that the number of UST systems in the universe remains constant over time, with new systems replacing closures. EPA's end-of-year reporting data reveal that the universe of conventional UST systems has declined at a rate between one and three percent per year since 2000.[59] Assuming this pattern continues, future annual compliance costs due to the final UST regulation are likely to be lower than estimated in this analysis. However, in absence of other data we assume new installations and upgrades will offset all closures, and annual compliance costs will remain constant. Impacts of assuming an alternative baseline universe of UST systems that declines over time are discussed in Sections 3.3.1 and 3.4.1.

- **Full compliance.** EPA assumes all owners and operators subject to each requirement will come into compliance. This ensures a high estimate of costs, as each system subject to the regulation implements the required measures and consequently incurs the related costs.

- **Timeliness of repairs.** EPA assumes all issues identified through testing of equipment will be properly addressed through immediate repair or replacement of equipment. This may overstate costs if owners or operators fail to address identified issues in a timely fashion.

- **Date on which costs are incurred.** EPA assumes all costs are incurred at the beginning of the year in which each requirement of the final UST regulation becomes effective. This may overstate costs that occur at the end of the time frame.

These combined assumptions help ensure that the total costs estimated in each scenario below are not likely to be understated, even in cases where some uncertainty is associated with unit cost estimates for equipment or testing. Two key areas of uncertainty that affect the distribution of costs are noted below.

- **Geographic distribution of technologies:** EPA lacks information on how UST systems with specific equipment (e.g., ATG) are distributed nationally. If most are located within states with existing applicable requirements, then costs could

[59] See: U.S. Environmental Protection Agency, Office of Underground Storage Tanks. *Semi-Annual Report of UST Performance Measures* for fiscal years 1999 and 2013.

be lower (conversely, if most are located in states with no existing applicable requirements, then costs could be higher). In the absence of this data, EPA assumes a uniform distribution of technologies across all states. EPA assesses the extent to which this assumption creates cost uncertainty at the end of this chapter.

- **Distribution of costs across systems:** EPA does not have information on how costs are likely to be distributed among the systems that are subject to new requirements. For example, a correlation among systems that require overfill prevention equipment inspections, spill prevention equipment testing, and secondary containment testing after repair would concentrate costs on these systems in ways that EPA's primary assessment of costs does not capture. While this does not affect total cost estimates, EPA assesses the distributional consequences of an outcome where costs are highly-concentrated in Chapter 5.

3.3.1. Calculation of Incremental Compliance Costs Using an Alternative Baseline

EPA's primary analysis assumes that the universe of UST systems stays constant over time. That is, the analysis assumes that when an UST system enters the universe, another exits, and vice versa. However, data show that the universe of UST systems has been declining over the past two decades (albeit at a slowing rate). Therefore, EPA also assesses compliance costs associated with the final UST regulation based on an alternative baseline that projects a declining universe.

To calculate the rate of universe decline, EPA mapped historical data on the universe of UST systems from 1991 through 2013 to an exponential one-phase decay function, which appears to most accurately represent the observed behavior of the UST system universe over time.[60] Steep declines in the universe of UST systems in past years reflect increases in tank size as well as industry consolidation. However, these declines may be reaching functional limits, both because the number of fuel outlets needed to serve the population is considerable, and because tank sizes may be reaching a practical limit in their ability to be transported and installed.[61,62]

The function used to project future UST universe sizes indicates that over a 20-year time period, the annual number of affected UST systems gradually declines to 574,045 UST systems

[60] To estimate future UST universe sizes, we used a single exponential decay function, which assumes that a quantity declines at a rate proportional to its value. This is an appropriate function given the singular and slowing rate of decline observed in the universe of UST systems over time. The equation for such an exponential singular decay function is $Y = (Yo - P) * e^{(-k*X)} + P$, where P represents the "plateau," or limit of the function and k represents the function's half-life. (See Appendix J for additional details.)

[61] See: Geyer, Wayne. "Where Has Our Petroleum Storage Capacity Gone?" Steel Tank Institute. Accessed at: https://www.steeltank.com/LinkClick.aspx?fileticket=h8g9YO5y%2BfI%3D&tabid=108&mid=502. This source indicates simultaneous trends in increasing average tank sizes as well as decreasing UST system totals.

[62] While this alternative baseline assumes a steady decline in the number of UST systems, it is possible that the number of UST systems may actually increase in the future to trend with population growth and economic expansion as more people living in more areas may necessitate more retail motor fuel outlets.

by year 20 under this alternative baseline.[63] The number of UST systems affected under this alternative baseline is approximately 99.8 percent of the size of the original baseline, which assumes a constant universe size of 577,981 UST systems over this period. As a result, compliance costs associated with the final UST regulation are only marginally smaller under this alternative baseline. See Appendix J for additional details.

3.4 Results of Assessment of Compliance Costs

Exhibit 3-2 presents a summary of the estimated incremental compliance costs associated with the final UST regulation by type of UST system affected. In all options, it is clear that the category of conventional UST systems will bear the largest proportion of compliance costs under the regulation. While compliance costs associated with removal of deferrals from EGTs are constant across regulatory scenarios, other costs vary substantially among the regulatory options. The model parameters used to produce the results discussed in this chapter are presented in Appendix E and were selected to reflect the selected and alternative options described in Chapter 1**.**

Exhibit 3-2

Annual Compliance Costs Of The Final UST regulation For UST Systems Affected [a]

Option	**Selected Option ($ millions)**	**Alternative 1 ($ millions)**	**Alternative 2 ($ millions)**
Conventional UST systems [b]	$130	$280	$63
Emergency Generator Tanks (EGTs)	$2.0	$2.3	$2.0
Airport Hydrant Fuel Distribution Systems (AHFDSs)	$10	$0.017	$0.0
UST systems with Field-Constructed Tanks (FCTs)	$11	$0.066	$0.0
Cost to Owners/Operators to Read Regulation (conventional UST systems and EGTs)	$5.5	$5.5	$5.5
Total	**$160**	**$290**	**$70**

[a] Cost estimates were derived using a seven percent discount rate.
[b] Conventional UST systems include all systems that are not AHFDSs, FCTs, or EGTs.

Exhibit 3-3 presents a disaggregation of compliance costs under each regulatory option. The following areas contribute significantly to the differences in compliance costs among the alternatives.

- **Release prevention**: The greatest difference in compliance costs between the Selected Option and Alternative 1 is related to release prevention; specifically, due to the combination of walkthrough inspections, overfill prevention equipment inspections, spill prevention equipment tests, and containment sump tests, testing after repairs, and the elimination of flow restrictors. These requirements account for 66 percent and 88 percent of compliance costs, respectively.[64] This variation is

[63] EPA assumes that owners and operators amortize all capital costs over a 20-year expected regulatory horizon to be consistent with the 20-year expected lifetime of an UST system.

[64] Total release prevention costs are approximately $99 million under the Selected Option and $247 million under Alternative 1. Respectively, these costs round to $100 million, or 63 percent of total Selected Option costs, and $250 million, or 86 percent of total Alternative 1 costs.

largely dependent on the testing or inspection frequency required under each alternative, as well as the fact that compliance costs for AHFDSs and FCTs are considerably lower in Alternative 1. Under Alternative 2, overfill prevention equipment inspections and containment sump tests are not required, and release prevention costs total $38 million, compared to roughly $100 million under the Selected Option.

- **Removal of deferrals for AHFDSs and UST systems with FCTs**: Removal of deferrals for AHFDSs and FCTs is accompanied by tightness testing of equipment under the Selected Option. This tightness test drives most of the compliance cost associated with these systems. Under the Selected Option, total costs for these systems are $21 million, or approximately 13 percent of compliance costs.[65] Under Alternative 1, only notification of the implementing agency and reporting of releases are required for these systems; correspondingly, total costs for these systems under Alternative 1 are below $0.1 million. Alternative 2 maintains the deferrals and therefore has no incremental compliance cost.

In total, these categories represent approximately 50 percent to 90 percent of the total compliance costs, depending on the option.

EPA determines average compliance costs per system by dividing the total cost of the final UST regulation by the total 577,981 systems in the regulated universe of conventional UST systems and EGTs. EPA's analysis shows that the compliance cost for this final UST regulation is approximately $232 per system, or approximately $715 per typical facility among motor fuel retailers, the sector with the highest average number of UST systems per facility.[66]

Exhibit 3-4 presents the same total costs as **Exhibit 3-3** but shows the number of systems affected and the cost of the requirement per affected system.[67] The costs in **Exhibit 3-4** reflect annualized one-time costs, discounting, and adjustments for the adoption of certain requirements over time (e.g., elimination of flow restrictors for new and replaced tanks), and therefore differ from the unit costs presented in **Exhibit 3-1**. It is important to note that the unit costs in **Exhibit 3-4** cannot be summed to obtain a cost per system, as nearly all systems are already in compliance with some requirements of the final UST regulation.

[65] Specifically, costs associated with AHFDSs total $10.4 million under the Selected Option, while costs associated with FCTs total $10.6 million. Together, these costs total to a rounded sum of roughly $21 million, or 13 percent of total Selected Option costs.

[66] The $232 estimate excludes costs associated with removal of deferrals for AHFDSs and UST systems with FCTs, assumes 3.07 systems per retail motor fuel facility, and includes the annualized cost of $26 per facility for them to review the regulation. This approach does not address variability of baseline compliance across systems; to assess uncertainty associated with this approach, EPA presents a sensitivity analysis in Chapter 5.

[67] For exhibits that show the disaggregation of compliance costs under each regulatory option as well as systems affected, see Appendix D.

Exhibit 3-3

Total Annual Compliance Costs Due To The Final UST regulation For UST Systems Affected
All values in $ thousands [a]

	Selected Option			Alternative 1			Alternative 2		
Description	**Capital Cost (Annualized)**	**O&M**	**Total Cost**	**Capital Cost (Annualized)**	**O&M**	**Total Cost**	**Capital Cost (Annualized)**	**O&M**	**Total Cost**
Release Prevention									
Walkthrough inspections	$0	$23,000	$23,000	$0	$53,000	$53,000	$0	$7,000	$7,000
Periodic testing/inspections of: - Overfill prevention equipment - Spill prevention equipment - Containment sumps	$0	$64,000	$64,000	$0	$180,000	$180,000	$0	$19,000	$19,000
Testing after repairs to spill and overfill prevention equipment, and secondary containment	$0	$12,000	$12,000	$0	$12,000	$12,000	$0	$12,000	$12,000
Elimination of flow restrictors in vent lines for all new tanks and when overfill prevention equipment is replaced	$2,500	$0	$2,500	$2,500	$0	$2,500	N/A	N/A	N/A
Subtotal – Release Prevention [b]	**$2,500**	**$99,000**	**$100,000**	**$2,500**	**$250,000**	**$250,000**	**$0**	**$38,000**	**$38,000**
Release Detection									
Operability tests for release detection methods (incl. groundwater and vapor monitoring)	$0	$21,000	$21,000	$0	$24,000	$24,000	$0	$21,000	$21,000
Groundwater and vapor monitoring for release detection [c]	$500	$0	$500	See note b	See note b	$1,000	$0	$0	$0
Add SIR/CITLD to regulation with performance criteria	$3	$0	$3	$3	$0	$3	$3	$0	$3

Exhibit 3-3

Total Annual Compliance Costs Due To The Final UST regulation For UST Systems Affected
All values in $ thousands [a]

Description	Selected Option			Alternative 1			Alternative 2		
	Capital Cost (Annualized)	**O&M**	**Total Cost**	**Capital Cost (Annualized)**	**O&M**	**Total Cost**	**Capital Cost (Annualized)**	**O&M**	**Total Cost**
Remove release detection deferral for emergency generator tanks [d]	$250	$1,700	$2,000	$290	$2,000	$2,300	$250	$1,700	$2,000
Response to interstitial monitoring alarms [e]	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal – Release Detection [b]	**$750**	**$23,000**	**$24,000**	**$290**	**$26,000**	**$27,000**	**$250**	**$23,000**	**$23,000**
Other									
Remove deferral for airport hydrant fuel distribution systems [f]	See note b	See note b	$10,000	See note b	See note b	$17	N/A		
Remove deferral for UST systems with field-constructed tanks [f]	See note b	See note b	$11,000	See note b	See note b	$66	N/A		
Require notification of ownership change	$0	$46	$46	$0	$46	$46	$0	$46	$46
Closure of lined tanks that cannot be repaired according to a code of practice [g]	$0	$2,400	$2,400	$0	$2,400	$2,400	$0	$2,400	$2,400
Requirements for demonstrating compatibility with fuels > E10 and > B20	< $0.1	$0	< $0.1	< $0.1	$1,100	$1,100	N/A	N/A	N/A
Cost to owners/operators to read regulation	$5,500	$0	$5,500	$5,500	$0	$5,500	$5,500	$0	$5,500
Subtotal – Other [b]	**$5,500**	**$2,400**	**$29,000**	**$5,500**	**$3,500**	**$9,100**	**$5,500**	**$2,400**	**$7,900**
EPAct-related Provisions									
Operator training	$23	$110	$130	$23	$110	$130	$23	$110	$130
Secondary containment	$980	$0	$980	$980	$0	$980	$980	$0	$980
Subtotal – EPAct-related Provisions [b]	**$1,000**	**$110**	**$1,100**	**$1,000**	**$110**	**$1,100**	**$1,000**	**$110**	**$1,100**
Subtotal [b]	**$9,800**	**$120,000**	**$160,000**	**$9,300**	**$280,000**	**$290,000**	**$6,700**	**$63,000**	**$70,000**

Exhibit 3-3

Total Annual Compliance Costs Due To The Final UST regulation For UST Systems Affected
All values in $ thousands [a]

Description	Selected Option			Alternative 1			Alternative 2		
	Capital Cost (Annualized)	O&M	Total Cost	Capital Cost (Annualized)	O&M	Total Cost	Capital Cost (Annualized)	O&M	Total Cost
Additions for new units (beyond those included above) [h]	$5	$0	$5	$5	$0	$5	$5	$0	$5
Total [b]	**$9,800**	**$120,000**	**$160,000**	**$9,300**	**$280,000**	**$290,000**	**$6,700**	**$63,000**	**$70,000**

[a] Cost estimates were derived using a seven percent discount rate.

[b] Totals may not add due to rounding. Costs associated with the removal of deferrals for FCTs and AHFDSs or groundwater and vapor monitoring for release detection under Alternative 1 are included in the total columns only.

[c] Costs under the Selected Option include the cost of conducting a site assessment or well verification, weighted by the probability that one of these is necessary, as a one-time cost. For Alternative 1, costs include a five-year phase out of groundwater and vapor monitoring as release detection methods. Capital and O&M costs are aggregated in this line item for Alternative 1 because this requirement was modeled separately from the other requirements. See Appendix D for details. For Alternative 2, costs include only the cost of operability tests for these types of release detection.

[d] Costs related to removal of deferrals for the regulation of emergency generator tanks include the cost of removal of deferrals, installation and maintenance of ATG on approximately seven percent of systems, installation and maintenance of SIR on 60 percent of systems, and performing operability tests on all EGT systems. See Appendix D for details.

[e] The cost associated with this requirement would be the incremental cost difference between a tightness test (required in the baseline) and an interstitial integrity test (required by the final UST regulation). However, because the cost of an interstitial integrity test is less than the cost of a tightness test, we do not assign any cost to this requirement. See Appendix D for additional information.

[f] Airport hydrant fuel distribution systems include a capital cost because tanks associated with airport hydrant fuel distribution systems without existing ATGs are assumed to install ATGs to comply with the requirement. Similarly, the DoE UST systems with field-constructed tanks include a capital costs because these tanks are assumed to install ATGs to comply with the requirement. UST systems with field-constructed tanks without existing ATGs are assumed to conduct annual precision tightness tests to comply with the requirement. Capital and O&M costs are aggregated in these line items because various components of the compliance with release detection include both capital and O&M costs. See Appendix A for details.

[g] Although the closure of lined tanks represents a capital cost, we consider it an operation and maintenance cost as a modeling convenience. See Appendix D for details.

[h] As a simplifying assumption, EPA assumes that UST systems enter and exit the universe at a constant annual rate, such that the total number of UST systems in the universe does not change. We assume that operation and maintenance costs associated with these systems offset each other, as the number of entries equals the number of exits; however, new systems entering the universe will still incur incremental capital costs associated with certain requirements (e.g., a new emergency generator tank would need to install a release detection method). For modeling purposes, we account for these new units in the "Additions for new units." The costs shown reflect the capital costs associated with new units for all but the following requirements: elimination of flow restrictors for new tanks, requirement of secondary containment for new tanks, and requirement of under-dispenser containment for new dispenser systems.

Exhibit 3-4

Discounted And Annualized Cost Per System Affected By Requirement [a]

Description [b]	Selected Option		Alternative 1		Alternative 2	
	Cost per System [c]	Systems Affected	Cost per System [c]	Systems Affected	Cost per System [c]	Systems Affected
Release Prevention						
Walkthrough inspections	$42	555,003	$96	555,003	$20	349,551
Periodic testing/inspections of: - Overfill prevention equipment - Spill prevention equipment - Containment sumps	$334	190,623[d]	$860	210,266[d]	$48	388,641[d]
Testing after repairs to spill and overfill prevention equipment, and secondary containment	$311	40,011	$311	40,011	$311	40,011
Eliminate flow restrictors in vent lines for all new tanks and when overfill prevention equipment is replaced	$40	63,818	$40	63,818	N/A	N/A
Release Detection						
Operability tests for release detection methods [d]	$126	165,492	$144	165,492	$126	165,492
Groundwater and vapor monitoring for release detection [e]	$59	25,475	$40	25,968	$19	25,475
Add SIR/CITLD to regulation with performance criteria	$1	2,756	$1	2,756	$1	2,756
Remove release detection deferral for emergency generator tanks [f]	$181	10,977	$207	10,977	$180	10,977
Response to interstitial monitoring alarms [h]	$0	10,634	$0	10,634	$0	10,634
Other						
Remove deferral from airport hydrant fuel distribution systems [g]	$128,829	81	$214	81	N/A	N/A
Remove deferral from UST systems with field-constructed tanks [g]	$30,745	346	$192	346	N/A	N/A
Require notification of ownership change	$5	8,726	$5	8,726	$5	8,726
Closure of lined tanks that cannot be repaired according to a code of practice	$41,803	57	$41,803	57	$41,803	57
Requirements for demonstrating compatibility with fuels > E10 and > B20	$0	234	$2	577,981	N/A	N/A
Cost to owners/operators to read regulation	$9	577,981	$9	577,981	$9	577,981
EPAct-related Provisions						
Operator training	$51	2,618	$51	2,618	$51	2,618
Secondary containment	$443	2,217[d]	$443	2,217[d]	$443	2,217[d]

[a] Cost estimates were derived using a seven percent discount rate.

[b] Requirements that apply at the facility level are converted to a system basis using a conversion factor of 2.71 systems per facility.

[c] Important: these unit costs cannot be summed to obtain a total cost per system because nearly all systems are already in compliance with some requirements of the final UST regulation.

[d] Because the number of systems affected varies depending on the individual testing requirements, we estimate the number of systems affected by all three requirements by dividing their total cost by the sum of their unit costs. For example, if the three requirements had total unit costs of $100 and created new costs of $100,000, we would estimate that they affect 1,000 systems.

[e] Costs under the Selected Option include the cost of operability tests for these types of release detection as the operation and maintenance cost, as well as the cost of conducting a site assessment or well verification, weighted by the probability that one of these is necessary, as a one-time cost. For Alternative 1, costs include a five-year phaseout of groundwater and vapor monitoring as release detection methods. For Alternative 2, costs include only the cost of operability tests for these types of release detection.

[f] Costs related to removal of deferrals for the regulation of emergency generator tanks include the cost of removal of deferrals, installation and maintenance of ATG on approximately seven percent of systems, installation and maintenance of SIR on 60 percent of systems, and performing operability tests on all EGT systems. See Appendix D for details. Costs for emergency generator tanks are lower in Alternative 2 because operability tests are performed every 3 years versus every year under other options.

[g] Because different subsets of AHFDSs are subject to different requirements, and because different requirements applicable to AHFDSs and FCTs include various types of one-time and O&M costs, we present average unit costs that divide the total cost to the affected universe by the total number of affected units. These costs include any TVM costs associated with operability tests. See Appendix A for additional details.

[h] The cost associated with this requirement would be the incremental cost difference between a tightness test (required in the baseline) and an interstitial integrity test (required by the final UST regulation). However, because the cost of an interstitial integrity test is less than the cost of a tightness test, we do not assign any cost to this requirement. See Appendix D for more information.

3.4.1 Assessment of Compliance Costs under the Alternative Baseline Scenario

Exhibit 3-5 presents total annual compliance costs of the final UST regulation under the alternative baseline discussed in Section 3.3.1. Annual compliance costs are slightly less than those presented in **Exhibit 3-2**, reflecting the fact that the cumulative universe of affected systems in the alternative baseline is only marginally smaller than the universe in the original baseline. However, as **Exhibit 3-5** shows, most cost reductions are within the rounding error of EPA's estimates for annual compliance costs of the regulation.

Exhibit 3-5

Annual Compliance Costs Of The Final UST regulation Using an Alternative Baseline For UST Systems Affected [a]

Option	Selected Option ($ millions)	Alternative 1 ($ millions)	Alternative 2 ($ millions)
Conventional UST systems [b]	$130	$280	$62
Emergency Generator Tanks (EGTs)	$2.0	$2.3	$2.0
Airport Hydrant Fuel Distribution Systems (AHFDSs)	$10	$0.017	$0.0
UST systems with Field-Constructed Tanks (FCTs)	$11	$0.066	$0.0
Cost to owners/operators to read regulation	$5.4	$5.4	$5.4
Total [c]	**$160**	**$290**	**$70**

[a] Cost estimates were derived using a seven percent discount rate.
[b] Conventional UST systems include all systems that are not AHFDSs, FCTs, or EGTs.
[c] Totals may not add exactly due to rounding.

3.5 Sensitivity Analyses

Certain aspects of EPA's compliance cost estimates are characterized by significant uncertainty and are sufficiently large that deviations from chosen assumptions may have a measurable impact on cost estimates. In this section, the analysis evaluates the sensitivity of certain results to variation in key parameters. These sensitivity analyses include evaluations of:

- Total compliance costs to the final UST regulation under an alternative estimate of labor costs. Specifically, the analysis evaluates the effect of using higher labor rates, overhead costs, and fringe benefits factors, and lower average labor costs.

- Highest and lowest compliance cost scenarios for the distribution of technologies for overfill prevention equipment inspections, spill prevention equipment tests, and containment sumps tests. If facilities using these technologies are disproportionately located in states that do not already have similar regulations in place, costs could be higher than estimates presented in the earlier parts of this chapter. Similarly, if affected facilities are located in states that already have similar regulations in place, costs could be substantially lower than estimated.

3.5.1. Compliance Costs of the Final UST regulation Using Alternative Estimates of Labor Rates, Overhead Costs, and Fringe Benefits

For conventional UST facilities, EPA has selected labor, overhead, and fringe benefits rates that best reflect a "typical" UST facility. These labor rates are representative of skilled labor costs at motor fuel retailers, which own and operate roughly 80 percent of the universe of UST systems. The use of these rates has a material impact on the estimated compliance cost of the final UST regulation because they drive the operation and maintenance costs associated with requirements for walkthrough inspections and operability tests.

To evaluate the impact of alternative labor rates on total compliance cost estimates, EPA considered two alternative scenarios. The first scenario is consistent with the OUST Information Collection Request 1360.12 and reflects labor rates reflective of economy-wide average wages, benefits, and overhead. This represents a high-end estimate because it also includes industries with highly skilled labor requirements and benefits (e.g., law firms).[68]

The second scenario uses specific labor categories and costs representative of retail motor fuel establishments, but assumes that lower-level staff may complete walkthrough inspections.

Exhibit 3-6 presents the results for the three labor category scenarios. While one-time costs are not affected by the change in labor rates, operation and maintenance costs in the high-cost scenario are roughly $40 million higher than EPA's primary estimate, totaling $200 million rather than $160 million (an increase of 25 percent). The majority of this increase is due to higher operation and maintenance costs related to walkthrough inspections and operability tests. In contrast, the low-end labor-rate cost estimate totals approximately $140 million, roughly $20 million (or 13 percent) lower than EPA's central estimate. In addition to lower benefits and labor rates, this low-end estimate assumes that clerical-level personnel will perform walkthrough inspections. For AHFDSs and systems with FCTs, EPA uses constant industry average labor rates across all scenarios.[69]

[68] These labor categories were reported in U.S. Environmental Protection Agency. Information Collection Request Number 1360.12. February 2011. We used revised labor rates from those categories to reflect 2012 conditions. However, documentation in this analysis did not provide a reason for the use of economy-wide average labor rates, and our assessment of the universe suggests that retail-based rates are more appropriate.

[69] This sensitivity analysis examines only the cost of obtaining labor with the skill sets needed to comply with the regulations. While it is possible that an owner/operator may opt to hire more highly-skilled workers to provide a range of skills beyond what is required for compliance, the broad availability of lower-priced labor and professional services in the market to achieve compliance render this unnecessary for compliance with the rule. Therefore, any acquisition of higher-skilled labor would represent a business decision that incorporates consideration of other factors not related to direct compliance, and is therefore not a cost imposed by the rule. While it may be beneficial for businesses to obtain workers with additional skills to improve their operations, EPA considers only the potential uncertainty of the cost of labor required to perform the required tasks under the rule. In other words, the alternate labor rates sensitivity analyses do not examine whether higher or lower labor rates include the acquisition or procurement or staff with different skill levels; rather, this sensitivity analysis assumes that staff skills are held constant at the level required for compliance with the rule, and that the uncertainty lies within the price at which these staff are available.

Exhibit 3-6

Compliance Cost Sensitivity Analysis: Alternative Labor Rates [a]

Description	Final UST regulation		
	Lower Estimate ($ thousands) [b]	**Primary Estimate used for Analysis ($ thousands)** [c]	**Upper Estimate ($ thousands)** [d]
Release Prevention			
Walkthrough inspections [e]	$11,000	$23,000	$45,000
Periodic testing/inspections of: - Overfill prevention equipment - Spill prevention equipment - Containment sumps	$63,000	$64,000	$64,000
Testing after repairs to spill and overfill prevention equipment, and secondary containment	$12,000	$12,000	$12,000
Elimination of flow restrictors in vent lines for all new tanks and when overfill prevention equipment is replaced	$2,500	$2,500	$2,500
Subtotal - Release Prevention [i]	**$89,000**	**$100,000**	**$120,000**
Release Detection			
Operability tests for release detection methods (incl. groundwater and vapor monitoring)	$20,000	$21,000	$35,000
Groundwater and vapor monitoring for release detection [f]	$500	$500	$500
Add SIR/CITLD to regulation with performance criteria	$3	$3	$3
Remove release detection deferral for emergency generator tanks	$1,900	$2,000	$2,700
Response to interstitial monitoring alarms [g]	$0	$0	$0
Subtotal - Release Detection [i]	**$22,000**	**$24,000**	**$38,000**
Other			
Remove deferral for airport hydrant fuel distribution systems [h]	$10,000	$10,000	$10,000
Remove deferral for UST systems with field-constructed tanks [h]	$11,000	$11,000	$11,000
Require notification of ownership change	$20	$46	$74
Closure of lined tanks that cannot be repaired according to a code of practice	$2,400	$2,400	$2,400
Requirements for demonstrating compatibility with fuels > E10 and > B20	< $0.1	< $0.1	< $0.1
Cost to owners/operators to read regulation	$2,400	$5,500	$8,900
Subtotal – Other [i]	**$26,000**	**$29,000**	**$32,000**
EPAct-related Provisions			
Operator training	$120	$130	$190
Secondary containment	$980	$980	$980
Subtotal - EPAct-related Provisions [i]	**$1,100**	**$1,100**	**$1,200**
Subtotal [i]	**$140,000**	**$160,000**	**$200,000**
Additions for new units (beyond those included above) [j]	$5	$5	$5
Total [i]	**$140,000**	**$160,000**	**$200,000**

Exhibit 3-6

Compliance Cost Sensitivity Analysis: Alternative Labor Rates [a]

[a] Cost estimates were derived using a seven percent discount rate.

[b] Lower Estimate relies on BLS Industry-Specific Occupational Employment and Wages, NAICS 447000 - Gasoline Stations, May 2011 for: Managerial (41-1011 First-Line Supervisors/Managers of Retail Sales Workers): Technical (53-1021 First-Line Supervisors/Managers of Helpers, Laborers, and Material Movers, Hand); Clerical (53-6031 Service Station Attendants); and BLS National Occupational Employment and Wages, May 2011 for Technical for operability tests (49-2094 Electrical and Electronics Repairers, Commercial and Industrial Equipment) and Legal (23-1011 Lawyers). Benefits rate is 25.1 percent of wages, as reported in BLS Employer Costs for Employee Compensation, December 2012. Table 10: Trade, transportation, and utilities - retail trade. Overhead rate is 12 percent from: U.S. Office of Management and Budget. Circular No. A-76. p. D-7. Assumes that service station attendants perform walkthrough inspections.

[c] Primary Estimate relies on BLS Industry-Specific Occupational Employment and Wages, NAICS 447000 - Gasoline Stations, May 2011 for: Managerial (11-0000 Management Occupations (Major Group)); and Clerical (43-9061 Office Clerks, General); and BLS National Occupational Employment and Wages, May 2011 for Technical for operability tests (49-2094 Electrical and Electronics Repairers, Commercial and Industrial Equipment); Technical (53-1021 First-Line Supervisors/Managers of Helpers, Laborers, and Material Movers, Hand); and Legal (23-1011 Lawyers). Benefits rate is 28.8 percent (BLS Employer Costs for Employee Compensation, December 2012. Table 10: All workers, service-providing industries). Overhead rate is 12 percent from: U.S. Office of Management and Budget. Circular No. A-76. p. D-7.

[d] Upper Estimate relies on BLS Employer Costs For Employee Compensation, December 2012 for Managerial (Table 9, Management, Professional, and Related); Technical and Technical for operability tests (Table 10, Professional and Technical Services (Service Industries)); and Clerical (Table 11, Office and Administrative Support); and BLS National Occupational Employment and Wages, May 2011 for Legal (23-1011 Lawyers). Benefits rate is 28.8 percent (BLS Employer Costs for Employee Compensation, December 2012. Table 10: All workers, service-providing industries). Overhead rate is 12 percent from: U.S. Office of Management and Budget. Circular No. A-76. p. D-7.

[e] Walkthrough inspections under the Lower Estimate rely on clerical labor rates estimated using BLS Standard Occupational Code 53-6031, Service Station Attendants; under other scenarios, we use technical labor rates estimated using BLS Standard Occupational Code 53-1021, First-Line Supervisors/Managers of Helpers, Laborers, and Material Movers, Hand.

[f] Costs under the Selected Option consist of the cost of conducting a site assessment or well verification, weighted by the probability that one of these is necessary, as a one-time cost.

[g] The cost associated with this requirement would be the incremental cost difference between a tightness test (required in the baseline) and an interstitial integrity test (required by the final UST regulation). However, because the cost of an interstitial integrity test is less than the cost of a tightness test, we do not assign any cost to this requirement. See Appendix D for additional information.

[h] The labor rate used for these types of systems, where they are DoD-owned, is the latest ICR labor rate (similar to the upper estimate rate), except for a component of the Operator Training requirement, which uses the United States Air Force labor rate for pay grade E-6 over 3. For AHFDSs located at commercial airports, the labor rates used originate from BLS National Occupational Employment and Wages, May 2011 for NAICS 481100 (Scheduled Air Transportation) for Legal (23-1011), Managerial (11-000), Technical (53-0000), and Clerical (43-000), except for a component of the Operator Training Requirement, which uses the hourly rate for a Fuel Distribution System Worker from December 2012, according to USAjobs.gov.

[i] Totals may not add exactly due to rounding.

[j] As a simplifying assumption, EPA assumes that UST systems enter and exit the universe at a constant annual rate, such that the total number of UST systems in the universe does not change. We assume that operation and maintenance costs associated with these systems offset each other, as the number of entries equals the number of exits; however, new systems entering the universe will still incur incremental capital costs associated with certain requirements (e.g., a new emergency generator tank would need to install a release detection method). For modeling purposes, we account for these new units in the "Additions for new units." The costs shown reflect the capital costs associated with new units for all but the following requirements: elimination of flow restrictors for new tanks, requirement of secondary containment for new tanks, and requirement of under-dispenser containment for new dispenser systems.

3.5.2 Sensitivity Analysis of Distribution of Technologies for Overfill Prevention Equipment Inspections, Spill Prevention Equipment Testing, and Containment Sump Testing

Because data on the distribution of UST technologies (including release detection and prevention technologies) is available only at a national level, EPA is not able to identify how facilities and systems with certain technologies are distributed across different states. As a result, the cost analysis assumes that technologies are distributed uniformly across all states and territories. For systems that require overfill prevention equipment inspections, spill prevention equipment tests, and containment sump tests, actual compliance costs may differ substantially from EPA's estimates if this assumption does not hold. For example, if facilities using these technologies are disproportionately located in states that do not already have similar inspection/testing requirements in place in the baseline, compliance costs could be higher than the estimates based on a uniform distribution presented in **Exhibit 3-2** and **Exhibit 3-3**. Similarly, if affected facilities are concentrated in states that already have similar regulations in place in the baseline, then actual compliance costs could be substantially lower than estimates based on a uniform distribution.

To investigate the impact of the assumption of uniform distribution of technologies, EPA performed a bounding analysis of the two extreme cases of distribution. **Exhibit 3-7** reports the possible range of values for three scenarios: one where compliance cost is the lowest (i.e., facilities are located in states that already satisfy the final UST regulation), the actual model scenario based on uniform distribution of technologies, and the scenario in which compliance costs are highest. Variation between the minimum and maximum cost scenarios totals approximately $30 million, or approximately 20 percent of the total compliance costs estimated for the regulation. EPA's primary estimate of these costs is near the mid-point of the range of estimates.

Exhibit 3-7

Discounted Highest And Lowest Compliance Cost Scenarios For Technologies For Overfill Prevention Equipment Inspections, Spill Prevention Equipment Tests, And Containment Sump Tests[a]

Regulatory change	Lower ($ millions)	Primary ($ millions)	Upper ($ millions)
Overfill prevention equipment inspections [b]	$29	$29	$29
Spill prevention equipment testing	$17	$19	$25
Containment sump testing	$0	$17	$22
Total [c]	**$45**	**$64**	**$75**

[a] Cost estimates were derived using a seven percent discount rate.
[b] Because the entire universe of systems will be required to perform overfill prevention equipment inspections, EPA does not expect any uncertainty related to the locations of affected systems.
[c] Totals may not sum due to rounding.

3.5.3 Summary of Sensitivity Findings

EPA's sensitivity findings suggest that possible variation in labor rates is likely to produce the most significant impact on the estimated cost of the final UST regulation: plausible selections for labor rates may reduce selected option costs by approximately $20 million (13 percent) or increase them by $40 million (25 percent). Separately, EPA has identified potential variation of approximately 20 percent related to the distribution of technologies involved in overfill prevention equipment inspections, containment sump testing, and spill prevention equipment testing. We note that each of these sensitivity analyses reflects variation compared with the primary estimates of costs presented throughout this chapter.

The estimates presented in the body of this chapter represent reasonable, conservative central tendencies for the costs of the final UST regulation.

3.6 State Government Administrative Compliance Costs

In addition to compliance costs related to the operation of UST systems, the final UST regulation will also impose new UST program administration requirements on state government agencies.[70] Specifically, state government agencies will incur costs associated with new notification requirements, and costs associated with obtaining and reading the regulation. This section reviews state government costs associated with these activities.

Costs associated with obtaining and reading the regulation assume that 10 people will each take six hours to read the regulation in each state (using the legal labor rate for states of $47 per hour from OUST's ICR 1360.08 inflated to 2012 dollars). In addition, based on the ICR, we assume that the reporting and recordkeeping burden for states to apply for State Program Approval (SPA) is approximately 28.5 hours (using the clerical labor rate for states of $26 per hour inflated to 2012 dollars). The total compliance cost in nominal terms is therefore approximately $219,000; the annualized compliance cost assuming the 20-year regulatory time horizon is approximately $21,000.[71]

State agencies that do not currently have a requirement for notification of changes in UST ownership or for at least an annual UST registration must also process a certain number of notices due to annual turnover in facility ownership. State government compliance costs for this activity assume a typical nominal recordkeeping cost of $32 per facility, based on OUST's ICR 1360.08 inflated to 2012 dollars; compliance costs assume the use of existing recordkeeping systems. Eight states and territories do not currently have recordkeeping requirements consistent with the final UST regulation.[72] These eight states and territories will incur approximately $100,000 per year, due to an annual turnover rate of approximately 10 percent in UST facility ownership.

Lastly, each state agency will incur costs to process the one-time notifications of existence for AHFDSs and FCTs. State government compliance costs for this activity assume a

[70] In some cases, UST systems are directly owned or operated by local, state, and federal government entities. These costs are subsumed in the estimates of compliance costs presented earlier in this chapter.

[71] Consistent with other parts of this regulatory impact analysis, we amortize one-time or capital costs over the regulatory time horizon of 20 years. If these costs are phased in over a three-year period, annual costs decrease to approximately $19,000.

[72] These states are Arizona, Georgia, Idaho, North Carolina, North Dakota, Nevada, and South Carolina. The Virgin Islands will also incur these costs.

typical nominal recordkeeping cost of $32 per facility, based on OUST's ICR 1360.08 inflated to 2012 dollars; compliance costs assume the use of existing recordkeeping systems. Based on the estimated universe of AHFDSs and FCTs, the total state processing cost in nominal terms is approximately $14,000; the annualized processing cost assuming the 20-year regulatory time horizon is approximately $1,300.

Total annualized state government administrative compliance costs sum to $120,000 per year. Note that under alternative baseline assumptions, these costs would decline by a very small percentage (less than one percent) as the universe of affected systems declines.

3.7 Summary – Total Annual Compliance Costs

In total, EPA estimates that the Selected Option for the final UST regulation will produce incremental costs of approximately $160 million per year compared to the current regulatory baseline. **Exhibit 3-8** summarizes these costs per category. Regardless of the option, conventional UST systems will incur over 80 percent of these costs. Costs to AHFDSs and FCTs comprise approximately 14 percent and 0.03 percent of total costs under the Selected Option and Alternative 1, respectively.

Exhibit 3-8

Total Annual Compliance Costs [a,b]

Category	Selected Option ($ millions)	Alternative 1 ($ millions)	Alternative 2 ($ millions)
Conventional UST systems [c]	$130	$280	$63
Emergency Generator Tanks (EGTs)	$2.0	$2.3	$2.0
Airport Hydrant Fuels Distribution Systems (AHFDSs)	$10	$0.017	$0.0
UST systems with Field-Constructed Tanks (FCTs)	$11	$0.066	$0.0
Cost to Owners/Operators to Read Regulation	$5.5	$5.5	$5.5
State Government Administrative Costs [d]	$0.12	$0.12	$0.12
Total Annual Compliance Costs [e]	**$160**	**$290**	**$70**

[a] Cost estimates were derived using a seven percent discount rate.
[b] Compliance costs include direct compliance costs and state oversight costs. For this regulatory impact analysis, direct compliance costs and state oversight costs provide a reasonable proxy to assess the final UST regulation's social costs. See Chapter 3.1 for further discussion.
[c] Conventional UST systems include all systems that are not AHFDSs, FCTs, or EGTs.
[d] The costs for UST systems directly owned or operated by local, state, and federal government entities are included in the estimates of compliance costs within the other categories. Costs shown here reflect the administrative costs for state governments to read the regulation, apply for state program approval, process notifications of ownership changes, and process one-time notifications of EGT, AHFDS, and FCT existence.
[e] Totals may not add up due to rounding.

Under the alternative baseline universe assumption described in Section 3.3.1, EPA estimates that the Selected Option for the final UST regulation will produce incremental compliance costs of approximately $155 million per year compared to $156 million in annual costs in the primary analysis; the results of both the primary and alternative scenario round to $160 million in total annual social costs. Under Alternative 1, the alternative baseline universe assumption yields an estimate of approximately $286 million per year in incremental compliance costs, compared to $287 million in the primary analysis; the results in both the primary and alternative scenarios round to $290 million in total annual social costs. Similarly, under Alternative 2, total annual social costs are approximately $70 million in both the alternative baseline scenario and the primary analysis.

Limitations of Compliance Cost Analysis

While EPA has taken steps to present a sound analysis of compliance costs, it recognizes that certain assumptions and limitations are inherent to this assessment.

Tank configuration: This analysis assumes that a particular configuration of equipment represents the average UST system. This assumption affects the compliance costs of the final UST regulation because systems with different configurations (e.g., more sumps per tank) could have different costs. Mischaracterizing this configuration may under- or overstate total costs as well as system-level costs.

System-level compliance costs: As discussed in Section 3.3, system-level compliance costs are based on public information, input from UST industry professionals, and EPA professional judgment, all of which are assumed to provide the most accurate available data at the time of this regulatory action. EPA recognizes that these data sometimes reflect only a small number of sources, and are therefore characterized by uncertainty.

As a result of these uncertainties, the precise cost of the final UST regulation may differ from the estimate generated by EPA's analysis. The above sensitivity analyses, though not strictly additive, suggest that the outside range of cost uncertainty is less than 35 percent from EPA's central estimates.[73] Moreover, because EPA's estimate is framed by a number of conservative assumptions (outlined in section 3.3), it is unlikely that this analysis understates the costs of the final UST regulation significantly.

[73] The alternative labor rates sensitivity analysis in **Exhibit 3-6** indicates that compliance costs may decrease by up to $20 million or increase by up to $40 million, depending on the set of labor rates specified. This reflects a range spanning from a total decrease of up to 13 percent ($20 million / $160 million) to a total increase of up to 25 percent ($40 million / $160 million). In addition, the technology distribution sensitivity analysis in **Exhibit 3-7** indicates that compliance costs may be overstated by up to $19 million, or understated by up to $11 million. This reflects a range spanning from a total decrease of up to 12 percent ($19 million / $160 million) to a total increase of up to seven percent ($11 million / $160 million). Combining these ranges yields a total outside range of cost uncertainty of less than 35 percent around EPA's central estimates: a potential total decrease of 25 percent (13 percent + 12 percent) to a potential total increase of 32 percent (25 percent + seven percent).

Chapter 4. Assessment of Cost Savings and Benefits

4.1 Introduction

The beneficial impacts of a regulatory change are typically measured in one of two ways: as "social benefits" or as avoided costs. Social benefits usually take the form of reduced environmental damage, reduced human health risk, and improvements in the value of environmental amenities. Benefits also include avoided costs associated with reduced need for cleanup and avoided costs of "averting behavior" (e.g., obtaining replacement water supplies). Ideally, social benefits reflect accurate measures of the total "willingness to pay" (WTP) of consumers to obtain improvements in environmental quality. In other cases, avoided costs (e.g., medical care) can be used to inform proxy estimates of WTP when direct estimates of WTP are unavailable. In the context of this regulation, EPA considers the avoided costs associated with reduced need for remediation (cleanup) of releases because avoided costs represent a real economic cost savings, and because reliable WTP estimates for the value of an avoided cleanup are not available. While avoided costs, or cost savings, could be subtracted from total costs and reported in Chapter 3, they do not typically accrue to the same parties that incur compliance costs. Therefore, for clarity of presentation, we examine them with other benefits and beneficial impacts in this chapter.

This chapter describes the approaches used to evaluate avoided remediation costs and other benefits. It first outlines several different methods attempted for measuring benefits and cost savings in the context of the proposed regulation, and describes the final selected method (expert consultation) in detail. Next, it provides a description of monetized cost savings, including avoided cleanup costs, avoided vapor damage cleanup estimates, and avoided product loss associated with anticipated reductions in releases and reductions in severity of releases. The chapter then presents a screening-level analysis of the quantity of groundwater potentially protected by the regulation. Finally, we provide a qualitative discussion of ecological, human health, and other social benefits.

4.2 Investigation of Empirical Methods for Measuring Cost Savings

The cost savings of the final UST regulation result from the reduced incidence and size of releases that would occur due to the new requirements. EPA examined a number of ways to use quantitative, empirical data on release rates, inspection effectiveness, and program performance to directly estimate the changes in releases that could be expected under the final UST regulation. This section describes the different data sources and methods considered, and the limitations of each.

4.2.1 Engineering Estimates and Literature

One approach to estimating the benefits of this regulation would be to develop an engineering model of the release rates associated with equipment and practices before and after the implementation of the regulation requirements. However, this approach would address only a small number of the final UST regulation components because most of the requirements are not focused on equipment modifications, but instead call for inspections, testing, and maintenance.

These are requirements for changes in human behavior, and are not easily measured using equipment testing.

This suggests that EPA could best measure benefits empirically by examining studies of how release rates change in response to more frequent inspection and testing. Therefore, in the context of the proposed regulation, EPA conducted a targeted review of engineering literature and studies on the effectiveness of testing and inspection programs. While we were unable to identify any studies directly applicable to the proposed UST regulation, we did identify several studies that examined the effects of better inspection and testing rates more generally. We summarize three key studies below.

- **California study of impact of secondary containment on UST system releases (2002):**[74] This study examined whether use of secondary containment throughout UST systems resulted in differences in release rates. The study's conclusions were hampered by a limited sample size, and authors note that releases from other parts of the systems may have affected results. The study did not find a significant relationship between secondary containment and release rates at sites, but did find that facility-level factors (e.g., improper installations) made it more likely than expected that all systems at a facility would either have or lack releases. While the study cannot be used to directly estimate the benefits associated with the proposed or final UST regulation, its conclusions suggest that regulations focusing on effective facility-level inspections may be well-targeted.

- **National Research Council study of effectiveness of state vehicle emissions inspection and maintenance programs (2001):**[75] This study reviewed four state programs and one city program aimed at reducing motor vehicle emissions by requiring inspections and maintenance. While the study did not address UST systems, the structure of vehicle inspection programs is similar to the UST regulation in that both require owners/operators to undertake routine inspections and perform maintenance as needed. The study found that the programs had a measureable impact on ambient air quality, but did not identify whether the differences were statistically significant.[76] The results do not provide a quantitative basis for estimating the impacts of the final UST regulation, but the study suggests that mandatory inspection programs can reduce emissions.

[74] Young, Thomas M. and Randy D. Golding. Underground Storage Tank Field-Based Research Project Report. Submitted to the California State Water Resources Control Board under contract to the University of California, Davis. May 31, 2002.

[75] Committee on Vehicle Emission Inspection and Maintenance Programs. *Evaluating Vehicle Emissions Inspection and Maintenance Programs*. National Academy Press, 2001.

[76] The study also concluded that the programs had more modest impacts than those predicted by air quality modeling, but this finding is of limited relevance to the current regulation, since no ambient conditions modeling has been conducted.

- **Environmental Results Program (ERP) data:**[77] Data from several environmental results programs (ERPs) show a statistically significant improvement in verified compliance as a result of a combination of self-certification, technical assistance, and inspections. While these programs do not isolate the impact of specific regulatory changes, the results are consistent with other findings that programs that rely in part on self-implemented inspections and reporting can reduce noncompliance.

In general, the literature does not address UST inspection programs directly, and does not provide quantitative results that can be used to estimate the impacts of the final UST regulation. However, the literature does provide data that generally indicate that self-implementing inspection programs (with external validation) do have an impact on equipment maintenance, and generally lead to a reduction in environmental impacts. This suggests that some positive impact should be expected from the final UST regulation.[78]

4.2.2 Statistical Analysis of State Release Data

A different approach to a robust analysis of benefits would be to develop a database of state UST regulations and reported release rates before and after the effective dates of regulations similar to the final UST regulation. With good quality data, it is possible to combine these regulations and reported release rates, and isolate the marginal impacts of various components of the final UST regulation. To collect detailed data at the facility level, however, would require visiting state UST programs individually and collecting detailed site inspection data from state case files and archives. Not only would such an effort be prohibitive in terms of available resources, but our current knowledge of the state programs suggests that variable inspection practices and changes in record-keeping practices over time may limit the ability of the exercise to provide robust results.

In the absence of site-specific data, however, we collected and examined data on state regulatory programs and reported releases from available aggregate sources at the time of the proposed regulation. Specifically, we identified and evaluated data from the following sources:

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[77] See: Vermont Department of Environmental Conservation. "Final Report – Environmental Results Project – Vermont: Underground Storage Tank Facilities." March 17, 2010; Rhode Island Department of Environmental Management. Underground Storage Tank Environmental Results Program, Final Report, Tables I-IV; U.S. Environmental Protection Agency. "Evaluation of Three Environmental Results Programs (ERPs)." August 31, 2009; and U.S. Environmental Protection Agency. "ERP States Produce Results." December 2007.

[78] EPA conducted an updated targeted literature review in October and November 2013 to determine whether additional studies examining the impacts of testing and inspection programs on environmental outcomes had been published. The conclusions of these additional studies are consistent with those described in this section. Additional studies reviewed include: Yin, H. "The environmental and economic impacts of environmental regulations: The case of underground storage tank regulations." January 1, 2006; and Musgrave, M. "The Illinois Underground Storage Tank Fund: Tanks for Nothing," *Politics & Policy* 41(5): 765-787. October 2013. The additional studies reviewed did not directly comment on specific outcomes, in terms of environmental impacts, from UST inspection programs, but did discuss the effects of risk-based insurance and financial assurance programs, which require a degree of regular inspection and maintenance, on avoiding leaks from USTs.

- **Leak Autopsy Reports:** In 2004 and 2005, EPA released two draft "leak autopsy" studies ("the draft 23-state Autopsy Report" and a separate study examining the State of Florida). These studies examined the sources and extent of releases that occurred in systems that were compliant with the 1998 standards, and identifies the extent to which different baseline releases are associated with failures of equipment in different parts of the UST system (e.g., piping, overfill protection equipment).[79]

- **State Regulatory and Report Data**: State programs are required to report aggregated information to EPA on the number of active UST systems, the number of inspections, and the number of confirmed releases reported in each six-month period.[80] In addition, EPA obtained information about state regulatory programs and the effective dates for state requirements that are similar to the requirements of the proposed regulation.

Using the available data, EPA examined several different statistical approaches, focusing on regression analysis, to compile and examine a set of state-level data that included the number of UST systems in each state in a given year, the number of releases from UST systems in each year, the number of UST inspections conducted in each year, and the presence or absence of regulations designed to prevent releases.

Before conducting regression analysis on the data set of state USTs and releases, EPA first adjusted the data to account for a number of data quality concerns. Of particular concern was the relationship between states with low-frequency inspections and states reporting small numbers of confirmed releases. To ensure that the reported UST releases accurately reflected most or all releases taking place, EPA developed an index that scored each state based on the frequency of inspections. States that reported inspection rates less frequent than every five years, and/or inconsistent inspection frequencies over time, were removed from the sample, based on the assumption that release data from those states may be less reliable due to less frequent third party verification (i.e., state inspection) of system operations. In other words, we assume that owners/operators may be less inclined to report releases or properly maintain their equipment if they are in a state where inspections occur infrequently or inconsistently.

In conducting the analysis, however, EPA identified several fundamental problems with the available data, further limiting the value of a regression analysis approach. These include significant data availability and reliability issues related to the limited number of observations and programmatic changes among states that prevent the isolation of regulation-related impacts. Specifically:

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79 U.S. Environmental Protection Agency, Office of Underground Storage Tanks. "Evaluation of Releases from New and Upgraded Underground Storage Tank Systems (peer review draft)." August 2004; and U.S. Environmental Protection Agency, Office of Underground Storage Tanks. "Petroleum Releases at Underground Storage Tank Facilities in Florida." March 2005.

80 Data can be accessed at: http://www.epa.gov/oust/cat/camar chv.htm.

- **Consistent, accurate release data are not available**. It is likely that measurement error exists in the recording of confirmed releases across states (the dependent variable) and that it is related in some systematic way to the regulatory structure of the state or other explanatory variables (as opposed to random reporting error) in the analysis. In addition, state inspections vary in timing and focus across states; this, in turn, affects the consistency of third-party verified compliance and release information. While EPA attempted to account for this by selecting only states with a high frequency of inspections for inclusion in the analysis, the interaction between inspection frequency and degree and effectiveness of regulation creates sample selection problems (i.e., states with higher release rates due to limited regulation may also be states that do not conduct frequent inspections and therefore have less reliable data).[81] Therefore, normal regression properties do not hold, and results may be biased in ways that do not allow for a reliable interpretation.[82]
- **Many regulations consistent with the proposed UST regulation are currently in place in only a small number of states**. EPA addressed limited variation in the presence of regulations by dropping several regulatory variables from the analysis, but the resulting lack of variation and the small number of observations make it likely that regulatory indicators will proxy for other relevant characteristics of that state.
- **Study design is limited by available data**. Ideally, an analysis of the effectiveness of UST leak prevention regulations would employ observations from a large number of states over a time period that includes years before and after regulations were in place. Such "panel" data would allow for identification of impacts temporally and spatially. Panel data would also allow for fixed-effects estimation, which controls for any unobserved characteristics of states that might affect release rates (such as soil pH or climate), independent of any effect of regulation. Available data superficially appear to be panel data, since they provide information on the number or rate of releases from different states in multiple time periods, along with information on the presence or absence of UST regulations by state. However, for many regulations it is unclear both when the regulation was first promulgated and when the effects of the regulation would be expected to be fully realized (e.g., through inspections).

As discussed in more detail in Appendix F, quantitative analysis of annual UST releases by state did not reveal a consistent measure of the potential impact of release prevention regulations. The data limitations noted above prevented the use of the preferred method of fixed effects estimation using panel data. In the absence of fixed-effects estimation, the analysis cannot

[81] As noted above, the only reliable approach to identify the relationship between inspection frequency, compliance, and number of releases would require a large-scale data collection effort. In absence of this, we use inspection frequency as an indicator of reliable data.

[82] For example, several regressions found an apparent *positive*, statistically significant relationship between secondary containment requirements and the number of releases per year. However, empirical data from Florida indicate that secondary containment contributes to release reductions of as much as 50 percent.

reliably draw conclusions about the impacts of regulations on releases, independent of any unmeasured characteristics of states that could be affecting the number of releases in each state. In other words, in addition to data quality issues discussed above, the small number of states with specific UST release prevention regulations prevents identification of robust relationships between individual regulations and the number of releases per year.

However, through cross-sectional analysis, EPA was able to estimate that release rates in California and Florida – two states with mature UST regulation regimes – were about 55-65 percent less than one would expect based on release rates at other states during the time period examined. This difference could serve as an upper bound for the potential of leak prevention regulations to reduce the rate of UST releases.[83]

4.3 Final Methodology for Assessment of Positive Impacts: Expert Consultation

In the absence of applicable engineering models and limited empirical state data, we resorted to a consultation with four experts with experience in regulation of USTs and implementation of state inspection programs to estimate the individual effects of each regulatory change. The remainder of this chapter describes in detail the final methodology used to identify reductions in releases associated with the final UST regulation, and the calculation of cost savings associated with those avoided releases.

For the proposed regulation, to ensure that the assessment of regulatory effects relied on broad expertise in regulatory implementation, EPA developed a pool of technical experts with national reputations for leadership in implementation of underground storage tank regulatory programs, or with extensive expertise in assessing spill causation at UST sites. From this pool, several experts were interviewed and five experts were identified. Each of these identified experts has over 20 years of experience in the regulation, assessment, and/or remediation of underground storage tanks, including direction of state programs and implementation of regulations similar to some aspects of the proposed regulation. One of the five experts did not provide input consistent with EPA's analytical methods, and as a result his quantitative estimates were not usable for the evaluation of the proposed regulation.[84] As a result, for the final UST regulation, EPA consulted the remaining four experts to evaluate avoided costs.

[83] Exhibit 6 in Appendix F shows the degree to which the actual number of releases in Florida and California in 2009, 2005, and from 2002 to 2006 is less than the number of releases that would be expected based on the release rates observed at other states. In 2005 and 2009, the years in which the dummy variable for California was statistically significant from zero, California had between 56 and 63 percent fewer releases than would be expected based on the regression analysis. In 2002-2006, when the period in which the dummy variable for Florida was statistically significant from zero, Florida had between 60 and 65 percent fewer releases than would be expected. EPA strongly cautions against generalizing these results beyond the states included in the analysis. However, these numbers do suggest an upper bound of potential avoided leaks associated with the operation of the mature, relatively stringent programs in both California and Florida.

[84] This expert's baseline estimate of releases was not consistent with EPA's, and he was not able to provide information on how to extrapolate to EPA's universe. In addition, his responses included apparent internal inconsistencies that could not be reconciled without collecting more information about baseline releases. The expert also provided clear opinions about the optimal regulatory structure and suggested that his answers were not reliable unless the regulatory language was amended to include specific technical requirements. This created additional uncertainty in the interpretation of his results.

EPA provided an identical set of written questions separately to each expert and conducted individual follow-up telephone interviews to clarify and verify responses. Appendix G provides a detailed explanation of the process EPA followed in identifying experts, more detailed information about the qualifications of the experts, the questions distributed to experts, and an explanation of the factors EPA considered when including and excluding expert feedback. Appendix H provides the experts' responses to EPA's questions.

Avoided Costs as a Measure of Beneficial Impacts

Avoided remediation costs represent the key beneficial impacts associated with the regulations. Avoided remediation costs represent cost savings that accrue to owners, operators and public entities charged with remediating releases at regulated facilities.[85] While avoided remediation costs are not a direct measure of total willingness to pay for environmental improvements, and are therefore not equivalent to social benefits, they represent real cost savings due to reduced demand for baseline remediation.[86]

Calculation of Annual Positive Impacts

The analysis presents the positive effects of the final UST regulation as a constant, recurring, annual value for analytical convenience. The timing of the positive impacts of the regulation is uncertain for several reasons:

- As shown in **Exhibit 1-2** in Chapter 1, the regulatory changes do not take effect simultaneously.

- Irrespective of when they take effect, the changes may require varying lengths of time to achieve full effect.

- EPA relies on its reported confirmed releases to calculate the reductions due to the final UST regulation. Confirmed releases recorded in a particular evaluation year vary significantly in severity and length of time undetected, which introduces variability in the extent to which costs are avoided each year.

- The final UST regulation includes activities such as: frequent inspections and equipment testing to prevent, identify and address releases; near-term shifts in technology; and long-term changes in technology. Each class of changes necessarily focuses on release avoidance and mitigation over different time horizons.

In the absence of detailed data characterizing releases by age and type, EPA assumes that implementation of the final UST regulation will have a uniform annual impact, with beneficial impacts realized on the last day of the year in which costs are incurred (i.e., a one-year delay). For equipment that is phased in over a period of time, we assume that positive impacts accrue at

[85] Chapter 5 provides a more detailed discussion on the potential positive effect of the final UST regulation on state financial assurance funds.

[86] Economists commonly define social benefits as the sum of individuals' willingness to pay to obtain a good or service or avoid an unwanted outcome. Avoided remediation costs may not equal willingness to pay.

the same rate as installation and adjust those impacts so that they are constant over time, maintaining the one-year delay.[87]

4.3.1 Avoided Remediation Costs

This section explains how EPA arrives at its estimates of avoided remediation costs.[88] EPA first explains how it calculates avoided remediation costs based on the source of a release. This is followed by a discussion of the methods used to calculate the number of releases avoided and the number of releases for which severity is mitigated. Finally, the two elements are combined to estimate the total avoided remediation cost due to the final UST regulation.

4.3.2 Calculating Avoided Remediation Costs

This analysis values avoided releases according to their cost of remediation. EPA developed average remediation costs for the four general release size categories reported in the draft 23-state Autopsy Report. The four categories generally conform with classification conventions used by state LUST offices, and the autopsy reports presented leak frequency data for different UST system components for each of the categories. The four categories include:

- Local site extent with soil contamination;
- Local site extent with water contamination;[89]
- Large site extent with soil contamination; and
- Large site extent with water contamination.[90]

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[87] Although remediation costs at a specific site may vary widely across years (if they extend past a year), available data do not support characterization of a typical cost stream that could be applied to each site. For example, some sites may require immediate and expensive response actions, while other sites may require multi-year remediation with a long initial planning phase. We do not have any national or state-level data that could be used to characterize an "average" cost stream: a review of available state-by-state and national level data under Contract Number EP-W-07-011, Work Assignment 3-42 indicated that site-by-site data do not contain payment stream information, and furthermore, due to a multitude of factors influencing time-to-closure or remediation duration at a given site (e.g., groundwater contamination, MTBE contamination, eligibility for state funding, state priority ranking for site, etc.), an "average" cost stream cannot be effectively generalized. As a result, this analysis calculates an average annual cost based on total site remediation cost. Thus, benefits associated with avoided remediation are expressed in annual terms. See Appendix I for detailed explanation of the methodology used to develop remediation cost estimates.

[88] We refer to avoided cleanup costs and avoided remediation costs interchangeably throughout this document.

[89] Water contamination refers to both groundwater and surface water contamination, though groundwater contamination is more common than surface water contamination.

[90] While no specific definition exists for a large site, the LUST Autopsy survey instruments used by the states generally define large sites as those with contamination that extends beyond the extent of construction excavation. In addition, EPA classified sites with off-site contamination as large sites.

EPA obtained remediation costs aligned with each of these size categories from a survey of state LUST offices and calculated average expected remediation costs for each of the release categories outlined in the draft 23-state Autopsy Report (**Exhibit 4-1**).[91] Remediation costs associated with groundwater remediation are generally higher than costs for soil remediation. Administrative, response, and oversight costs were provided by New Hampshire, and remediation costs reflect an average of the costs provided by New Hampshire and Utah.[92,93]

Exhibit 4-1

Remediation Costs By Release Extent[a, b]

	Site Size And Contamination Type			
Remediation Cost Category	**Small extent, soil only**	**Large extent, soil only**	**Small extent, Groundwater Contamination**	**Large extent, Groundwater Contamination**
Typical administrative cost (public notification, fines, fees, etc)[c]	$0	$0	$500	$3,700
Typical response cost (e.g., alerting and sending personnel, assessments and planning, immediate actions to stop the release)[c]	$10,000	$10,000	$10,000	$10,000
Typical remediation cost[d]	$14,800	$103,000	$98,500	$409,500
Typical oversight cost (e.g., monitoring)[c]	$500	$1,000	$1,500	$5,000
Total typical cost per LUST category	**$25,300**	**$114,000**	**$110,500**	**$428,200**

Notes:

[a] Costs shown are one-time costs associated with a site remediation and have been rounded to the nearest hundred dollars.

[b] Costs are presented here in 2008 dollars. EPA inflates these costs to 2012 dollars for use in the analysis.

[c] The costs presented for administrative, response, and oversight costs are based on New Hampshire data only.

[d] The remediation costs shown represent the average costs from data provided by New Hampshire and Utah. Although New Mexico also reported costs, we excluded it for two reasons. First, groundwater cleanup cost estimates from New Mexico are much higher than those for other states ($2.5 million compared with $0.6 million or less for other states) but the state did not provide data on the number or type of sites that resulted in this high estimate of costs. Second, New Mexico has a relatively small number of UST systems (3,773 UST systems as of fiscal year 2013). As a result, New Mexico's costs may be atypical and could skew results to overstate avoided costs.

Sources:

1. New Hampshire Department of Environmental Services, Underground Storage Tank Program, November 18, 2008.
2. Utah Department of Environmental Quality, Underground Storage Tank Program, November 18, 2008.

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[91] U.S. Environmental Protection Agency Office of Underground Storage Tanks, "Evaluation of Releases from New and Upgraded Underground Storage Tank Systems," draft, August 2004.

[92] To develop an avoided cleanup cost estimate, EPA collected data from Montana, New Hampshire, New Mexico, South Carolina, Utah, and Virginia, all of which use state financial assurance funds to pay for LUST remediation. Each state UST program office received a questionnaire requesting data on typical cleanup costs broken out by the four general release types; New Hampshire, New Mexico, South Carolina, Utah and Virginia provided responses. New Hampshire provided the most comprehensive set of information, including cleanup costs by category (i.e., administrative, response, remediation, and oversight), while New Mexico and Utah could only provide estimates of remediation costs. Virginia and South Carolina were unable to provide the detail required for this analysis, as neither state was able to break out costs by the extent of release (i.e., large or small).

[93] New Mexico data are excluded from the calculation for two reasons. First, large-extent groundwater cleanup cost estimates from New Mexico are much higher than those for other states ($2.5 million compared with $0.6 million or less for other states) but the state did not provide data on the number or type of sites that resulted in this high estimate of costs. Second, New Mexico has a relatively small number of UST systems (3,773 UST systems as of fiscal year 2013). As a result, we believe that New Mexico may be atypical and could skew results to overstate avoided costs. We therefore do not include its results among the average avoided costs of remediation.

EPA then used the average cost data from states to develop weighted average costs associated with remediation of releases from different portions of the UST system, based on release frequency data for each source. **Exhibit 4-2** presents, for each of the release sources identified in the draft 23-state Autopsy Report, the probability of a release by LUST category.[94] Using the cost data from **Exhibit 4-1**, inflated to 2012 dollars, EPA estimates a weighted average avoided cost per release size by multiplying the cost per site by the probability of each release type. These are summed across the categories to obtain the weighted average cost by release source.[95, 96] The following section describes how this information is used to generate an estimate of incremental avoided costs.

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[94] U.S. Environmental Protection Agency, Office of Underground Storage Tanks. "Evaluation of Releases from New and Upgraded Underground Storage Tank Systems (peer review draft)." August 2004. Release probabilities were calculated using data for 580 spill events collected from 23 states during the development of EPA's Autopsy report effort. Specifically, Figures 3, 16, 17, and 18 in the Autopsy Report provide data on the percent of releases by source, by extent, and by media affected for each extent (local or large). By multiplying the percent of total releases from a given source (e.g., piping), the percent of those releases affecting a given media type (e.g., soil), and the percent of releases affecting that medium that are of a given extent (e.g., local soil), EPA is able to generate the probability distributions in Exhibit 4-2. Note that these sources include California and Florida releases, and may therefore be skewed slightly if those more stringent and established programs have smaller releases. We are unable to adjust the data to correct for this, but its impact, if any, would likely be to reduce the average size and cost of baseline releases slightly, leading to an understatement of regulation-related cost savings.

[95] For more information on this approach and the draft 23-state Autopsy report, see: Industrial Economics, Inc. "Methodology to Estimate Avoided Costs Associated with a Typical UST Leak." October 27, 2008.

[96] If we calculate a weighted-average cost per release where sources are weighted proportionally by their contribution to total releases, we obtain an overall average cost per release of approximately $152,000 in 2012 dollars (See Appendix I for details). This is generally consistent with ASTSWMO's annual average cost estimate for site remediation of roughly $124,000 in 2012. ASTSWMO's average site remediation value may understate typical remediation costs because co-pays, deductibles, and other costs not paid by state funds are excluded. Additionally, because the ASTSWMO estimates depend on expenditures in a given year, these estimates tend to vary substantially over time. See: Association of State and Territorial Solid Waste Management Officials. *State Fund Survey Results 2012*.

Exhibit 4-2

Probability And Weighted Average Of Avoided Costs Per Release Source And Extent

Release Source (as identified in 23-state Autopsy Report)		Small extent, soil only	Small extent, groundwater contamination	Large extent, soil only	Large extent, groundwater contamination	Total/ Weighted Average
Piping	Probability	40.5%	22.0%	4.5%	33.0%	100.0%
	Cost	$10,900	$25,900	$5,500	$150,700	$193,000
Dispenser	Probability	71.6%	9.7%	5.4%	13.3%	100.0%
	Cost	$19,300	$11,400	$6,600	$60,900	$98,100
Tank	Probability	30.7%	17.7%	17.3%	34.3%	100.0%
	Cost	$8,300	$20,800	$21,000	$156,700	$206,800
STP Area	Probability	50.0%	31.0%	0.0%	19.0%	100.0%
	Cost	$13,500	$36,500	$0	$86,800	$136,700
Delivery Problems	Probability	59.2%	16.8%	1.8%	22.2%	100.0%
	Cost	$15,900	$19,800	$2,200	$101,500	$139,400

Note: Costs shown have been rounded to the nearest hundred dollars. Costs have been inflated to 2012 dollars.
Sources:
1. U.S. EPA, *Evaluation of Releases from New and Upgraded Underground Storage Tanks* (Draft). 2004. ("23-state Autopsy Report")
2. New Hampshire Department of Environmental Services, Underground Storage Tank Program, November 18, 2008.
3. Utah Department of Environmental Quality, Underground Storage Tank Program, November 18, 2008.

4.4 Establishing Avoided Releases

To estimate the number of baseline releases that would be either avoided completely or reduced in severity as a result of the final UST regulation, experts responded to a common set of questions about potential impacts of the regulatory changes under consideration and participated in subsequent individual discussions of specific areas of uncertainty.

Each expert reviewed the requirements under consideration for the final UST regulation and estimated how they would affect the following dimensions of releases:[97]

1. Changes in total frequency (number) of annual confirmed releases;
2. Changes in the number of remaining releases that reach groundwater; and/or
3. Changes in the average quantity released among remaining releases.

Experts had the option of expressing reductions in release severity in terms of the percent reaching groundwater or volume (quantity) of product, depending on how they typically collected and reviewed release data. In addition, experts were given the option of expressing these changes either: 1) as a total national estimate that accounted for variation in existing regulation and technology among states and facilities, or 2) as a change applied to a specific

[97] EPA did not provide experts with information about the universe of facilities or costs associated with remediation; experts did, however, have access to information about the number of confirmed releases in 2008, 2011, and 2012 and their distribution across different parts of the UST system (e.g., tanks, pipes, and STP areas). EPA uses confirmed releases as the baseline estimate of total releases because high quality data on total releases are not available, and release confirmation triggers the remediation costs that would be avoided.

subset of the tank universe (e.g., 10 percent change among tanks with a certain technology that are not currently regulated).

Experts also estimated the sensitivity of results to changes in the frequency of regulatory requirements (e.g., the impact of inspections occurring at different intervals, consistent with different regulatory options) and noted synergies or dependencies between requirements, such as:

- Dependency between equipment upgrades and walkthrough inspections: Experts consistently noted that simply replacing equipment with newer technologies (e.g., requiring that new systems have secondary containment) is insufficient for preventing all releases. Regular visual inspections are necessary to identify potential problems and ensure timely maintenance when a release has not yet occurred.

- Synergy between equipment maintenance and walkthrough inspections: Experts noted that the combination of operability tests and visual (walkthrough) inspections would result in more avoided releases by identifying equipment problems quickly and ensuring effective maintenance.

- Dependency between operator training and walkthrough inspections: Experts noted that training alone is not adequate to ensure effective site maintenance, and walkthrough inspection requirements are not effective without trained staff.

Experts provided separate estimates of impacts for each regulatory requirement. EPA then used these requirement-specific estimates to calculate total avoided costs for the final UST regulation.[98] It is important to note, however, that when considering relationships among regulatory requirements, experts differed in how they isolated and/or "allocated" impacts across specific requirements because the allocation of impacts across different regulatory requirements could potentially be interpreted in several ways (e.g., one expert might decide that inspections drove all impacts, while another might decide that testing was the primary factor). EPA therefore avoids emphasis on the requirement-specific estimates provided by each expert, and considers their results in total.[99]

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[98] Experts were also asked to provide an estimate of the "total cumulative impact" for the final UST regulation in aggregate. This general estimate was used only to verify that the experts' logic was internally consistent, and to identify areas of overlap or synergy among the regulatory requirements. Because of adjustments required to align expert responses with the combination of regulatory requirements ultimately selected for the final UST regulation (e.g., using experts' sensitivity responses for tanks on tribal lands rather than their responses for tanks overall), we are unable to assess the magnitude of overlap or synergy. However, the fact that the average of the experts' cumulative estimates is higher than the average of their requirement-specific totals indicates that they do not believe there is significant overlap among requirements. As a result, benefits are unlikely to be overstated due to overlap.

[99] Note that EPA carefully examined and reviewed each requirement-specific estimate from each expert, and verified the results and assumptions with each expert, particularly in cases where results reflect a wide range. For detailed information on expert responses, see Appendix H.

In general, EPA applies the estimates presented by the experts to the number of affected units. In cases where reductions involved a range of values, EPA selected the midpoint of the range of values identified by each expert. Where experts' comments reflect qualitative assumptions that substantially affect their quantitative estimates, the analysis acknowledges those factors as caveats to estimated rates of release avoidance. If these assumptions assume regulatory language more stringent or significantly different than the final language, the analysis does not include any benefits for that requirement.[100]

To calculate the number of releases completely avoided as a result of potential regulatory changes, EPA combines the estimated reductions as identified by experts with a release distribution based on data from the draft 23-state Autopsy Report (see Appendix I for more detail). To estimate changes in release severity, the analysis uses the distribution of releases from the same report to quantify the number of groundwater releases avoided due to reduced release volume. **Exhibit 4-3** provides a summary of our findings with respect to avoided releases. Experts' responses suggest that the Selected Option will avoid approximately nine percent to 50 percent of 6,128 annual releases, or roughly 560 to 3,000 releases in the first evaluation year. In addition, as summarized in **Exhibit 4-4**, of the remaining releases, approximately 210 to 900 releases would be reduced in severity (i.e., these releases would occur but instead of reaching groundwater they would remain soil contamination only).[101]

Exhibit 4-3

Avoided Releases

Expert	**Selected Option**	**Alternative 1**	**Alternative 2**
Expert 1	1,100	1,600	590
Expert 2	560	690	170
Expert 3	1,600	2,400	1,200
Expert 4	3,000	3,700	2,200
Average *(Range)*	**1,600** *(560-3,000)*	**2,100** *(690-3,700)*	**1,000** *(170-2,200)*

Note: See Appendices H and I for inputs and methods for calculating these values. Estimates were validated with experts to ensure they accurately capture their opinions.

[100] For example, Experts 1, 2, and 3 attributed reductions to the groundwater and vapor monitoring site assessment requirements; however, these experts also noted that they assumed the requirements would lead users to switch to another leak detection method. Because EPA's cost analysis does not assume that users will necessarily switch methods, we conservatively removed the experts' assumed reductions for this requirement.

[101] EPA assumes that these groundwater releases will instead become soil releases. Hypothetically, if releases are proportionally split as 50 percent groundwater and 50 percent soil before the regulation takes effect, and if the regulation reduces groundwater contamination by 20 percent, releases would be split 40 percent groundwater and 60 percent soil after the regulation.

Exhibit 4-4

Avoided Groundwater Contamination Incidents

Expert	Selected Option	Alternative 1	Alternative 2
Expert 1	900	1,100	620
Expert 2	210	460	88
Expert 3	320	310	280
Expert 4	600	480	570
Average *(Range)*	**510** *(210-900)*	**600** *(310-1,100)*	**390** *(88-570)*

Note: See Appendices H and I for inputs and methods for calculating these values. Estimates were validated with experts to ensure they accurately capture their opinions.

4.4.1 Avoided Releases Using an Alternative Baseline

EPA's primary analysis assumes that the universe of confirmed releases from UST systems remains constant over the time frame of the analysis. However, both the universe of UST systems and the release rate (defined as the number of confirmed releases divided by the number of UST systems in a given year) have declined over the last two decades.[102] This is consistent with the regulatory context of the past 20 years, in which two key factors have been driving the number of releases. First, the universe of UST systems has been declining as older, smaller tanks have been replaced by newer, larger systems. Second, many of the confirmed releases reported in the 1990s and early 2000s were "legacy" releases associated with older systems that did not meet the technical standards under 40 CFR Part 280 (e.g., tanks that were installed prior to the promulgation of the UST regulation at 40 CFR Part 280). Many of these legacy releases are discovered when tanks are removed during property transactions and other development projects.

As the number of legacy releases has declined, the declining trend in total releases has "flattened" – trend data suggest that release rates have been approximately one confirmed release per hundred tanks in recent years. In addition, it is possible that confirmed releases may *increase* in future years, as UST systems continue to age, and as new fuel blends with potentially higher corrosivity are introduced into the industry. Given this uncertainty, EPA assumes in the primary analysis that release rates remain constant.

However, to address the uncertainty associated with the number of confirmed releases, EPA also assesses avoided costs under the final UST regulation using an alternative baseline that projects a continued decline in the release rate consistent with the recent historical trend, and also captures the decline in the number of UST systems as estimated in Chapter 3, Section 3.3.1.[103] This represents a conservative avoided cost scenario because it does not account for the possibility that aging systems or changes in fuel could result in increases in the number of confirmed releases reported, or that the number of UST systems could increase (if, for example, an expanding economy or population growth demands more service locations).

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[102] See Appendix J for charts and data sources that demonstrate these two trends.

[103] This decline in UST systems also captures the effects of declining gasoline use in recent years.

To estimate the rate of universe decline, EPA mapped historical data on the number of UST systems from 1991 through 2013 to an exponential one-phase decay function, which appears to most accurately represent the observed behavior of the UST system universe over time.[104] EPA also mapped historical data on the release rate to a similar decay function. [105] These two functions were then used to project future UST universe sizes as well as future release rates. We used the results from these two projections to estimate future number of confirmed releases.[106]

The cumulative universe of releases over 20 years under this alternative baseline is approximately 69 percent of the number of cumulative releases over 20 years in the primary analysis. The alternative baseline contains proportionally fewer releases than UST systems because two separate declining trends, UST systems and release rate, are used to estimate the future decline in releases. This compounds the projected decline in releases.

Exhibits 4-5 and **4-6** provide a summary of our findings with respect to avoided releases and avoided groundwater contamination events, respectively, assuming the alternative baseline releases occur. The alternative baseline results in a reduction of roughly 31 percent of both avoided releases and avoided groundwater contamination relative to the original baseline. Correspondingly, in the alternative baseline scenario, approximately 390 to 2,100 releases are avoided under the Selected Option, compared to 480 to 2,600 under Alternative 1 and 120 to 1,500 under Alternative 2. Under the alternative baseline, approximately 140 to 620 groundwater contamination incidents would be avoided under the Selected Option, 210 to 790 under Alternative 1, and 61 to 430 under Alternative 2.

Exhibit 4-5

Avoided Releases Under Alternative Baseline

Expert	Selected Option	Alternative 1	Alternative 2
Expert 1	760	1,100	410
Expert 2	390	480	120
Expert 3	1,100	1,700	840
Expert 4	2,100	2,600	1,500
Average *(Range)*	**1,100** *(390-2,100)*	**1,500** *(480-2,600)*	**720** *(120-1,500)*

Note: See Appendices H and I for inputs and methods for calculating these values. Estimates were validated with experts to ensure they accurately capture their opinions.

[104] See Section 3.3.1.

[105] To estimate future release rates, we used a single exponential decay function, which assumes that a quantity declines at a rate proportional to its value. This is an appropriate function given the singular and slowing rate of decline observed in the release rate over time. The equation for such an exponential singular decay function is $Y = (Yo – P) * e^{(-k*X)} + P$, where P represents the "plateau," or limit of the function and k represents the function's half-life. See Appendix J for additional details.

[106] We use release rates to project future number of releases (rather than use past trends in the number of confirmed releases) for two reasons: First, as the UST universe and release rate both appear to decline in a way approximating a single-decay exponential function, these projections can be used to estimate future number of releases without the added uncertainty of whether the release trend is truly a single-decay exponential function. In addition, using the release rate projections to estimate future releases yields a more conservative (lower) total number of releases than if we were to use the past trend in the number of releases, which leads to more conservative (lower) avoided remediation cost estimates in the alternative baseline.

Exhibit 4-6

Avoided Groundwater Contamination Incidents Under Alternative Baseline

Expert	Selected Option	Alternative 1	Alternative 2
Expert 1	620	790	430
Expert 2	140	320	61
Expert 3	220	210	190
Expert 4	420	330	390
Average *(Range)*	**350** *(140-620)*	**410** *(210-790)*	**270** *(61-430)*

Note: See Appendices H and I for inputs and methods for calculating these values. Estimates were validated with experts to ensure they accurately capture their opinions.

4.5 Benefits from Avoided Releases and Reduced Release Severity

Two sources of avoided costs constitute the majority of quantifiable positive impacts from the final UST regulation. First, some costs related to release remediation do not occur because a number of releases are altogether avoided. Second, some remaining releases are reduced in severity because of the regulatory requirements (e.g., through earlier detection from walkthrough inspections and improved operability of release detection equipment). To capture this dimension of avoided costs, the analysis relies on incremental avoided groundwater remediation costs—the cost to remediate a groundwater release less the cost to remediate a soil release—as groundwater releases are generally more costly to remediate than soil releases.

In addition to avoiding remediation costs, release prevention and mitigation results in a variety of other beneficial impacts, including:

- Avoided vapor intrusion damages;
- Avoided product loss;
- Human health benefits;
- Avoided acute exposure events and large-scale releases; and
- Ecological benefits (including protection of groundwater quality).

The following sections monetize, quantify, or otherwise describe these impacts.

4.5.1 Avoided Release Remediation

To determine the benefits of avoided releases, the analysis relies on the draft 23-state Autopsy Report's distribution of releases by source (i.e., the part of the UST system that produces the release), and applies the reduction associated with each regulation to the appropriate source to reduce the number of releases avoided by source.[107,108] Each avoided release is valued according to the weighted average of remediation costs shown in **Exhibit 4-2**.[109]

Exhibit 4-7 presents the total avoided remediation costs under each regulatory option. We estimate that discounted benefits from avoided remediation costs range between approximately $68 million and $380 under the Selected Option, while avoided costs amount to between $82 million and $530 million under Alternative 1 and between $24 million and $290 million under Alternative 2. Consistent with OMB's guidance on discount rates, this chapter presents results using a seven percent annual discount rate; for comparison, Chapter 7 presents results for the Selected Option using a three percent discount rate.

Exhibit 4-7

Discounted Avoided Release Remediation Costs

Expert	Selected Option ($ millions)	Alternative 1 ($ millions)	Alternative 2 ($ millions)
Expert 1	$140	$210	$80
Expert 2	$68	$82	$24
Expert 3	$190	$330	$160
Expert 4	$380	$530	$290
Average *(Range)*	**$190** *($68-$380)*	**$290** *($82-$530)*	**$140** *($24-$290)*

Note: Cost estimates reflect a seven percent discount rate.

4.5.2 Reduction in Release Severity

EPA expects that the regulatory requirements will reduce the volume and duration of releases. As a result of the smaller quantity released and the shorter duration of the release, releases are assumed to be less likely to reach groundwater, thus reducing release severity. To assess the impact on remediation costs associated with reduced release severity, the analysis focuses on changes in the number of releases that would have involved groundwater in the baseline, but because of the final UST regulation, involve only soil. While this metric does not capture all of the release mitigation effects of the regulatory requirements, avoided groundwater contamination is likely to be among the most significant effects of the regulation. The difference in remediation costs between soil and groundwater releases is substantial: remediation cost for an average groundwater release is approximately $290,000, while an average soil release costs

107 We exclude the 'Other' category of releases from the draft 23-state Autopsy Report because it does not map to the reductions designated by the experts. Because 'Other' accounts for only 1 percent of releases in the study, we distribute those releases proportionally across the remaining release sources.

108 We use five system sources to identify release types: piping, dispenser, tank, sump turbine pump area, and delivery problems. We then assign each regulation's effect to source types based on the regulation (e.g. spill bucket tightness tests are assumed to affect releases from delivery problems).

109 This approach assumes that avoided releases are well-represented by the distribution of release severity that is identified in the draft 23-state Autopsy Report.

approximately $74,000 to remediate.[110] Remediation costs across release extent and medium contaminated range from $27,000 to $460,000 based on typical site remediation costs from New Hampshire and Utah.[111]

To estimate the number of releases that are reduced in severity, we use experts' estimates of reductions in groundwater involvement and distribute them across release source, medium contaminated, and release extent.[112] We distribute remaining releases according to the draft 23-state Autopsy Report results and calculate additional benefits from remediation due to reductions in groundwater contamination following the regulation. We calculate avoided costs from reduced release severity by subtracting the cost to remediate all remaining releases after the final UST regulation is in effect from the cost to remediate all remaining releases in the baseline. In both cases, we remove from consideration the same number of fully-avoided releases and consider only the avoided costs from shifting releases from groundwater to soil.

A key limitation of this approach may lead to a conservative estimate of the effects of the final UST regulation. The analysis assumes that the distribution of releases across size (i.e., extent) does not change as a consequence of changes in groundwater contamination. In reality, changes in the likelihood of groundwater contamination are probably (at least in part) a consequence of reductions in release volume and duration. The same reductions in release volume that lower the incidence of groundwater contamination would likely also reduce the number of large extent releases of all types and decrease the average size of smaller releases. That is, new requirements should both reduce the number of groundwater contamination events and large extent events of all types. Our model captures only changes in the number of times that groundwater would be contaminated, and does not consider cost savings associated with smaller soil-only sites or small groundwater contamination incidents. We therefore likely understate avoided remediation costs.[113]

Exhibit 4-8 displays EPA's findings regarding discounted avoided costs due to the mitigation of groundwater incidents. The analysis calculates avoided remediation costs by taking the difference between estimated remediation costs before and after the regulatory changes are implemented. This difference accounts for both the reduction in groundwater release incidents as well as the increase in soil contamination events.[114] EPA estimates that benefits from averted

[110] These costs reflect a simple average of the costs to remediate a large extent and local extent release of each medium.

[111] Release extent is classified in the draft 23-state Autopsy Report as either local or large. Releases that do not extend beyond the area excavated during remediation are considered local, while releases that extend beyond property lines are considered large. Extent does not explicitly involve a measure of release volume.

[112] See Appendix I for details on the calculation of avoided costs.

[113] A change in the distribution of releases could also potentially cause the "average size" and cost of soil-only releases to *increase* (because larger groundwater releases are eliminated but become "large" local soil-only releases). While this could result in higher average costs for local releases, (i.e., the cost savings for avoiding a groundwater release might be less than the difference between "average" groundwater and soil releases), the analysis also does not consider the cost savings associated with reducing the size of groundwater releases that still reach groundwater or the cost savings associated with reducing the size of soil releases.

[114] This occurs because the analysis maintains the total number of releases constant: every groundwater release that is avoided still requires remediation as a soil release.

groundwater releases range from approximately $46 million to $190 million under the Selected Option, $80 million to $290 million under Alternative 1, and $20 million and $130 million under Alternative 2. Avoided costs from reduced groundwater contamination are additive to avoided costs from avoided releases.

Exhibit 4-8

Discounted Avoided Groundwater Remediation Costs

Expert	Selected Option ($ millions)	Alternative 1 ($ millions)	Alternative 2 ($ millions)
Expert 1	$190	$290	$130
Expert 2	$46	$120	$20
Expert 3	$71	$80	$61
Expert 4	$130	$120	$120
Average *(Range)*	**$110** *($46-$190)*	**$150** *($80-$290)*	**$84** *($20-$130)*

Note: Cost estimates reflect a seven percent discount rate.

4.5.3 Total Avoided Remediation Costs from Avoided Releases and Reduced Release Severity

Exhibit 4-9 displays the sum of avoided remediation costs across both avoided releases and mitigated groundwater incidents for all four experts. Because experts with the lowest estimate in one of these categories did not necessarily have similarly low estimates in the other, the range of total avoided costs is not equal to the sum of the ranges from **Exhibits 4-7** and **4-8**.

Exhibit 4-9

Total Discounted Avoided Remediation Costs[a]

Expert	Selected Option ($ millions)	Alternative 1 ($ millions)	Alternative 2 ($ millions)
Expert 1	$330	$490	$210
Expert 2[b]	$110	$200	$44
Expert 3	$260	$410	$220
Expert 4	$510	$650	$410
Average *(Range)*	**$300** *($110-$510)*	**$440** *($200-$650)*	**$220** *($44-$410)*

[a] Cost estimates were derived using a seven percent discount rate.

[b] Expert 2 provided responses that generate benefits that are relatively low compared to the other experts. Conversations with this expert indicated that he assumed partial noncompliance of at least 25 percent (that is, a compliance rate of at most 75 percent). To evaluate the potential magnitude of this inconsistency, we examined the impact of scaling Expert 2's avoided remediation costs from 75 percent compliance to 100 percent compliance. This adjustment resulted in avoided remediation costs of greater than $150 million annually under the Selected Option, assuming a seven percent discount rate. See Appendix H for additional discussion.

Although the values generated by the experts' responses cover a wide range, we note that the avoided cost estimates tend to spread evenly around the mean. Expert 4 consistently represents the high-end estimate of avoided costs, and Expert 2 consistently represents the low-end. While we are not able to explain why Expert 4's estimates are consistently higher than those of the other experts, we do note one source of uncertainty that applies to Expert 4's estimates. The experience of most experts is related to implementing state regulatory programs, which directly consider the universe of confirmed releases evaluated in this analysis. However, the experience of Expert 4 considers system engineering and changes in UST-related equipment. As a result, Expert 4's estimates consider all potential releases and then align these to EPA's universe of confirmed releases. While this approach is methodologically sound, it requires one more assumption on the part of the expert to derive a total estimate.[115]

In contrast, Expert 2's responses generate benefits estimates that are low compared to the responses of other experts. Comments provided by the expert indicated, and subsequent conversations with him verified, that he assumed a significant level of noncompliance with the regulations in deriving his estimates. His estimates assume that at least 25 percent of facilities will not correctly implement the requirements (that is, a compliance rate of at most 75 percent). The expert noted that this assumed level of compliance did not include intentional noncompliance, but did attempt to account for a lack of awareness or human error by owners/operators. This assumption is methodologically sound, but is not consistent with the full compliance assumed in our cost analysis. As a result, the values provided by Expert 2 may significantly understate benefits relative to costs. To evaluate the potential magnitude of this inconsistency, we scale Expert 2's avoided remediation costs from 75 percent compliance to 100 percent compliance as a sensitivity analysis. This adjustment results in total avoided remediation costs greater than $150 million annually under the Selected Option, assuming a seven percent discount rate. Appendix H provides additional discussion of the effect of assumed noncompliance on the experts' responses and potential net benefits of the final UST regulation.

4.5.4 Benefits from Avoided Releases and Reduced Release Severity under the Alternative Baseline Scenario

Exhibits 4-10 and **4-11** present avoided remediation costs associated with the avoided releases and avoided groundwater incidents shown in **Exhibits 4-5** and **4-6** under the alternative baseline scenario. In the alternative baseline scenario, avoided release remediation costs range from $47 million to $260 million under the Selected Option, between $56 million and $370 million under Alternative 1, and between $17 million and $200 million under Alternative 2. Averted groundwater remediation costs, meanwhile, range from $32 million to $130 million under the Selected Option, $55 million to $200 million under Alternative 1, and $14 million to $92 million under Alternative 2. These alternative estimates represent conservative estimates of the potential value of avoided releases, because they do not consider possible factors that may lead to increases in the number of releases reported or the number of UST systems in the future.

[115] The type of universe adjustment conducted by Expert 4 will not necessarily result in estimates that are overstated, and could instead result in estimates that are understated. The adjustment is noted here simply as an additional source of uncertainty unique to this expert.

Exhibit 4-10 **Discounted Avoided Release Remediation Costs Under Alternative Baseline**			
Expert	**Selected Option ($ millions)**	**Alternative 1 ($ millions)**	**Alternative 2 ($ millions)**
Expert 1	$94	$140	$56
Expert 2	$47	$56	$17
Expert 3	$130	$230	$110
Expert 4	$260	$370	$200
Average *(Range)*	**$130** *($47-$260)*	**$200** *($56-$370)*	**$95** *($17-$200)*
Note: Cost estimates reflect a seven percent discount rate.			

Exhibit 4-11 **Discounted Avoided Groundwater Remediation Costs Under Alternative Baseline**			
Expert	**Selected Option ($ millions)**	**Alternative 1 ($ millions)**	**Alternative 2 ($ millions)**
Expert 1	$130	$200	$92
Expert 2	$32	$84	$14
Expert 3	$49	$55	$42
Expert 4	$89	$83	$85
Average *(Range)*	**$75** *($32-$130)*	**$100** *($55-$200)*	**$58** *($14-$92)*
Note: Cost estimates reflect a seven percent discount rate.			

Exhibit 4-12 displays the sum of avoided remediation costs across both avoided releases and mitigated groundwater incidents under the alternative baseline scenario. Because experts with relatively lower estimates in one of these categories did not necessarily have similarly low estimates in the other, the range of avoided costs presented is not the sum of lower and higher bounds in **Exhibits 4-10** and **4-11**. As the cumulative release universe in the alternative baseline scenario is roughly 69 percent of cumulative releases in the original baseline, total avoided costs in the alternative baseline are approximately 31 percent lower than they are in the primary analysis.

Exhibit 4-12 **Total Discounted Avoided Remediation Costs Under Alternative Baseline**			
Expert	**Selected Option ($ millions)**	**Alternative 1 ($ millions)**	**Alternative 2 ($ millions)**
Expert 1	$230	$340	$150
Expert 2	$79	$140	$31
Expert 3	$180	$290	$150
Expert 4	$350	$450	$280
Average *(Range)*	**$210** *($79-$350)*	**$300** *($140-$450)*	**$150** *($31-$280)*
Note: Cost estimates reflect a seven percent discount rate.			

4.5.5 Avoided Costs by Requirement

Exhibit 4-13 presents overall avoided remediation costs by requirement for the Selected Option. The exhibit shows the avoided costs for each requirement based on experts' responses to the effects of the individual requirements in the final UST regulation. Beneficial impacts are concentrated similarly to costs: the majority of avoided costs are captured by walkthrough inspections, overfill prevention equipment tests, spill bucket tightness tests, containment sump tests, and operability tests.[116] Estimates in **Exhibit 4-13** assume that cost savings associated with each regulatory requirement occur one year after implementation and reflect discounting. Similar exhibits presenting overall avoided remediation costs by requirement for Alternative 1 and Alternative 2 are included in Appendix I.

The model used by EPA to estimate avoided remediation costs is not designed to measure avoided costs from large-scale releases such as those typically associated with UST systems with FCTs and AHFDSs. Releases from these types of systems constitute a small portion of total releases, but may be large in volume and can result in significant groundwater impacts. Our analysis does not estimate the benefits associated with changes in operation of these systems. However, we include a qualitative discussion of these acute events later in this chapter.

Exhibit 4-13

Total Discounted Avoided Costs By Requirement For Conventional UST Systems[a,b] ($ millions)
Selected Option

Description[c]	Expert 1	Expert 2	Expert 3	Expert 4	Average
Release Prevention					
Walkthrough inspections	$140	$44	$130	$270	$150
Overfill prevention equipment inspection	$23	$1.1	$19	$25	$17
Spill prevention equipment testing	$16	$7.3	$36	$21	$20
Containment sump testing	$9.3	$18	$1.0	$9.7	$9.4
Testing after repairs to spill and overfill prevention equipment, and secondary containment	$2.7	$11	$1.9	$7.9	$5.9
Eliminate flow restrictors in vent lines for all new tanks and when overfill prevention equipment is replaced	$2.2	$7.5	$0.85	$1.5	$3.0
Subtotal - Release Prevention	**$190**	**$89**	**$190**	**$330**	**$200**
Release Detection					
Operability tests for release detection methods	$130	$13	$61	$170	$92
Groundwater monitoring site assessment[d]	$0.00	$0.00	$0.00	$0.00	$0.00
Vapor monitoring site assessment[d]	$0.00	$0.00	$0.00	$0.00	$0.00
Add SIR and CITLDS usage[e]	$0.21	$0.00	$0.94	$0.56	$0.43

[116] Some requirements, particularly those that target narrow subpopulations of the UST system universe, may generate higher avoided costs than this analysis suggests. Three sources of uncertainty drive these smaller universe results. First, EPA's model is calibrated to estimate avoided costs for broad-based national changes at average facilities; extrapolation of these results to small populations may not reflect specific subpopulations (e.g., UST systems in Indian country). Second, several experts stated that their estimates of impacts for requirements affecting narrow subsets of UST populations are more uncertain than broader estimates. Finally, experts emphasized that equipment replacement, inspection, training, and testing are all essential to ensure release reductions, and they used judgment to emphasize the different roles of these different activities. Therefore, the assignment of specific impacts to each of the requirements is potentially less accurate than the aggregate estimates of avoided impacts.

Exhibit 4-13

Total Discounted Avoided Costs By Requirement For Conventional UST Systems [a,b] ($ millions)
Selected Option

Response to interstitial monitoring alarms	$0.80	$10	$0.21	$0.78	$2.9
Remove release detection deferral for EGTs	$0.68	$2.2	$7.6	$5.9	$4.1
Subtotal - Release Detection	**$130**	**$25**	**$70**	**$170**	**$99**
Other					
Notification of ownership changes[f]	$0.00	$0.00	$0.00	$0.00	$0.00
Replacement of lined tanks that cannot be repaired according to a code of practice[g]	$0.00	$0.00	$0.01	$0.00	$0.00
Requirements for demonstrating compatibility with fuels >E10 and >B20[h]	$0.00	$0.11	$0.00	$0.12	$0.06
Subtotal – Other	**$0.00**	**$0.11**	**$0.01**	**$0.12**	**$0.06**
EPAct-related Provisions					
Operator Training	$1.0	$0.04	$0.60	$1.5	$0.80
Secondary containment	$1.0	$0.66	$7.6	$2.4	$2.9
Subtotal - EPAct-related Provisions	**$2.1**	**$0.69**	**$8.2**	**$3.9**	**$3.7**
TOTAL	**$330**	**$110**	**$260**	**$510**	**$300**

[a] Cost estimates were derived using a seven percent discount rate.
[b] Reductions in frequency and release severity (as measured by changes in groundwater contamination) do not adequately capture the positive impacts of preventing releases from very large systems such as AHFDSs and UST systems with FCTs. Releases from these types of systems constitute a small portion of total releases, but may be large in volume and can result in significant groundwater impacts. Especially in the case of AHFDSs, even minor problems can create large releases due to the significant pressure under which contents are stored. The model used by EPA to estimate avoided remediation costs is not designed to measure avoided costs from very large releases such as those typically associated with AHFDSs and FCTs, and we therefore do not offer an estimate of avoided costs for requirements that apply to these systems.
[c] Some requirements, particularly those that target narrow subpopulations of the UST system universe, may generate higher avoided costs than this analysis suggests. Three sources of uncertainty drive these smaller universe results: First, EPA's model is calibrated to estimate avoided costs for broad-based national changes at average facilities; extrapolation of these results to small populations may not reflect specific subpopulations (e.g., UST systems in Indian country). Second, several experts stated that their estimates of impacts for requirements affecting narrow subsets of UST populations are more uncertain than broader estimates. Finally, experts emphasized that equipment replacement, inspection, training, and testing are all essential to ensure release reductions, and they used judgment to emphasize the different roles of these different activities. Therefore, the assignment of specific impacts to each of the requirements is potentially less accurate than the aggregate estimates of avoided impacts.
[d] Experts 1, 2, and 3 attributed reductions to the groundwater and vapor monitoring site assessment requirements; however, these experts also noted that they assumed the requirements would lead users to switch to another leak detection method. Because EPA does not assume that users will necessarily switch methods, we conservatively removed the experts' assumed reductions for this requirement. Expert 4 did not attribute reductions to these requirements.
[e] Expert 2 assumed negligible effect of the requirement to add SIR and CITLDS usage on release frequency and severity.
[f] All experts assumed no effect, or in the case of Expert 3, a negligible effect, of the requirement for notification of ownership changes on reductions in release frequency or severity.
[g] Although all experts attributed some reduction in release frequency or severity to this requirement, the number of tanks that cannot be repaired according to a code of practice is assumed to be so small that estimated benefits are negligible.
[h] Experts 1 and 3 attributed reductions to the compatibility requirement but noted that the majority of the benefit should be attributed to E10 users, which are not included in this requirement. As a result, we conservatively removed these experts' assumed reductions for this requirement.

As noted in **Exhibit 4-1**, EPA excluded the highest state-level remediation cost values from its calculation of average cost of release remediation. While this step contributes toward a conservative (low) estimate of avoided costs, the possibility remains that the average remediation costs used in **Exhibit 4-13** overestimate the positive impacts of the final UST regulation if state data provided are not representative of national average remediation costs. In **Exhibit 4-14**, we therefore estimate the positive effects of the final UST regulation using only the lowest remediation costs available.[117] As shown in **Exhibit 4-14,** EPA's estimate of the avoided remediation costs of the final UST regulation using the lowest state cost estimates is $73 million to $330 million per year under the Selected Option. While this is not a true "lower bound" estimate, these estimates reflect costs that lead to lower than average costs when compared to figures reported by ASTSWMO.[118] Similar exhibits presenting overall avoided remediation costs by requirement for Alternative 1 and Alternative 2 are included in Appendix I.

Exhibit 4-14

Sensitivity Analysis: Total Discounted Avoided Costs By Requirement Based On New Hampshire Remediation Costs[a,b] ($ millions)
Selected Option

Description[c]	Expert 1	Expert 2	Expert 3	Expert 4	Average
Release Prevention					
Walkthrough inspections	$86	$27	$81	$170	$92
Overfill prevention equipment inspection	$15	$0.74	$13	$16	$11
Spill prevention equipment testing	$11	$5.0	$24	$14	$14
Containment sump testing	$6.1	$13	$0.68	$6.5	$6.5
Testing after repairs to spill and overfill prevention equipment, and secondary containment	$1.7	$6.9	$1.2	$5.1	$3.7
Eliminate flow restrictors in vent lines for all new tanks and when overfill prevention equipment is replaced	$1.3	$5.1	$0.57	$0.97	$2.0
Subtotal - Release Prevention	**$120**	**$58**	**$120**	**$220**	**$130**
Release Detection					
Operability tests for release detection methods	$77	$7.3	$38	$100	$56
Groundwater monitoring site assessment[d]	$0.00	$0.00	$0.00	$0.00	$0.00
Vapor monitoring site assessment[d]	$0.00	$0.00	$0.00	$0.00	$0.00
Add SIR and CITLDS usage[e]	$0.13	$0.00	$0.58	$0.36	$0.27
Response to interstitial monitoring alarms	$0.49	$6.2	$0.13	$0.50	$1.8
Remove release detection deferral for EGTs	$0.42	$1.2	$4.7	$3.6	$2.5
Subtotal - Release Detection	**$78**	**$15**	**$43**	**$110**	**$61**
Other					
Notification of ownership changes[f]	$0.00	$0.00	$0.00	$0.00	$0.00

[117] These were provided by the State of New Hampshire's UST program.

[118] If we calculate a weighted-average cost per release where sources are weighted proportionally by their contribution to total releases using the lowest remediation cost data available (i.e., from New Hampshire), we obtain an overall average cost per release of approximately $103,000 (See Appendix I for details). Under the alternative baseline, total avoided costs based on New Hampshire remediation costs range from $51 million to $230 million in the Selected Option. This represents an extreme lower bound analysis of avoided remediation costs.

Additionally, we consider whether the remediation costs used in this analysis is are consistent with those reported by ASTSWMO. As noted above, ASTSWMO estimates the annual average remediation cost per site to be roughly $124,000 in 2012. If we value the releases and groundwater incidents avoided under each option using the ASTSWMO average site remediation cost, we obtain total avoided costs that are consistent with the primary estimates used in this analysis. Specifically, avoided remediation costs are approximately $96 million to $450 million under the Selected Option, $140 million to $520 million under Alternative 1, and $32 million to $340 million under Alternative 2. However, ASTSWMO's average site remediation value may understate typical remediation costs because co-pays, deductibles, and other costs not paid by state funds are excluded.

Exhibit 4-14

Sensitivity Analysis: Total Discounted Avoided Costs By Requirement Based On New Hampshire Remediation Costs[a,b] ($ millions)

Selected Option

Replacement of lined tanks that cannot be repaired according to a code of practice[g]	$0.00	$0.00	$0.00	$0.00	$0.00
Requirements for demonstrating compatibility with fuels >E10 and >B20[h]	$0.00	$0.07	$0.00	$0.08	$0.04
Subtotal – Other	**$0.00**	**$0.07**	**$0.00**	**$0.08**	**$0.04**
EPAct-related Provisions					
Operator Training	$0.66	$0.02	$0.38	$1.0	$0.52
Secondary containment	$0.67	$0.44	$4.8	$1.5	$1.9
Subtotal - EPAct-related Provisions	**$1.3**	**$0.46**	**$5.2**	**$2.5**	**$2.4**
TOTAL	**$200**	**$73**	**$170**	**$330**	**$190**

[a] Cost estimates were derived using a seven percent discount rate.

[b] Reductions in frequency and release severity (as measured by changes in groundwater contamination) do not adequately capture the positive impacts of preventing releases from very large systems such as AHFDSs and UST systems with FCTs. Releases from these types of systems constitute a small portion of total releases, but may be large in volume and can result in significant groundwater impacts. Especially in the case of AHFDSs, even minor problems can create large releases due to the significant pressure under which contents are stored. The model used by EPA to estimate avoided remediation costs is not designed to measure avoided costs from very large releases such as those typically associated with AHFDSs and FCTs, and we therefore do not offer an estimate of avoided costs for requirements that apply to these systems.

[c] Some requirements, particularly those that target narrow subpopulations of the UST system universe, may generate higher avoided costs than this analysis suggests. Three sources of uncertainty drive these smaller universe results: First, EPA's model is calibrated to estimate avoided costs for broad-based national changes at average facilities; extrapolation of these results to small populations may not reflect specific subpopulations (e.g., UST systems in Indian country). Second, several experts stated that their estimates of impacts for requirements affecting narrow subsets of UST populations are more uncertain than broader estimates. Finally, experts emphasized that equipment replacement, inspection, training, and testing are all essential to ensure release reductions, and they used judgment to emphasize the different roles of these different activities. Therefore, the assignment of specific impacts to each of the requirements is potentially less accurate than the aggregate estimates of avoided impacts.

[d] Experts 1, 2, and 3 attributed reductions to the groundwater and vapor monitoring site assessment requirements; however, these experts also noted that they assumed the requirements would lead users to switch to another leak detection method. Because EPA does not assume that users will necessarily switch methods, we conservatively removed the experts' assumed reductions for this requirement. Expert 4 did not attribute reductions to these requirements.

[e] Expert 2 assumed negligible effect of the requirement to add SIR and CITLDS usage on release frequency and severity.

[f] All experts assumed no effect, or in the case of Expert 3, a negligible effect, of the requirement for notification of ownership changes on reductions in release frequency or severity.

[g] Although all experts attributed some reduction in release frequency or severity to this requirement, the number of tanks that cannot be repaired according to a code of practice is assumed to be so small that estimated benefits are negligible.

[h] Experts 1 and 3 attributed reductions to the compatibility requirement but noted that the majority of the benefit should be attributed to E10 users, which are not included in this requirement. As a result, we conservatively removed these experts' assumed reductions for this requirement.

4.6 Avoided Vapor Intrusion Damages

Vapor intrusion generally occurs when petroleum or highly-dissolved concentrations of free product come into direct contact with building sumps and foundations, elevator shafts, and preferential pathways (e.g. improperly sealed utility lines). Intrusion can also occur when these substances come close to building foundations.[119] The cost to remediate vapor intrusion is typically incremental to the cost to remediate a LUST site. Based on information provided by four states, EPA estimates that, on average, 5.5 percent of all releases cause vapor intrusion

[119] Davis, Robin V. "Petroleum Hydrocarbon Vapor Intrusion Investigations: Current General Practice." Leaking Underground Storage Tanks, Utah Department of Environmental Quality, February 9, 2010. Accessed at: http://www.epa.gov/oust/pviwebinar_approach.pdf.

issues. Each of these instances requires additional remedial actions valued at approximately $42,000 beyond ordinary release remediation costs.[120] As reported in **Exhibit 4-15**, given 770 to 3,600 avoided releases and mitigated groundwater incidents, we estimate between 42 and 200 avoided vapor intrusion incidents under the Selected Option. This reduction would avoid between $1.7 million and $7.9 million per year in avoided remediation costs related to vapor intrusion. Under Alternative 1, this range increases to $2.5 million to $9.1 million, and under Alternative 2, this range decreases to $0.6 million to $6.0 million per year.

Exhibit 4-15

Avoided Vapor Intrusion Costs ($ millions)

	Expert 1	**Expert 2**	**Expert 3**	**Expert 4**	**Average** *(Range)*
Selected Option					
Total avoided releases and avoided groundwater incidents	2,000	770	1,900	3,600	2,100 *(770-3,600)*
Avoided vapor intrusion incidents	110	42	100	200	110 *(42-200)*
Avoided vapor intrusion costs	$4.3	$1.7	$4.1	$7.9	$4.5 *($1.7-$7.9)*
Alternative 1					
Total avoided releases and avoided groundwater incidents	2,700	1,100	2,700	4,200	2,700 *(1,100-4,200)*
Avoided vapor intrusion incidents	150	63	150	230	150 *(63-230)*
Avoided vapor intrusion costs	$5.9	$2.5	$5.9	$9.1	$5.9 *($2.5-$9.1)*
Alternative 2					
Total avoided releases and avoided groundwater incidents	1,200	260	1,500	2,800	1,400 *(260-2,800)*
Avoided vapor intrusion incidents	66	14	82	150	78 *(14-150)*
Avoided vapor intrusion costs	$2.6	$0.6	$3.2	$6.0	$3.1 *($0.6-$6.0)*

Under the alternative baseline, avoided vapor intrusion costs fall due to the smaller universe of releases. In the Selected Option, avoided costs are $1.2 million to $5.5 million. Under Alternative 1, avoided costs range from $1.7 million to $6.3 million; under Alternative 2, they range between $0.4 million and $4.1 million.

4.7 Avoided Product Loss

Releases into the environment cause operators to lose otherwise marketable fuel products. **Exhibit 4-16** presents costs avoided due to product loss. The analysis calculates the product loss associated with avoided releases by multiplying the average volume associated with each release source by the number of releases of that type before and after the final UST regulation is in effect. Based on the estimates of avoided releases presented by the experts, the draft 23-state Autopsy Report's distribution of releases, and average release volumes reported in the Florida

[120] New Hampshire, Utah, South Carolina, Virginia, and New Mexico were contacted for LUST remediation costs, but only New Hampshire was able to provide a cost for cleanup actions related to vapor intrusion. Other state programs contributed data to the frequency of incidents, but not to costs.

study, EPA estimates that approximately 0.25 million gallons to 1.9 million gallons per year of diesel and gasoline releases are avoided as a consequence of the Selected Option. At an average price of $3.73 per gallon, owners and operators avoid losing approximately $0.9 million to $6.5 million in product due to releases.[121] These values range from 0.22 million gallons to 2.2 million gallons, or $0.8 million to $7.6 million, under Alternative 1. Under Alternative 2, these values decrease to a range of 0.10 million gallons to 1.5 million gallons, or $0.4 million to $5.2 million. Limited data on release size do not support an analysis of avoided product loss associated with releases that are reduced in severity. This estimate of avoided product loss there understates total likely avoided product losses.

Exhibit 4-16

Value Of Avoided Product Loss

Expert	**Selected Option**		**Alternative 1**		**Alternative 2**	
	Thousand gallons	**$ millions**	**Thousand gallons**	**$ millions**	**Thousand gallons**	**$ millions**
Expert 1	650	$2.3	750	$2.6	440	$1.5
Expert 2	250	$0.9	220	$0.8	100	$0.4
Expert 3	830	$2.9	1,200	$4.1	710	$2.5
Expert 4	1,900	$6.5	2,200	$7.6	1,500	$5.2
Average *(Range)*	**900** *(250-1,900)*	**$3.1** *($0.9-$6.5)*	**1,100** *(220-2,200)*	**$3.8** *($0.8-$7.6)*	**690** *(100-1,500)*	**$2.4** *($0.4-$5.2)*

Releases are valued using an average price of motor fuel in 2012. Prices per gallon for all grades of retail motor gasoline and No. 2 diesel fuel (all concentrations of sulfur) were $3.63 and $3.97, respectively, as reported by: U.S. Bureau of Transportation Statistics. "Sales Price of Transportation Fuel to End-Users." National Transportation Statistics 2013. Table 3-11. Accessed at: http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/NTS_Entire_0.pdf. We weight these prices according to prime supplier sales volumes in 2012 published by the Energy Information Administration, which summed to 347,234.5 thousands of gallons per day for gasoline and 143,270.6 thousands of gallons per day for all grades of diesel fuel (U.S. Energy Information Administration. Petroleum & Other Liquids. Prime Supplier Sales Volumes. Accessed at: http://www.eia.gov/dnav/pet/pet_cons_prim_dcu_nus_a.htm.).

Under the alternative baseline, avoided costs due to product loss are lower than in the original baseline as there are relatively fewer releases. Under the Selected Option, avoided costs due to product loss are $0.6 million to $4.5 million. Under Alternative 1, avoided costs range from $0.5 million to $5.2 million; under Alternative 2, they range from $0.3 million to $3.6 million.

4.8 Human Health Benefits

Exposure to petroleum through ingestion, dermal contact, and inhalation can cause a range of health effects, including cancer and non-cancer impacts associated with benzene, and non-cancer impacts (e.g., neurological impacts) associated with other petroleum constituents

[121] Releases are valued using an average price of motor fuel in 2012. Prices per gallon for all grades of retail motor gasoline and No. 2 diesel fuel (all concentrations of sulfur) were $3.63 and $3.97, respectively, as reported by: U.S. Bureau of Transportation Statistics. "Sales Price of Transportation Fuel to End-Users." National Transportation Statistics 2013. Table 3-11. Accessed at: http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/NTS_Entire_0.pdf. We weight these prices according to prime supplier sales volumes in 2012 published by the Energy Information Administration, which summed to 347,234.5 thousands of gallons per day for gasoline and 143,270.6 thousands of gallons per day for all grades of diesel fuel (U.S. Energy Information Administration. Petroleum & Other Liquids. Prime Supplier Sales Volumes. Accessed at: http://www.eia.gov/dnav/pet/pet_cons_prim_dcu_nus_a.htm.).

such as toluene.[122] In addition, exposure to jet fuel, such as that stored in AHFDSs and FCTs at commercial and military airports, can result in non-cancer impacts to skin, nervous, and respiratory systems.[123] The types of health risks that may be avoided by the final UST regulation are described in more detail below.

The complex nature of petroleum mixtures and the limited toxicological data available both for petroleum mixtures and for individual component compounds of petroleum limits EPA's ability to comprehensively document the health effects associated with the most significant releases. However, the toxicological testing that has been conducted on some common components of total petroleum hydrocarbons (TPH) suggests that exposures to TPH through inhalation or ingestion of gasoline or diesel could result in the following effects:

- Neurological effects, such as central nervous system depression, have been associated with acute and chronic exposures to toluene and xylenes; n-hexane exposure has been associated with effects on peripheral neuropathy;
- Hematological effects associated with oral and inhalation exposure to benzene and with oral and inhalation exposure to naphthalene;
- Renal and hepatic effects associated with BTEX compounds and other aromatic hydrocarbon compounds;
- Developmental effects associated with intermediate exposures to ethylbenzene and xylenes; and
- Carcinogenic effects of oral exposures to certain polycyclic aromatic hydrocarbons (PAHs) including benzo(a)pyrene, benz(a)anthracene, and dibenz(a,h)anthracene.[124]

Health risks may also be associated with exposure to kerosene, which may be stored in USTs or used as a component in jet fuel. Although risks associated with kerosene have not been studied as widely as those associated with petroleum, existing data suggest that these risks primarily include non-cancer impacts to the skin, nervous, and respiratory systems.[125] In the baseline, some of these risks may be reduced due to existing monitoring standards under the

[122] For example, see: Paustenbach, D J, et. al. "Benzene toxicity and risk assessment, 1972-1992: implications for future regulation." *Environ Health Perspect*, December 1993, 101(Suppl 6):177–200.

[123] U.S. Department of Labor Occupational Safety and Health Administration. "Safety and Health Topics: Jet Fuel (JP8)." Accessed at: http://www.osha.gov/dts/chemicalsampling/data/CH_248748.html.

[124] U.S. Department of Health and Human Services. Public Health Service. Agency for Toxic Substances and Disease Registry. "Toxicological Profile for Polycyclic Aromatic Hydrocarbons." August 1995.

[125] See, for example: U.S. Department of Labor Occupational Safety and Health Administration. "Safety and Health Topics: Jet Fuel (JP8)." Accessed at: http://www.osha.gov/dts/chemicalsampling/data/CH_248748.html; and U.S. Department of Health and Human Services. Public Health Service. Agency for Toxic Substances and Disease Registry. "Toxic Substances Portal – Jet Fuels JP-5 and JP-8." Accessed at: http://www.atsdr.cdc.gov/phs/phs.asp?id=771&tid=150.

Occupational Safety and Health Administration (OSHA).[126] However, because the final UST regulation includes new requirements for AHFDSs and UST systems with FCTs located at commercial and military airports, avoidance of health risks from kerosene could represent an additional benefit of the final UST regulation.

The magnitude of health benefits associated with avoiding exposure to petroleum and jet fuel components depends on multiple factors. These factors include the number of cancer cases and non-cancer impacts per average UST release, which in turn depends on the number of groundwater users surrounding UST sites; the number of releases prevented through implementation of the final UST regulation; and the willingness-to-pay to avoid a fatal cancer (e.g., the value of a statistical life) or willingness-to-pay to avoid non-cancer impacts. In addition, assumptions about baseline behaviors, such as the assumption that individuals will limit their own exposure in certain cases (e.g., when petroleum contamination exceeds a "taste/odor threshold" and water is no longer palatable), affect the estimated magnitude of health benefits. Based on available information on average plume volumes and ages and the distribution of groundwater users, these benefits are expected to be small.[127] Nevertheless, some larger releases may have significant cancer and non-cancer risks associated with them. Although these health effects are not able to be reliably quantified with available data, they represent additional potential benefits of the regulation.

4.9 Avoided Acute Exposure Events and Large-Scale Releases

Most health effects associated with leaking underground storage tanks reflect long-term exposures, but some releases from UST systems relate to acute events such as fire or explosion. These releases can involve acute exposures, large volumes of free product, extensive ecological damage, and injuries and death, depending on the circumstances of the event. Because these events are both infrequent and difficult to predict, it is not possible to quantify or monetize the impact associated with avoiding them, but the response, remediation, and medical costs associated with a single acute incident could be significant. The final UST regulation is designed to ensure effective maintenance of UST systems, and one benefit will be to reduce the chances of an acute event that could result in a large-scale release and its associated damages (e.g., a well-maintained UST system is less likely to be in a condition where it may explode).

Acute events are especially important in the case of UST systems such as AHFDSs and UST systems with FCTs, which can hold large volumes of fuel. Releases from these systems can result in extensive groundwater and other environmental and health impacts. For instance, an estimated 300,000 to 500,000 gallons of fuel was released from a 2.1 million gallon underground field-constructed tank at a fuel depot in Portsmouth, VA that was in operation from the 1950s to

[126] U.S. Department of Labor Occupational Safety and Health Administration. "Safety and Health Topics: Jet Fuel (JP8)." Accessed at: http://www.osha.gov/dts/chemicalsampling/data/CH_248748.html.

[127] U.S. Environmental Protection Agency, Office of Underground Storage Tanks. "Petroleum Releases at Underground Storage Tank Facilities in Florida." March 2005. See also: RTI International. "Risk Analysis to Support Potential Revisions to Underground Storage Tank (UST) Regulations." December 22, 2010.

mid-1980s. Free product was found within 20 feet of a nearby creek in 1987. As of 2011, approximately 143,000 gallons of product had been recovered.[128]

In addition, the final UST regulation may large-scale releases associated with AHFDSs and FCTs. An example of the potential magnitude of the releases from these systems is the pattern of releases at Pease Air Force Base, where jet fuel was delivered to the runway apron via an underground fueling system.[129] Historical leakage from the system contaminated soil and groundwater, forming groundwater plumes at many sites along the system.[130] A site release study identified 60 to 70 release points with varying degrees of severity along the refueling system line with free product found under the apron at closure.[131] While there are no historical records available indicating the amount of leaked fuel or leak origins, the presence of residual soil and groundwater contamination poses a significant threat to human health and the environment.

While the analytical procedure used by EPA to estimate monetized benefits was unable to capture the positive impacts of preventing releases from these types of systems, we note that preventing or mitigating these releases may generate substantial reductions in remediation costs and public exposure.

4.10 Ecological Benefits

A document prepared for EPA outlines the types of ecological damages that can result from land-based pollution releases:[132]

> Measurable damage to ecological resources from land releases generally occurs when groundwater or overland flow of water carry contaminants to a nearby surface water body. Flood events and other acute incidents can cause releases of waste that have an immediate and significant effect on ecological resources (e.g., a surface impoundment dike fails and releases contaminants into a river, killing fish and other biota). More common are gradual increases in contaminant levels due to long-term releases to groundwater. These may have a broad array of impacts on both resources used by humans (such as fish populations) and on "non-use value" such as the value of preserving habitat and species diversity. In addition, biota can be affected by uptake of contaminants from soil, particularly in wetlands or areas where the water table is high.

Because releases from USTs typically reach soil before reaching groundwater, such releases would likely be classified as land releases. Any releases avoided due to the final UST regulation

[128] Phone conversation and email from Lynne Smith, geologist, and Russ Ellison, Virginia Department of Environmental Quality.

[129] New Hampshire Department of Environmental Services, Air Resources Division. 2007. Permit Application Review Summary, Former Pease AFB Remediation Project, FY04-0453. 10 March 2010. Accessed at: http://www2.des.state.nh.us/OneStopPub/Air/3301590780FY04-0453TypeSummary.pdf.

[130] New Hampshire Department of Environmental Services, Air Resources Division. 2009. Permit Application Review Summary, Former Pease AFB Remediation Project, 09-0113. 10 March 2010. Accessed at: http://www2.des.state.nh.us/OneStopPub/Air/330159094909-0113TypeSummary.pdf.

[131] Hilton, Scott. Site Summaries Pease Air Force Base Newington/Portsmouth. 2008. New Hampshire Department of Environmental Services. 10 March 2010. Accessed at: http://des.nh.gov/organization/divisions/waste/hwrb/fss/superfund/summaries/pease.htm.

[132] Industrial Economics, Inc. "Approaches to Assessing the Benefits, Costs, and Impacts of the RCRA Subtitle C Program." October 2000. Accessed at: http://www.epa.gov/oswer/docs/rcradocs/rcra.pdf. p. 3-17

may result in ecological benefits. A complete assessment of ecological benefits, however, requires significant location-specific data, and it is often difficult to identify sufficient data to support valuation of both use and non-use values of preserving habitat and species diversity.

The ecological benefits that accrue from the final UST regulation are likely to occur as a consequence of averted groundwater contamination. The resource economics literature contains numerous examples of studies that value these services, as demonstrated by the public's willing-to-pay (WTP) for groundwater protection programs (e.g., see Poe et al. 2001).[133] However, these values are largely context-specific in terms of location, scale, and the specific threat to groundwater considered and do not provide broadly-applicable information on the value of groundwater.

Some attempts have been made to develop standardized values for groundwater, often for purposes of Natural Resource Damage Assessment (NRDA).[134] For instance, the State of New Jersey currently employs a replacement cost approach to determine interim economic losses associated with injuries to groundwater.[135] Even so, replacement cost methods do not constitute a proper WTP valuation. The replacement costs of natural resources and their services capture WTP only when they meet three criteria: 1) replacement provides equivalent quality and quantity of services; 2) the public is actually willing to pay for the replacement; and 3) replacement is the most cost-effective means of restoring the lost services.[136] Even if these conditions are true, this approach may overestimate groundwater values in urban areas, as land is typically more expensive, and underestimate groundwater values in areas where land is less expensive.

Because an assessment of the value of groundwater protected by the final UST regulation is affected by spatial heterogeneity, it requires information about the public's WTP for protection in all states and territories. These data are not available, and EPA is therefore unable to place a value on the groundwater protected. Instead, we provide an estimate below of the total quantity of groundwater that may be protected by the regulation. We note, though, that a portion of the value of restoring groundwater is captured as part of the cost to remediate each release discussed earlier in this chapter. However, while the cost of restoring groundwater to a higher quality after

[133] Poe, Gregory L., K.J. Boyle, and J.C. Bergstrom. "A Preliminary Meta Analysis of Contingent Values for Ground Water Revisited." In *The Economic Value of Water Quality*, edited by Bergstrom, J.C., K.J. Boyle and G.L. Poe, Cheltenham, United Kingdom: Edward Elgar Publishing Limited. 2001.

[134] Natural Resource Damage Assessment (NRDA) is the process of estimating the monetary cost of restoring natural resources injured by discharges of oil or releases of hazardous substances. Monetary costs, or damages, are estimated by identifying the services provided by the injured natural resources, determining the baseline level of the services provided by the resources, and quantifying the reduction in services that result from the natural resource injury. See: U.S. Environmental Protection Agency. Natural Resource Damage Assessment. Accessed at: www.epa.gov/ superfund/ programs/nrd/nrda2.htm.

[135] New Jersey's approach follows three steps. First, the approach determines the total present value of potential yield from the contaminated area over the relevant period of impairment, typically based on a site-specific or regional recharge rate for the area in question. Second, again considering regional recharge rates, it estimates the amount of land required to protect an equivalent present value total volume of groundwater. Finally, the approach identifies and appraises candidate parcels. The cost of acquiring such a parcel for purposes of protecting a volume of groundwater equivalent to what was lost represents the measure of damages.

[136] Freeman, A.M. III. *The Measurement of Environmental and Resource Values: Theory and Methods*. Resources for the Future: Washington, DC. 2003. p. 460.

contamination is captured as part of the cost to remediate each release, it cannot be assumed that remediation captures WTP. In many cases, performing remediation to "safe" levels does not fully eliminate contamination, and therefore does not restore the resource to its original value. Therefore, while a significant portion of the value of the quantity of groundwater protected may be captured by the avoided remediation costs, it may not reflect the full WTP of groundwater protection.

Exhibit 4-17 summarizes a screening assessment of the volume of groundwater contamination potentially avoided because of reductions in releases and groundwater contamination incidents. The analysis relies on the EPA risk assessment, which describes typical volumes of groundwater affected by releases of different sizes over various discovery time frames.[137] EPA's analysis estimates that, under the Selected Option, 19 billion gallons to 88 billion gallons of groundwater per year are protected under conservative assumptions of 10-gallon release volumes that migrate for only one year before discovery. Under the upper bound conditions of 5,000-gallon release volumes and 100-year lifetimes, up to 3.9 trillion gallons of groundwater per year would be potentially protected by the Selected Option.[138] We also calculate the impact of 50-gallon releases over one- and five-year time frames. These releases appear most consistent with empirical data in the draft 23-state Autopsy Report. Assuming that 50-gallon releases and one- to five-year time frames represent the average parameters of avoided releases, we estimate that approximately 50 to 240 billion gallons of groundwater would be protected annually from LUST-related releases due to the regulatory changes.[139]

[137] RTI International. "Risk Analysis to Support Potential Revisions to Underground Storage Tank (UST) Regulations." December 22, 2010.

[138] The risk assessment on which this analysis is based did not estimate groundwater contamination volumes outside of a one-mile radius about the point of release. The assessment notes that groundwater may be contaminated outside that radius, but it does not estimate this quantity. Generally, only releases greater than 1,000 gallons are affected by this phenomenon, i.e., groundwater contamination is likely underestimated for the 5,000 gallon, 100-year release scenario.

[139] The release volume data used in the groundwater protection assessment differs from the data used to calculate product loss and may lead to apparent inconsistencies. For instance, under the Selected Option, prevention of 900,000 gallons of product loss over 1,600 releases implies an average of over 500 gallons per release; however, in the groundwater protection analysis, EPA relies on estimates of groundwater contaminated based on releases of 50 gallons for the following two reasons: (1) the volumes of product loss based on Florida data are based on actual data, while the risk analysis relies on a simulation; and (2) the simulation assumes that product is released over a relatively short period of time (approximately one month), which likely overstates the effect of groundwater contamination for any given volume. Given these circumstances, EPA selected an average release volume to characterize groundwater contamination that is significantly lower than the volume implied by the analysis of product loss, but which reduces the risk of overstating positive impacts from groundwater protection.

Exhibit 4-17

Volume Of Groundwater Protected (billion gallons per year)

	Expert 1	Expert 2	Expert 3	Expert 4	Average *(Range)*
Selected Option					
Total avoided releases and avoided groundwater incidents	2,000	770	1,900	3,600	2,100 *(770-3,600)*
1 year until discovery, 10 gal. release *(24,068,183 gal. GW contaminated)**	48	19	45	88	50 *(19-88)*
1 year until discovery, 50 gal. release *(48,785,436 gal. GW contaminated)**	97	38	92	180	100 *(38-180)*
5 years until discovery, 50 gal. release *(80,192,581 gal. GW contaminated)**	160	62	150	290	170 *(62-290)*
100 year until discovery, 5,000 gal. release *(1,056,971,192 gal. GW contaminated)**	2,100	820	2,000	3,900	2,200 *(820-3,900)*
Primary estimate (average of 50 gal. release over 1 and 5 years)	**130**	**50**	**120**	**240**	**130** *(50-240)*
Alternative 1					
Total avoided releases and avoided groundwater incidents	2,700	1,100	2,700	4,200	2,700 *(1,100-4,200)*
1 year until discovery, 10 gal. release *(24,068,183 gal. GW contaminated)**	66	28	66	100	65 *(28-100)*
1 year until discovery, 50 gal. release *(48,785,436 gal. GW contaminated)**	130	56	130	210	130 *(56-210)*
5 years until discovery, 50 gal. release *(80,192,581 gal. GW contaminated)**	220	92	220	340	220 *(92-340)*
100 year until discovery, 5,000 gal. release *(1,056,971,192 gal. GW contaminated)**	2,900	1,200	2,900	4,500	2,900 *(1,200-4,500)*
Primary estimate (average of 50 gal. release over 1 and 5 years)	**180**	**74**	**180**	**270**	**170** *(74-270)*
Alternative 2					
Total avoided releases and avoided groundwater incidents	1,200	260	1,500	2,800	1,400 *(260-2,800)*
1 year until discovery, 10 gal. release *(24,068,183 gal. GW contaminated)**	29	6	36	66	34 *(6-66)*
1 year until discovery, 50 gal. release *(48,785,436 gal. GW contaminated)**	59	13	73	130	70 *(13-130)*
5 years until discovery, 50 gal. release *(80,192,581 gal. GW contaminated)**	97	21	120	220	110 *(21-220)*
100 year until discovery, 5,000 gal. release *(1,056,971,192 gal. GW contaminated)**	1,300	270	1,600	2,900	1,500 *(270-2,900)*
Primary estimate (average of 50 gal. release over 1 and 5 years)	**78**	**17**	**96**	**180**	**92** *(17-180)*

* Release time to discovery and volume (*average groundwater volume contaminated*). Average groundwater volume contaminated per release based on: RTI International. "Risk Analysis to Support Potential Revisions to Underground Storage Tank (UST) Regulations." December 22, 2010.

Under the alternative baseline, assuming that 50 gallon releases and one- to five-year time frames represent the average parameters of avoided releases, approximately 34 to 160 billion gallons of groundwater would be protected annually under the Selected Option.

4.11 Measuring Benefits through Housing Price Changes

A growing body of literature documents the effect that leaking USTs may have on local housing prices. Under certain assumptions, these price changes may serve as a proxy for households' willingness-to-pay (WTP) to avoid UST releases. The impact of avoiding or reducing releases on housing prices will, at least in part, overlap with some of the benefits discussed above, including avoided human health risks, ecological benefits, and groundwater quality protection (to the extent that the effects are borne by the private households). However, other factors not previously discussed may also contribute to property devaluation (e.g., aesthetics) due to UST releases. By avoiding releases and groundwater contamination incidents, the final UST regulation may generate benefits that could at least partially be reflected by avoided declines in property values.

To estimate the effect of leaking USTs on housing prices, existing studies rely on hedonic property value models, and examine how house prices vary with proximity to a leaking UST, or how prices respond to a release should one occur. Under certain assumptions, the change in price can be interpreted as a measure of WTP to avoid potential contamination. Hedonic property value models isolate the effect of UST leaks on housing prices by controlling for housing and neighborhood characteristics as well as the presence of the UST facility itself. Several previous studies have found that property values were approximately 10 percent to 17 percent lower, all else constant, at homes in the vicinity of leaking or "high-risk" UST systems.[140] Stated-preference studies on the effect of groundwater contamination from a leaking UST on housing values have found similar results.[141]

Two recent hedonic analyses of UST sites in Maryland attempt to provide insight into the effects of leaking USTs at various stages of the cleanup process by using panel data of home sales in three Maryland counties over 11 years. This dataset includes information on home sales prior to the discovery of UST leaks, as well as during and after leak investigation and cleanup. One of these two studies incorporated home-specific data on the level of groundwater contamination and the extent to which information about the leak was received.[142] Although this study found little impact of leaking USTs on home values in general, the study did find 9 percent to 12 percent depreciation at homes where the private groundwater well was tested for contamination after an UST leak. This depreciation occurred regardless of whether the well water was found to be contaminated. The second study, which relied on the same sales dataset

[140] See, for example: Simons, Robert A., William Bowen, and Arthur Sementelli. "The Effect of Underground Storage Tanks on Residential Property Values in Cuyahoga County, Ohio." *Journal of Real Estate Research*, 1997, 14(1), 29-42; Simons, Robert A., William Bowen and Arthur Sementelli. "The Price and Liquidity Effects of UST Leaks from Gas Stations on Adjacent Contaminated Property." *The Appraisal Journal*, 1999, 67, 186-194; and Isakson, H. and M.D. Ecker. "The Effect of Leaking Underground Storage Tanks on the Values of Nearby Homes." Technical Report. Department of Mathematics. University of Northern Iowa. 2010. Accessed at: http://faculty.cns.uni.edu/~ecker/research.html.

[141] See: Guignet, Dennis. "The impacts of pollution and exposure pathways on home values: A stated preference analysis." *Ecological Economics*, 2012, 82, 53-6; Simons, Robert A. and Kimberly Winson-Geideman. 2005. "Determining Market Perceptions on Contamination of Residential Property Buyers Using Contingent Valuation Surveys," *Journal of Real Estate Research*, 27(2), 193-220.

[142] Guignet, Dennis. "What Do Property Values Really Tell Us? A Hedonic Study of Underground Storage Tanks." *Land Economics*, 2013, 89(2), 211-226.

but used information on publicity following the leak rather than the testing of private wells, also found little impact of leaking USTs on home values in general. However, this study found that highly publicized releases decreased surrounding home values by more than 10 percent.[143] Both studies found that property devaluation was most likely to occur when homeowners were aware of the actual or potential contamination.

As a result, we expect that in the presence of adequate information, such as with highly publicized UST releases, there is the potential for property devaluation from releases due to environmental, human health, and aesthetic changes. Studies that examine those price changes could provide valuable insight into the WTP for avoiding such releases. However, because of the small body of available literature characterizing the potential magnitude of these effects, its limited geographic scope, and the large degree of spatial heterogeneity in the characteristics that would drive the benefits of avoided releases, a benefits transfer to estimate avoided property devaluation from UST releases nationwide would not be appropriate. Therefore, we are unable to quantify the potential benefit of the final UST regulation using hedonic property value studies.

4.12 Conclusion

Exhibit 4-18 summarizes the monetized avoided costs and benefits due to the final UST regulation. In total, EPA estimates approximately $120 million to $530 million in costs will be avoided as a consequence of the Selected Option. Although their value cannot be reliably monetized, roughly 50 billion to 240 billion gallons of groundwater per year will avoid contamination due to new requirements. Finally, the regulation will avoid costs associated with acute events, large-scale releases (for example, releases from AHFDSs and FCTs), and property devaluation, and will generate reductions in human health risks and ecological benefits that we could not quantify in our analysis.

Exhibit 4-18

Summary Of Positive Impacts

SELECTED OPTION						
Type Of Impact	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Average**	**Range**
Monetized Avoided Costs Associated With Conventional USTs and EGTs ($ millions, present value 2012$)[a]						
Releases and groundwater incidents[b]	$330	$110	$260	$510	$300	$110 - $510
Vapor intrusion	$4.3	$1.7	$4.1	$7.9	$4.5	$1.7 - $7.9
Product loss	$2.3	$0.86	$2.9	$6.5	$3.1	$0.86 - $6.5
Total[c]	**$330**	**$120**	**$270**	**$530**	**$310**	**$120 - $530**
Non-Monetized Impacts[d]						
Groundwater protected (billion gallons)	130	50	120	240	130	50 - 240
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)[e]	n/e	n/e	n/e	n/e	n/e	n/e
Ecological benefits[e]	n/e	n/e	n/e	n/e	n/e	n/e
Human health risks[e]	n/e	n/e	n/e	n/e	n/e	n/e

[143] Zabel, Jeffrey E. and Dennis Guignet. "A hedonic analysis of the impact of LUST sites on house prices." *Resource and Energy Economics*, 2012, 34, 549-564.

Exhibit 4-18

Summary Of Positive Impacts

ALTERNATIVE 1						
Type Of Impact	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Average**	**Range**
Monetized Avoided Costs Associated With Conventional USTs and EGTs ($ millions, present value 2012$)[a]						
Releases and groundwater incidents[b]	$490	$200	$410	$650	$440	$200 - $650
Vapor intrusion - low assumptions	$5.9	$2.5	$5.9	$9.1	$5.9	$2.5 - $9.1
Product loss	$2.6	$0.78	$4.1	$7.6	$3.8	$0.78 - $7.6
Total[c]	**$500**	**$210**	**$420**	**$670**	**$450**	**$210 - $670**
Non-Monetized Impacts[d]						
Groundwater protected (billion gallons)	180	74	180	270	170	74 - 270
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)[e]	n/e	n/e	n/e	n/e	n/e	n/e
Ecological benefits[e]	n/e	n/e	n/e	n/e	n/e	n/e
Human health risks[e]	n/e	n/e	n/e	n/e	n/e	n/e
ALTERNATIVE 2						
Type Of Impact	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Average**	**Range**
Monetized Avoided Costs Associated With Conventional USTs and EGTs ($ millions, present value 2012$)[a]						
Releases and groundwater incidents[b]	$210	$44	$220	$410	$220	$44 - $410
Vapor intrusion - low assumptions	$2.6	$0.56	$3.2	$6.0	$3.1	$0.56 - $6.0
Product loss	$1.5	$0.36	$2.5	$5.2	$2.4	$0.36 - $5.2
Total[c]	**$220**	**$45**	**$220**	**$420**	**$230**	**$45 - $420**
Non-Monetized Impacts[d]						
Groundwater protected (billion gallons)	78	17	96	180	92	17 - 180
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)[e]	n/e	n/e	n/e	n/e	n/e	n/e
Ecological benefits[e]	n/e	n/e	n/e	n/e	n/e	n/e
Human health risks[e]	n/e	n/e	n/e	n/e	n/e	n/e

[a] Avoided remediation costs from releases and groundwater incidents are the costs related to site remediation. Avoided vapor intrusion costs include additional avoided costs associated with the remediation of vapor intrusion cases; the RIA does not address human health risk associated with vapor intrusion. Avoided product loss costs are also separate and additive.
[b] Expert 2 provided responses that generate benefits that are relatively low compared to estimated costs, unlike the other three experts. Conversations with this expert indicated that this discrepancy may be due to his assumptions about partial noncompliance. See Section 4.5.3 and Appendix H for additional discussion.
[c] Totals may not add up due to rounding. Cost estimates were derived using a seven percent discount rate.
[d] Due to data and resource constraints, EPA was unable to monetize some of the positive impacts of the final UST regulation. Chapter 4 provides a qualitative discussion of these benefits.
[e] Benefits not estimated are denoted by n/e.

4.12.1 Summary of Positive Impacts under the Alternative Baseline Scenario

Exhibit 4-19 summarizes the monetized avoided costs and benefits due to the final UST regulation under the alternative baseline. In total, EPA estimates approximately $81 million to $360 million in costs will be avoided as a consequence of the Selected Option under the alternative baseline. Approximately 34 billion to 160 billion gallons of groundwater per year will avoid contamination due to the proposed requirements in the Selected Option. Overall, positive impacts under the alternative baseline are roughly 69 percent of positive impacts when the original baseline is assumed.

Exhibit 4-19

Summary Of Positive Impacts Under Alternative Baseline

SELECTED OPTION						
Type Of Impact	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Average**	**Range**
Monetized Avoided Costs Associated With Conventional USTs and EGTs ($ millions, present value 2012$) [a]						
Releases and groundwater incidents[b]	$230	$79	$180	$350	$210	$79 - $350
Vapor intrusion	$3.0	$1.2	$2.8	$5.5	$3.1	$1.2 - $5.5
Product loss	$1.6	$0.59	$2.0	$4.5	$2.2	$0.59 - $4.5
Total[c]	**$230**	**$81**	**$190**	**$360**	**$220**	**$81 - $360**
Non-Monetized Impacts[d]						
Groundwater protected (billion gallons)	89	34	84	160	92	34 - 160
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)[e]	n/e	n/e	n/e	n/e	n/e	n/e
Ecological benefits[e]	n/e	n/e	n/e	n/e	n/e	n/e
Human health risks[e]	n/e	n/e	n/e	n/e	n/e	n/e
ALTERNATIVE 1						
Type Of Impact	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Average**	**Range**
Monetized Avoided Costs Associated With Conventional USTs and EGTs ($ millions, present value 2012$) [a]						
Releases and groundwater incidents[b]	$340	$140	$290	$450	$300	$140 - $450
Vapor intrusion	$4.1	$1.7	$4.1	$6.3	$4.1	$1.7 - $6.3
Product loss	$1.8	$0.54	$2.9	$5.2	$2.6	$0.54 - $5.2
Total[c]	**$350**	**$140**	**$290**	**$460**	**$310**	**$140 - $460**
Non-Monetized Impacts[d]						
Groundwater protected (billion gallons)	120	51	120	190	120	51 - 190
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)[e]	n/e	n/e	n/e	n/e	n/e	n/e
Ecological benefits[e]	n/e	n/e	n/e	n/e	n/e	n/e
Human health risks[e]	n/e	n/e	n/e	n/e	n/e	n/e
ALTERNATIVE 2						
Type Of Impact	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Average**	**Range**
Monetized Avoided Costs Associated With Conventional USTs and EGTs ($ millions, present value 2012$) [a]						
Releases and groundwater incidents[b]	$150	$31	$150	$280	$150	$31 - $280
Vapor intrusion	$1.8	$0.39	$2.2	$4.1	$2.1	$0.39 - $4.1
Product loss	$1.1	$0.25	$1.7	$3.6	$1.7	$0.25 - $3.6
Total[c]	**$150**	**$31**	**$150**	**$290**	**$160**	**$31 - $290**
Non-Monetized Impacts[d]						
Groundwater protected (billion gallons)	54	11	67	120	64	11 - 120
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)[e]	n/e	n/e	n/e	n/e	n/e	n/e
Ecological benefits[e]	n/e	n/e	n/e	n/e	n/e	n/e
Human health risks[e]	n/e	n/e	n/e	n/e	n/e	n/e

[a] Avoided remediation costs from releases and groundwater incidents are the costs related to site remediation. Avoided vapor intrusion costs include additional avoided costs associated with the remediation of vapor intrusion cases; the RIA does not address human health risk associated with vapor intrusion. Avoided product loss costs are also separate and additive.

[b] Expert 2 provided responses that generate benefits that are relatively low compared to estimated costs, unlike the other three experts. Conversations with this expert indicated that this discrepancy may be due to his assumptions about partial noncompliance. See Section 4.5.3 and Appendix H for additional discussion.

[c] Totals may not add up due to rounding. Cost estimates were derived using a seven percent discount rate.

[d] Due to data and resource constraints, EPA was unable to monetize some of the positive impacts of the final UST regulation. Chapter 4 provides a qualitative discussion of these benefits.

[e] Benefits not estimated are denoted by n/e.

Chapter 5. Distributional Impacts and Considerations

5.1 Introduction

This chapter considers specific impacts that may be created by the distribution of the costs and benefits of the final UST regulation. EPA has undertaken several analyses to examine how the pattern of costs and benefits may affect specific populations and sectors of the economy. Specifically, the chapter considers:

- **Economic impacts associated with the costs of the final UST regulation:** These could include changes in facility operation and closure of facilities due to cost increases under the regulation. In addition, the final UST regulation may create negative and positive employment impacts, including both reductions in employment to reduce costs and increases in employment to ensure implementation of regulatory provisions. Finally, the regulation may affect public spending related to cleanup of contaminated sites.

- **Energy impacts associated with the final UST regulation:** EPA considers the potential for this regulation to affect the supply, distribution, or use of energy, including changes in the price of fuel.

- **Impacts on small business and governments:** EPA's regulatory flexibility analysis considers the potential for regulatory costs to have a significant impact on a substantial number of small entities (SISNOSE).

- **Impacts on minority and low-income populations:** EPA considers the potential for the final UST regulation to have disproportionate impacts on minority or low-income populations.

- **Children's health impacts:** EPA considers the potential for the final UST regulation to have a significant or disproportionate impact on the health of children.

Note that the analyses in this chapter employ data and results from EPA's primary analysis assuming a constant number of tanks and releases over 20 years. This chapter does not consider impacts under the alternative baseline scenarios. In general, impacts under alternative baseline assumptions would be slightly smaller, reflecting the smaller universe of affected facilities over time.

5.2 Economic Impacts

In the context of regulatory analysis, an economic impact is an effect on the economic wellbeing, or welfare, of any stakeholder due to compliance with the final UST regulation. Direct economic impacts can be borne by producers (i.e., those who produce, distribute, or sell products associated with the regulation), by consumers (i.e., those who purchase products associated with the regulation), or both.

The economic impacts of the final UST regulation result from increases in compliance costs due to new regulation. In the short run, producers (i.e., owners or operators of facilities with UST systems) can respond to cost increases in one of two ways: by passing through some or all costs to customers (consumers) through increases in price, or by absorbing costs and reducing profitability. If producers cannot pass on to consumers any of their increased compliance costs, the regulation will chiefly affect producers in the short run, and economic impacts may include reduced profits, changes in operation, and in extreme cases, facility closure. If producers are able to increase prices on products to recover some or all compliance costs, the regulation will affect consumers by raising prices. The extent to which producers can pass through costs depends on the structure of the markets in which they operate.

As we discuss in subsequent sections, we do not believe that many firms will be able to pass increases in prices on to consumers through higher fuel prices. While local-level motor fuel retail stations may face similar increases in costs of compliance, consumers' sensitivity to changes in gasoline prices provides a significant disincentive for station operators to increase fuel prices.[144] Instead, compliance costs are likely to be passed on through cross-marketed goods whose demand is less sensitive to changes in prices, such as items for sale at gas station convenience stores.

EPA's assessment of the economic impacts associated with this regulation is presented as follows:

- **Distribution of affected facilities.** We first discuss the universe of affected facilities, with a focus on the retail motor fuels sector. This section also describes supply and demand dynamics within the retail motor fuels market and the likely economic responses to increased compliance costs.

- **Screening level economic impact analysis of average costs on facilities.** EPA presents a screening assessment of the impacts of average estimated facility-level costs on the facilities affected by the regulation.

- **Sensitivity analysis of economic impacts.** To address uncertainty related to the distribution of costs among UST facilities, we present a "worst-case" sensitivity analysis that identifies the maximum number of facilities that could face significant economic impacts due to regulatory costs. This section also briefly discusses implications for facility closures and changes in employment.

- **Impacts on public funding for cleanups.** The final UST regulation is estimated to result in significant cost savings associated with avoided cleanup requirements as releases decline. A significant portion of cleanup costs are currently borne by the public sector, using taxes and fees to fund state cleanup efforts. EPA examines

[144] A high degree of consumer sensitivity to changes in gasoline prices does not imply that prices are equal across gasoline stations in the same area. Factors that affect retail motor fuel prices at the station-level include traffic flows, population density, and intensity of local retail competition on the demand side, while supply can be affected by land cost, station setup, labor costs, and taxes. See: Fischer, Jeffrey. "The Economics of Price Zones and Territorial Restrictions in Gasoline Marketing." Federal Trade Commission. 2004. Accessed at: http://www.ftc.gov/be/workpapers/wp271.pdf. p. 15 – 16

the potential reduction in public sector liabilities associated with the broader reduction in releases.

5.2.1 Distribution of UST Systems by Industry Sector

As shown in **Exhibit 2-3** in Chapter 2, the majority of UST systems are located at motor fuel retailers (i.e., gas stations). EPA estimates that, of the 577,981 UST systems active in 2013, 454,774 (roughly 80 percent) were located at approximately 148,000 motor fuel locations in the United States.[145] The remaining 123,207 UST systems (roughly 20 percent of the total) are spread across several industries, including the commercial sector (wholesale, retail, accommodation, and food services), manufacturing, transportation, communications and utilities, and hospitals.[146] Notably, the sectors other than retail motor fuels are difficult to characterize with regard to UST systems; depending on their uses, UST systems may occur in varying numbers at facilities of varying size and purpose across all sectors. Only in the retail motor fuel sector do UST systems serve a similar, central function at virtually all facilities in the sector.

In addition to comprising approximately 80 percent of all UST systems, establishments in the retail motor fuels sector also have the highest average number of UST systems per facility, with a facility average of 3.07 (roughly three systems per facility). In comparison, facilities in other sectors have, on average, between 1.47 and 1.81 systems.[147] Because many requirements in the final UST regulation occur at the UST system level, establishments in the retail motor fuels sector have the highest average compliance costs per facility. In total, this sector is likely to bear roughly 70 percent of total costs associated with the final UST regulation.[148]

Because the costs of the final UST regulation will primarily affect the retail motor fuels sector, and because this sector is characterized by a large number of independently-owned facilities and companies, this economic impact analysis focuses on the retail motor fuels sector.

5.2.2 Market Dynamics in the Retail Motor Fuels Sector

This section provides an overview of the U.S. wholesale and retail motor fuels markets, including market concentration, fuel distribution practices, and the implications of market structure for pricing.

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145 EPA's count of UST systems includes states and territories, while the estimate of retail motor fuel locations includes only facilities in the continental U.S., Hawaii, and Alaska. Because only 4,963 UST systems (approximately 0.9 percent) are located in other U.S territories, we use 148,000 facilities as the total population.

146 See Chapter 2.1 for more detail.

147 See **Exhibit 2-3**. For example, we calculate 1.81 systems per commercial facility by dividing 1,450 systems by 801 facilities (agriculture sector).

148 Total costs under the Selected Option are $160 million, with $130 million directly related to conventional USTs and EGTs (including the cost to read the regulations). Motor fuel retailers will bear approximately 80 percent of these $130 million in costs, which represent roughly 70 percent of total costs under the Selected Option.

Supply-side Characteristics: Ability of Producers to Pass Through Costs

The North American Industrial Classification System (NAICS) code for retail motor fuel sales (i.e., gasoline stations) is 447, and specifically applies to retailers of automotive fuel and automotive oils. Establishments classified under NAICS code 447 include facilities with and without convenience stores, and all have specialized equipment for the storing and dispensing of automotive fuels.[149]

According to the 2007 Economic Census, average revenues for establishments in NAICS sector 447 were approximately $3.8 million. On average, each establishment employed approximately eight employees.[150]

Market Concentration

Market concentration is an indicator of the ability of firms to raise prices in response to changes in the costs of doing business: in markets with fewer, larger companies (i.e., highly concentrated markets), large firms typically have greater ability to pass through price increases to consumers. One indicator of market concentration is the proportion of total sales made by individual firms within a particular market. In markets where concentration is high, few firms earn a relatively large proportion of the total revenues in a market and are sometimes able to pass price increases through to consumers because of limited competition from smaller firms.

The retail motor fuels sector is representative of the broader retail sector in market concentration. Specifically, 41 percent of all sales made by NAICS sector 447 are made by establishments owned by the fifty largest firms in the sector, compared with one-third of sales to the largest 50 firms in the broader retail sector.[151] This level of market concentration does not suggest that retailers will easily pass through price increases.[152]

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[149] 2007 Economic Census, Retail Trade, Industry series. Gasoline Stations: 2007. Accessed at: http://www.factfinder2.census.gov.

[150] While EPA relies on 2007 Economic Census figures for values per facility, this analysis relies on more recent and focused National Petroleum News Survey values for a count of the number of facilities.

[151] 2007 Economic Census, Retail Trade, Industry series. Gasoline Stations: 2007. Accessed at: http://www.factfinder2.census.gov.

[152] A common measure of market concentration can be obtained through the Herfindahl-Hirschman Index ("HHI"), which is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. For example, if only two firms operate in a market and each has 50 percent of sales, then the index would register $50^2 + 50^2 = 5{,}000$. The U.S. Department of Justice's merger guidelines categorize markets in which HHI is between 1,000 and 1,800 points as moderately concentrated, and those in which the HHI is in excess of 1,800 points as concentrated. Because the four largest firms in NAICS sector 447 generate only 10 percent of the sales in that market, the HHI will be well below 1,000 for this sector. We conclude that firms' relatively small market share translates into weak pricing power. For additional information, see: U.S. Department of Justice. Herfindahl-Hirschman Index. Accessed at: http://www.justice.gov/ atr/public/testimony/hhi.htm.

Geographical Concentration

Gasoline stations are generally distributed across the United States in proportion to population. The most populous states have more establishments and higher proportions of gasoline sales.[153] While no data are available regarding the distribution of facilities by size, the retail gasoline market is relatively homogeneous nationwide, and it is likely that facilities of different sizes are distributed according to population as well.

Ownership Structure

The 2013 NACS Retails Fuel Report published by the National Association of Convenience Stores (NACS) classifies motor fuel retailers into three broad categories, depending on the manner in which they obtain their wholesale product:[154]

- **Refinery-Owned:** Less than one percent of facilities are retail operations directly owned by large oil producers. These stations receive wholesale product directly from the oil company's refinery, and their profit is part of the oil company's profit. At these facilities, the parent corporation manages all aspects of the customer experience and establishes a consistent brand identity.

- **Branded Independent Retailers:** Approximately 50 percent of facilities are branded independent retailers. These facilities are owned by independent operators and contract with a refinery to sell a particular brand of gasoline. This owner leverages the supplier's marketing and ensures constant supply in exchange for a surcharge per gallon paid to the supplier. Branded retailers' contracts with refiners typically contain clauses that specify the margins retailers can charge above wholesale prices.

- **Unbranded Independent Retailers:** Approximately 50 percent of facilities are unbranded independent retailers. These retailers purchase gasoline on the open market, without committing to a particular supplier.

Wholesale gasoline is a commodity, but varies in price regionally based on a combination of refinery locations, specific fuel mixes (e.g., to meet air quality standards), and the type of distributors in a region. Types of wholesalers include:[155]

- **Refinery-owned wholesalers**: Refiners (typically large oil companies) distribute directly to their own retail outlets in all regions, and in some areas may also

[153] U.S. Census Bureau. Industry Statistics Sampler: NAICS 447, Geographic Distribution - Gasoline Stations: 1997. Accessed at: http://www.census.gov/epcd/ec97/industry/E447.HTM.

[154] National Association of Convenience Stores. "Who Sells America's Fuel?" Accessed at: http://www.nacsonline.com/YourBusiness/FuelsReports/GasPrices_2014/Retail-Operations/Pages/Who-Sells-Americas-Fuel.aspx

[155] Kleit, Andrew N. "The Economics of Gasoline: Retailing Petroleum Distribution and Retailing Issues in the U.S." December 2003.

distribute directly to independent branded and unbranded retailers (competing with other suppliers in the unbranded market).

- **Area Franchisees**: Otherwise known as "jobbers," these firms obtain the right from oil companies to franchise a brand of motor fuel in a particular area. Jobbers are responsible for siting and building new facilities and marketing the brand, which further removes refiners from operating activities. The term is also used to describe wholesale distributors of motor fuels that offer multiple brands.

While some regions have significant competition among distributors, the market power of refiners and the contract structure of many retailers means that retailers in general have little control over the price of their fuel supply.[156] As a consequence, any cost increases must be absorbed by retailers or passed through to customers.

Demand-side Characteristics: Consumer Response to Price Increases

Consumer reactions to price changes are critical in determining whether a producer (i.e., retailer) can pass on costs. The degree to which consumers change the quantity they consume when the price of a good increases is known as the price elasticity of demand. Economists define demand as inelastic if the quantity demanded changes less than price (e.g., quantity demanded changes by one percent when prices rise (or fall) by 1.4 percent). Similarly, demand is said to be elastic if quantity demanded changes proportionally more for a relative change in price.

Motor fuel retailers rely on sales of gasoline for most revenues, though most also sell other automobile-related or convenience products. Research has documented that broad (national) market demand for gasoline is relatively price-inelastic in the short-run: consumers do not make immediate, significant changes in gasoline purchases if prices increase.[157] On its face, this dynamic would suggest that a retailer could pass through any cost increases to consumers. However, the structure of the market for gasoline prohibits significant price fluctuations at the facility level. While national demand is relatively consistent, consumers are highly sensitive to price differences within local markets.[158] Small increases in price at one location can produce relatively large changes in quantity demanded for a particular facility as consumers seek other local retailers with lower costs.

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[156] Other suppliers, e.g. for convenience store items, may be easier with which to negotiate but may not be available to all motor fuel retailers.

[157] Dahl, Carol and Thomas Sterner. "Analyzing Gasoline Demand Elasticities: A Survey." Energy Economics, July 1991. p. 203 – 210.

[158] As noted above, a high degree of consumer sensitivity to changes in gasoline prices does not imply that prices are equal across gasoline stations in the same area. See: Fischer, Jeffrey. "The Economics of Price Zones and Territorial Restrictions in Gasoline Marketing." Federal Trade Commission. 2004. Accessed at: http://www.ftc.gov/be/workpapers/wp271.pdf.

A recent National Association of Convenience Stores (NACS) survey provides insights into the price pressures faced by local retailers:[159]

- 66 percent of respondents stated that price was the most important factor in their gasoline-purchasing choices.

- 67 percent stated that they would take the time to make a left turn on a busy street to save five cents per gallon of gasoline.

- 39 percent said they would drive 10 minutes out of their way (a 20-minute round trip plus cost of fuel) to save five cents per gallon. This amounts to savings of less than one dollar in terms of fuel for nearly all passenger vehicles on the road today.

Local competition for price-sensitive customers discourages retailers from increasing gasoline prices, except in cases such as wholesale price increases or tax increases where changes are uniform across facilities.[160] Because compliance costs may vary by facility depending on existing technology and practice, it is not likely that retailers will opt to pass through compliance costs by raising gasoline prices. While retailers may be able to increase the prices of other products (e.g., motor oil or convenience store products), it is also likely that some retailers will be forced to absorb some or all of the costs associated with the regulation.

Retailers in relative isolation may be better positioned to pass on increases in cost to consumers. Research shows that store-level pricing is sensitive to the concentration of competition. In areas where motor fuel retailers are relatively sparse, facilities may be better able to pass cost increases on to consumers, for whom the opportunity cost of finding an alternative store is higher when they must travel farther.[161]

However, because consumers are especially price sensitive about gasoline and it is not clear what other options owners or operators have to increase prices, we assume that owners or operators will likely bear the economic impacts of the regulation. We therefore examine producer impacts, including the possibility that some facilities may close due to cost increases.[162]

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[159] National Association of Convenience Stores. "Consumer Research: Price Still Dominates Gas Purchasing Decisions." Accessed at: http://www.nacsonline.com/YourBusiness/FuelsReports/GasPrices_2014/Consumer-Research/Pages/Consumer-Research-Price-Still-Dominates-Gas-Purchasing-Decisions.aspx.

[160] This may vary, depending on the region. For example, in Vancouver, gasoline prices are uniform and rigid (due to tacit collusion among wholesalers), while prices in Ottawa are dispersed and volatile (due to the price-disrupting behavior of "maverick" firms). See: Eckert, Andrew and Douglas S. West. "A Tale of Two Cities: Price Uniformity and Price Volatility in Gasoline Retailing." *Annals of Regional Science*, 2004, vol. 38, issue 1, p. 25-46.

[161] See: Hoch *et al*. "Determinants of Store-level Price Elasticity." *Journal of Marketing Research*, Vol. 32 (1), 1995: p. 17 – 29.

[162] A more detailed analysis of consumer impacts is prohibitively difficult for two reasons. First, the precise set of goods and services whose prices may increase is difficult to characterize. Second, gasoline aside, the main draw to products sold at retail motor fuel facilities is convenience, i.e., ease of access. Most non-fuel products can be purchased for lower prices at grocery stores, for example. Consumers can therefore shop at other types of facilities for the same goods, but typically opt to pay a premium for purchases at a convenient location. Note that, even

5.2.3 Assessment of Market Exits and Employment Impacts

In a market setting where producers cannot reliably pass through costs, the most significant economic impacts are related to reduced facility profits. In some cases, managers can cut supply or employment costs (this could result in smaller worker paychecks). In cases where costs exceed facility profits, it is likely that in the long term a facility would exit the market. A critical factor, therefore, is an estimate of average firm or facility profits.

It is difficult to estimate the profitability of retail motor fuel stations because many are small and privately held and are not required to report profits publicly. However, some evidence suggests that profit margins are below five percent, and data suggest that average after-tax profit margins reported to the IRS for gas stations are roughly 1.8 percent.[163] Holding all other things equal, an annual cost greater than 1.8 percent of gross sales (i.e., a cost greater than $1,800 for a firm earning $100,000 a year) would exceed average reported profits and would therefore cause a motor fuel retailer to operate at a loss. If the facility cannot adjust its prices or lower costs, it will eventually exit the market.[164]

Consistent with the assessment of small business impacts in Section 5.4 of this chapter, EPA considers the impact of the final UST regulation on small facilities in order to identify the most likely facilities to exit the market. Assuming that all motor retail facilities, regardless of income, have an "average" configuration of approximately three tanks, EPA calculates the average total cost per facility to be $715 (2012 dollars), or $658 in 2007 dollars, under the Selected Option (reflecting a cost of approximately $232 per UST system in 2012 dollars, or $214 per system in 2007 dollars).[165,166]

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though consumers will be able to purchase equivalent goods at different locations, there is a reduction in consumer surplus associated with the loss of convenience in the purchase.

[163] For corporations reporting net income, profit margins before non-cash items (depreciation and amortization) and income tax (or credits) were approximately 1.8 percent (2.4 percent less amortization and depreciation, but not taxes paid). Earnings before depreciation and amortization account for the fact that firms can postpone capital expenditures to save cash, and would likely do so while adapting to higher costs. If non-cash items and taxes are included, earnings drop to roughly one (1.3) percent. Our approach averages the two options (2.4 percent, before amortization and discounting, and 1.3 percent, after including non-cash items and taxes) to yield a margin of 1.8 percent, reflecting an assumption that firms will do something to adapt to higher costs while they sort out how to adjust prices, and that firms typically minimize profits reported to the IRS. See: U.S. Internal Revenue Service. SOI TaxStats. Table 7: Corporation Returns with Net Income for 2009. Accessed at: http://www.irs.gov/taxstats/article/0,,id=170693,00.html. See also 2002 - 2012 RMA *Statement Studies*, Sector 447, for a range of profitability data from facilities of different sizes.

[164] Throughout this chapter, EPA refers interchangeably to reductions in net profit and the proportion of revenues that the costs of the final UST regulation will create. In both cases, we refer to the impact of the cost of the final UST regulation on the profitability of a facility.

[165] Specifically, we assume 3.07 UST systems per facility.

[166] Under Alternative 1 the average retail motor fuel facility cost would be $1,509, and under Alternative 2 it would be $369 (2012 dollars). In Indian country, where facilities are required to meet more requirements than elsewhere; average cost per facility is $2,257 under the Selected Option, $3,326 under Alternative 1, and $1,801 under Alternative 2 (2012 dollars).

Using data from the 2007 Economic Census and the regulatory flexibility screening analysis methodology described in Section 5.4, EPA concludes that a facility-level cost of $658 ($715 in 2012 dollars) would exceed 1.8 percent of total reported 2007 revenues (i.e., be equal to or greater than total profits) for 19 firms, representing less than one-tenth of one percent of the universe of 148,000 motor fuel retail facilities.[167] In comparison, approximately 2,024 facilities per year closed over the period between 2005 and 2013.[168] In some cases, any exits related to regulatory costs may coincide with exits that would have occurred in the baseline. Furthermore, it is likely that many of the affected facilities will also have options to pass through at least a portion of costs, and many small facilities may have fewer than three UST systems. Therefore, EPA concludes that the market impacts associated with this regulation are likely to be diffuse and minimal, assuming a relatively uniform distribution of costs nationwide.

Sensitivity Analysis: Considering Impacts of a "Worst-Case Scenario"

EPA's finding of minimal market impacts rests on an assessment of average facilities with average regulatory compliance costs. If the costs of the final UST regulation are concentrated on certain facilities, it is possible that additional impacts (e.g., market exits) could occur. EPA therefore employs several sensitivity analyses to consider alternative, "worst-case" distributions of regulatory costs across facilities.

To examine the extent to which the distribution of regulatory costs can be "concentrated" on specific facilities, EPA constructs a "worst-case distribution" in which regulatory costs are concentrated on a subset of facilities.[169] To obtain this distribution, we artificially assign costs to create the largest cost for the largest number of facilities, by assuming that the same facilities in

[167] An analogous statement of this outcome is that all facilities with revenues below approximately $36,300 per year would incur new costs equal to or in excess of profits of 1.8 percent of total revenue. Note that U.S. Census data indicate that all firms in the motor fuel sector that earn less than $36,300 are single-location firms.

[168] NPN reported a station count of 147,902 in 2013, compared with 164,094 in 2005. Note that 168,987 represents the total number of establishments offering gas filling services reported by NACS. We adjusted this number downward by the 4,893 "hypermarketer" facilities reported in existence by NACS in 2012 to reach the 164,094 retail motor fuel stations nationally. For the purposes of these calculations, we adjust both station counts downward for the number of "hypermarketers" providing retail motor fuel in 2013, which are not gas stations but rather supermarkets or wholesalers with filling stations. These figures imply a decrease of approximately 16,000 stations over eight years, or approximately 2,024 (1.2 percent) per year. See: National Petroleum News. "MarketFacts 2013"; and National Petroleum News. Market Pulse. "2005 U.S. Motor Fuel Station Count: 168,987," both accessed at: http://www.npnweb.com/. Additionally, see "The U.S. Petroleum Industry: Statistics, Definitions" from the National Association of Convenience Stores (NACS), accessed at: http://www.nacsonline.com/YourBusiness/FuelsReports/GasPrices_2014/Retail-Operations/Pages/Who-Sells-Americas-Fuel.aspx.

[169] Ideally, EPA would evaluate which facilities are likely to incur significant impacts by examining the specific changes each will be required to make to achieve compliance. These costs would be compared with the facility's revenue and profit margin to establish whether it can incur the additional costs and remain in business. To EPA's knowledge, no data of this resolution are available for the large population of facilities with UST systems.

the state make every regulatory change.[170] We further assume that the smallest facilities in the U.S. are the facilities that must make the regulatory changes.[171]

Exhibit 5-1 displays the universe of retail motor fuel UST facilities in the United States when costs are allocated to concentrate impacts. This creates an allocation of costs that varies broadly, from as little as $30 to over $4,500 per facility.[172]

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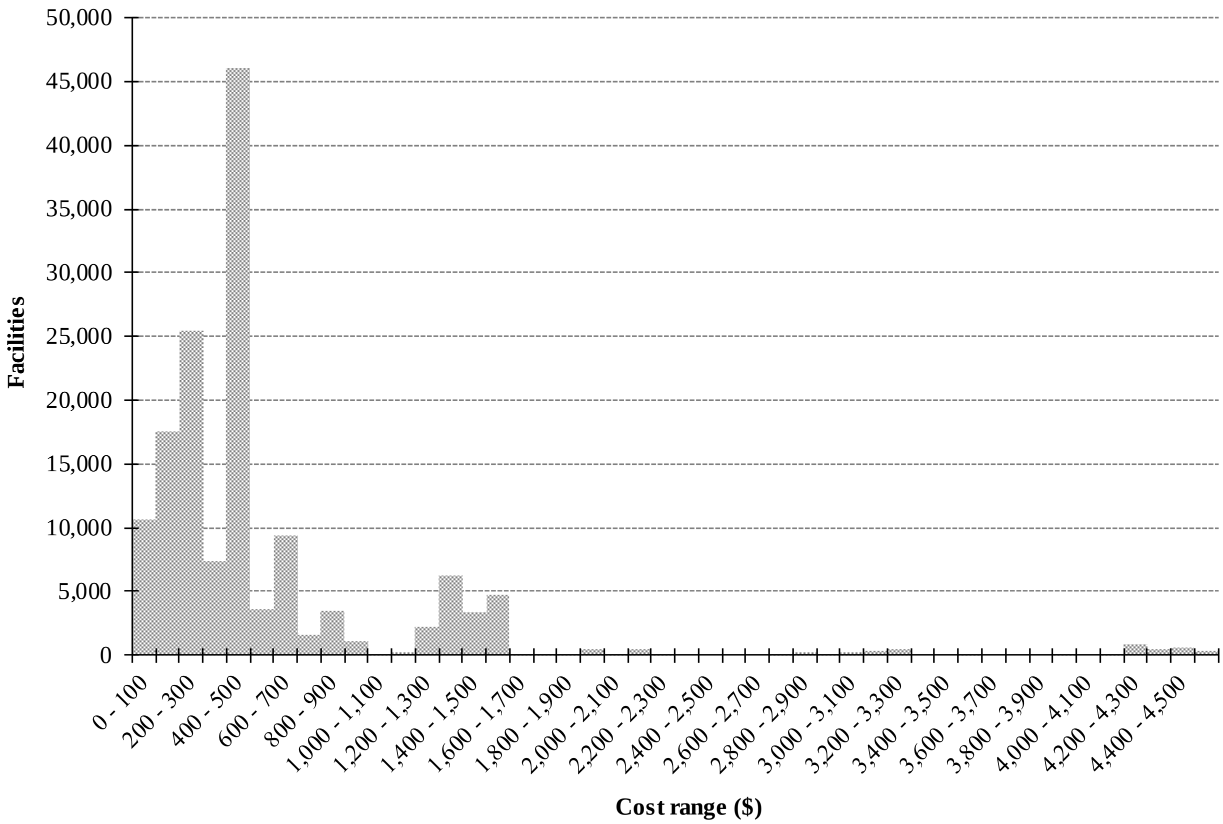
[170] For example, consider a state with 850 UST facilities that will be subject to three hypothetical technical requirements: Requirement A will affect 500 facilities and cost $50 per facility; Requirement B will affect 250 facilities and cost $100 per facility; and Requirement C will affect 100 facilities and cost $200 per facility. The average cost for all of these facilities is $82 (((50*500) + (250*100) + (100*200))/850). However, the highest cost possible in this state is $350 (costs of $50 from Requirement A, $100 from Requirement B, and $200 from Requirement C), and the largest number of facilities that could incur this cost is 100 (the smallest of the universes affected by Requirements A, B, or C). The next highest cost is $150 (costs of $100 from Requirement B and $50 from Requirement A), which affect 150 facilities, excluding those also affected by Requirement C. The last group would be affected only by Requirement A, with 250 facilities at a cost of $50 per facility. Such an allocation of costs creates an unlikely outcome with a high potential for market exits. Appendix K provides the detailed summary of this threshold calculation.

[171] EPA also examined a sensitivity analysis that would specifically consider the effects of "front-loading" capital cost requirements, but this scenario would have no effect on the results of the "worst-case" sensitivity analysis. The "worst-case" scenario examined here already assumes simultaneous implementation of all requirements under the final UST regulation, including several which actually have delayed implementation schedule (e.g., secondary containment tests). In addition, the analysis includes annualized costs for capital requirements for Indian country systems (e.g., secondary containment). The "worst-case" scenario does not address the replacement of closure of lined tanks that cannot be repaired according to a code of practice, and does not assume that full capital costs are incurred in a single year for affected tanks, but the facilities that would be affected by these changes are already among the highest cost facilities identified, and are already therefore included in the number of facilities potentially affected under this worst-case assumption.

[172] One possible concern is whether facilities that are likely to face high costs are geographically concentrated in certain states or regions. To assess this, we examined the geographic distribution of the six percent of facilities that would incur the highest costs if costs were artificially concentrated (specifically, 9,310 facilities incurring costs greater than $1,500). Our analysis includes 4,681 firms incurring costs between $1,500 and $1,600. For simplicity and to preserve a conservative estimate, we assume that these firms all incur costs of $1,600.) The proportion of "highest-cost facilities" does not vary substantially by state, because several regulatory requirements affect only a small percentage of the entire UST universe in any state. The concentration (percentage) of facilities that could be subject to costs over $1,600 is highest in American Samoa, where 6.3 percent of facilities could be affected at that cost. In the remaining 55 states and territories, facilities that could, in a worst-case scenario, incur costs over $1,600 represent less than 3.7 percent of total facilities within each state. Differential economic impacts across states are not likely to occur as a result of disproportionate state-level impacts from this regulation, even in a scenario of maximum concentration of costs across the fewest firms.

Exhibit 5-1

Distribution Of Retail Motor Fuel UST Facility Costs Using "Worst-Case" Distribution



To assess economic impacts using this unlikely worst-case scenario, EPA pairs the distributions of facility size and costs to maximize the number of situations in which estimated costs would exceed 1.8 percent of gross sales (the average reported retail motor fuel facility profit). Facilities with costs exceeding 1.8 percent of revenues would potentially face a significant economic impact under worst-case assumptions.

Market Exits

Even under the artificially adverse scenario presented above, economic impacts to affected entities are limited. The least compliant facilities in the least regulated states would incur costs under $4,600 in the worst case.[173] This represents less than 1.8 percent of revenues for facilities earning more than $250,000 per year, suggesting that even these facilities could

[173] Facility costs of roughly $4,300 or less are representative of approximately 99 percent of worst-case, high-end cost outcomes. Facilities in Indian country are the only exception, as they will also be required to comply with additional regulations for operator training and secondary containment. Because this group of facilities represents only roughly one percent of facilities with costs at or above $4,300, we do not present them as the main highest-cost scenario.

absorb all worst-case costs without becoming unprofitable.[174] To assess the worst-case potential impact, EPA assumed that the facilities with the highest costs (those in the right-hand tail of the distribution in **Exhibit 5-1**) are also the facilities with the lowest revenues and allocated costs to those facilities to maximize the number of potential exits. EPA estimates that 4,500 facilities earning less than $250,000 per year in the U.S. (in 2007 dollars) would be subject to costs exceeding 1.8 percent of revenues in the worst-case scenario.[175,176] To the extent that those facilities could not increase prices to offset higher costs, it is likely that at least some of them would exit the market. If all of these facilities exited the market, the closures would constitute roughly three percent of existing facilities.[177] However, this scenario imposes several unlikely assumptions, including:

- **All facilities with income less than $250,000 have average configurations of three UST systems.** In fact, small facilities likely have fewer than three tanks and would therefore be subject costs that are much lower than the facility-level costs estimated here. It is likely that the smallest facilities also operate only a single UST system, which would reduce their compliance costs by approximately 67 percent.[178] Under such circumstances, most small operators would not be subject to a significant economic impact even in the worst-case scenario.

- **No facility has any option to increase prices on any goods or services or to identify any options for savings.** While gasoline prices are unlikely to rise in response to this regulation, consumers may be willing to pay marginal cost

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174 For simplicity, we assume that all facilities earning less than $250,000 per year (in 2007 dollars) earn less than $243,000, in order to enable the use of Census data to estimate the number of facilities subject to costs exceeding 1.8 percent of revenues. This is a conservative estimate; in reality, there are likely some facilities earning between $243,000 and $250,000 per year that would not be subject to costs exceeding 1.8 percent of revenues.

175 The 2007 Economic Census identified 3,463 facilities that earned less than $250,000 in 2007. For the purposes of its SBA analysis, EPA revised this estimate upward by 38 percent to reconcile disparities between Census gas stations counts from 2007 and NACS gas station counts from 2013. Of the estimated 4,781 facilities earning less than $250,000 per year in 2007, we arrayed the highest cost facilities with the highest revenue facilities, to ensure an estimate of as many exits as possible, which yielded an estimate of approximately 4,500 facilities that could exit the market. See Appendix K for a detailed explanation of our methods.

176 Census data on number of facilities per firm indicate that virtually all firms earning less than $250,000 per year in 2007 had only one facility. We therefore use "firm" and "facility" interchangeably in this context.

177 In other words, of the 4,781 facilities earning less than $250,000 per year in 2007, EPA estimates that up to 4,500 facilities may incur compliance costs that exceed 1.8 percent of revenues (i.e., costs greater than $4,600 per facility). To the extent that those facilities could not increase prices to offset higher costs, it is likely that at least some of them would exit the market. See Appendix K for a detailed explanation of our methods.

178 According to the 2013 NACS Convenience Store Industry Fact Book, the average motor fuel retailing facility has monthly throughput of approximately 128,000 gallons. As discussed in Chapter 2, we believe that the average motor fuel retailer operates approximately 3 UST systems. This equates to roughly 42,700 gallons of monthly throughput per system. In addition, based on information from a mid-size retail fuel marketer, EPA believes that a facility requires a minimum throughput of approximately 30,000 gallons per month to remain economically viable, which equates to upward of $50,000 in revenues per month given gasoline prices in excess of $2.00 since 2005. See: U.S. Energy Information Administration. Petroleum & Other Liquids. Retail prices for Regular Gasoline. Accessed at: http://www.eia.gov/dnav/pet/pet_pri_gnd_a_epmr_pte_dpgal_a.htm.

increases on other products and services. Moreover, in remote rural areas, retailers may be able to directly pass costs on to consumers.

- **A profit margin of 1.8 percent is standard.** The worst-case scenario uses the average profits reported to the IRS to determine typical profitability. However, privately-held companies have a clear incentive to minimize taxable profits when filing income taxes with the IRS. Because net income (profit) is taxable, corporations that are not publicly traded typically take legitimate steps (e.g., year-end investments in equipment, employee bonuses) to reduce both net income and tax burdens. As a result, a 1.8 percent after-tax profit estimate based on IRS data is likely to understate average profitability.

Finally, this analysis does not adjust the 2007 Economic Census data on facility revenues for inflation, though costs are presented in 2012 dollars. Due to the variability of gasoline pricing, we adopt a conservative assumption that revenues have remained static in nominal terms since 2007.

While our sensitivity analysis suggests that an extreme worst-case scenario could impose significant economic impacts on as many as 4,500 facilities, it is unlikely that a significant number of actual market exits would result from the final UST regulation. It is more likely that closures will occur in specific cases where facilities with high upgrade costs also face high levels of local competition. These closures would likely be consistent with the current rate of industry consolidation of 1.2 percent per year.

Price Impacts

The high sensitivity of local demand to changes in retail motor fuel prices makes it unlikely that firms will react to the final UST regulation by raising gasoline prices. However, the cost of other goods and services could potentially increase as firms seek to offset regulatory costs through sales of other products. Retailers will likely increase the prices of goods that are relatively price inelastic, such as tobacco products, auto service charges, or snack foods and other convenience items.

Employment Impacts

In addition to addressing the costs and benefits of the final UST regulation, EPA has analyzed the impacts of this regulation on employment. While a standalone analysis of employment impacts is not included in a standard cost-benefit analysis, such an analysis is of particular concern in the current economic climate of sustained high unemployment. Executive Order 13563, “Improving Regulation and Regulatory Review” (January 18, 2011), states, “Our regulatory system must protect public health, welfare, safety, and our environment while promoting economic growth, innovation, competitiveness, and job creation.” For this reason, we are examining the effects of these requirements on employment in the regulated sectors. A discussion of costs associated with this regulation (including labor costs) is included in Chapter 3, Section 3.2.2, with a sensitivity analysis regarding labor cost assumptions in Chapter 3, Section 3.5.1.

The employment effects of environmental regulation are difficult to disentangle from other economic changes and business decisions that affect employment over time and across regions and industries. In light of these difficulties, economic theory provides a constructive framework for approaching these assessments and for better understanding the inherent complexities in such assessments. Neoclassical microeconomic theory describes how profit-maximizing firms adjust their use of productive inputs in response to changes in their economic conditions.[179] In this framework, labor demand impacts for regulated sectors can be decomposed into output and substitution effects. For the output effect, by affecting the marginal cost of production, regulation affects the profit-maximizing quantity of output. The substitution effect describes how, holding output constant, regulation affects the labor-intensity of production. Because the output and substitution effects may be both positive, both negative or some combination, standard neoclassical theory alone does not point to a definitive net effect of regulation on labor demand at regulated firms.

In the labor economics literature, there is an extensive body of peer-reviewed empirical work analyzing various aspects of labor demand, relying on the above theoretical framework.[180] This work focuses primarily on the effects of employment policies (e.g. labor taxes, minimum wage).[181] In contrast, the peer-reviewed empirical literature specifically estimating employment effects of environmental regulations is very limited. Several empirical studies, including Berman and Bui (2001) and Morgenstern et al (2002), suggest that net employment impacts may be zero or slightly positive but small even in the regulated sector.[182] Other research suggests that more highly regulated counties may generate fewer jobs than less regulated ones.[183] However, since these latter studies compare more regulated to less regulated counties, they overstate the net national impact of regulation to the extent that regulation causes plants to locate in one area of the country rather than another. List et al. (2003) find some evidence that this type of geographic relocation may be occurring.[184] Overall, the peer-reviewed literature does not contain evidence that environmental regulation has a large impact on net employment (either negative or positive) in the long run across the whole economy.

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[179] For a discussion, see: Layard, P.R.G., and A. A. Walters. 1978. Microeconomic Theory (McGraw-Hill, Inc.), Chapter 9.

[180] For a detailed treatment, see: Hamermesh. 1993. Labor Demand (Princeton, NJ: Princeton University Press), Chapter 2.

[181] For a concise overview, see: Ehrenberg, Ronald G., and Robert S. Smith. 2000. Modern Labor Economics: Theory and Public Policy (Addison Wesley Longman, Inc.), Chapters 3 and 4.

[182] Berman, E. and L. T. M. Bui (2001). "Environmental Regulation and Labor Demand: Evidence from the South Coast Air Basin." Journal of Public Economics 79(2): 265-295; and Morgenstern, Richard D., William A. Pizer, and Jhih-Shyang Shih. "Jobs Versus the Environment: An Industry-Level Perspective." Journal of Environmental Economics and Management 43 (2002): 412-436.

[183] Greenstone, M. 2002. "The Impacts of Environmental Regulations on Industrial Activity: Evidence from the 1970 and 1977 Clean Air Act Amendments and the Census of Manufactures," Journal of Political Economy 110(6): 1175-1219; and Walker, Reed. (2011)."Environmental Regulation and Labor Reallocation." American Economic Review: Papers and Proceedings 101(3): 442-447.

[184] List, J. A., D. L. Millimet, P. G. Fredriksson, and W. W. McHone. 2003. "Effects of Environmental Regulations on Manufacturing Plant Births: Evidence from a Propensity Score Matching Estimator." The Review of Economics and Statistics 85(4): 944-952.

Analytic challenges make it very difficult to accurately produce net employment estimates for the whole economy that would appropriately capture the way in which costs, compliance spending, and environmental benefits propagate through the macro-economy. Quantitative estimates are further complicated by the fact that macroeconomic models often have very little sectoral detail and usually assume that the economy is at full employment. The EPA is currently in the process of seeking input from an independent expert panel on modeling economy-wide impacts, including employment effects.[185]

As described in detail in Chapter 2, Section 2.3, this regulation affects sectors using active UST systems. Most UST systems in the United States are located at motor fuel retail establishments (i.e., gas stations), and virtually all motor fuel retail establishments use UST systems. EPA estimates that this sector employs approximately 1.1 million workers.[186]

The increased operating costs incurred by facilities in this sector to comply with this regulation may result in slightly increased prices for their goods and services, as previously discussed. These potential price increases may result in reduced demand and thus reduced output of the facilities' goods and services. This could translate into lower demand for labor, a result commonly referred to as the output, or demand, effect.[187] As discussed earlier, the price effect is expected to be small, and given the relatively inelastic demand for gasoline, the demand effect is likely to be small as well. The final UST regulation may also contribute to a small number of market exits, which could cause a temporary negative employment effect as these workers look for other positions. However, as noted above and discussed below, these exits are consistent with exits that are already occurring in the baseline.[188] In addition, given the competitive nature of the retail motor fuel sector and the similar regulatory costs faced by each facility, many of these facilities may be able to pass through at least a portion of these costs (see Price Impacts section above).[189] As a result, the potential employment effect of market exits from the final UST regulation is likely small.

While the final UST regulation is unlikely to have measurable employment impacts related to market exits, it is possible that some facilities will attempt to offset regulatory costs by reducing hours or staff. Even under worst-case conditions, it is unclear whether facilities would reduce employment. Because most personnel employed at retail motor fuel facilities earn hourly wages rather than salaries, facilities have little to gain from eliminating positions and laying off

[185] For more information, see: U.S. Environmental Protection Agency. Comment Request; Draft Supporting Materials for the Science Advisory Board Panel on the Role of Economy-Wide Modeling in U.S. EPA Analysis of Air Regulations. February 5, 2014. Accessed at: https://www.federalregister.gov/articles/2014/02/05/2014-02471/draft-supporting-materials-for-the-science-advisory-board-panel-on-the-role-of-economy-wide-modeling.

[186] The 2011 County Business Patterns report states that NAICS sector 447 employs 847,516 workers at 110,830 facilities. EPA extrapolated this value to the approximately 148,000 facilities counted by the 2012 NACS survey.

[187] See, for example: Berman, E. and L. T. M. Bui (2001). "Environmental Regulation and Labor Demand: Evidence from the South Coast Air Basin." Journal of Public Economics 79(2): 265-295.

[188] See footnote 169.

[189] Note that small marginal facilities are also likely to have fewer than three UST systems and thus face lower than average facility-level compliance costs.

employees: operations require a particular number of people-hours, and the owner or operator will still need to allocate those tasks among the remaining workers.

Some requirements of the final UST regulation may have a positive impact on employment. For example, walkthrough inspections require labor as a primary input; this may lead to small increases in employment at regulated facilities.[190] In addition, the increased demand for testing services and training under the final UST regulation may also increase demand for labor. Since the final UST regulation could potentially affect the demand for labor both positively and negatively, the overall direction of net employment impacts is unclear, but is most likely very small relative to the size of the industry.

Long-run Economic Impacts

The final UST regulation is unlikely to generate substantial additional impacts in the long run. In an unlikely worst-case scenario it could accelerate ongoing consolidation trends in the retail motor fuel sector, but only if market exits result. NACS reports that 164,094 motor fuel stations operated in the United States in 2005.[191] By 2013, this number had fallen to 147,902, a decrease of 9.9 percent compared with 2005, or approximately 1.2 percent per year.[192] While broader market consolidation is related to ownership strategies among oil companies and general economic patterns, facilities facing significant periodic costs (e.g. UST system replacement) may be among those most likely to close. Similarly, facilities that face higher operating costs as a result of the regulation may opt to close. In such cases, exits caused by the regulation are likely to affect the most marginal firms and would likely coincide to some extent with exits that would have occurred in the absence of the regulation. These closures will occur in the context of the national decline in the number of facilities, such that the regulation is unlikely to cause a significant number of closures beyond those that will occur as part of the existing trend.

5.2.4 Assessment of Public Sector Cost Savings Related to Avoided Releases

A major positive effect of the final UST regulation derives from its impact on state funds created for the purpose of providing a financial responsibility mechanism to UST owners and operators.[193] Among 56 state and territory governments, 35 state funds are active and continue to accept claims.[194] In many of these states, owners and operators are required to pay for a portion

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[190] For example, EPA estimates that monthly walkthrough inspections of a facility will take roughly half an hour to complete, on average. A compliant owner or operator in a state that does not currently have this requirement will need to allocate roughly six man-hours of incremental effort per year to satisfy this portion of the final UST regulation.

[191] Note that 168,987 represents the total number of establishments offering gas filling services reported by NACS. We have adjusted this number downward by the 4,893 "hypermarketer" facilities reported in existence by NACS in 2012 to reach the 164,094 retail motor fuel stations nationally.

[192] See footnote 169.

[193] State funds are created by state legislation and are submitted to EPA for approval before they can be used as financial responsibility mechanisms.

[194] At the time of this assessment, Connecticut had not fully sunsetted its state fund. It was therefore included in this assessment; in other words, this assessment is based on 36 state funds. U.S. Environmental

of remedial actions through deductibles that generally range from zero to $100,000.[195] Given an average state-fund cost of remediation per site of $124,488 in 2012, however, state funds are frequently required to finance some portion of remediation costs.[196] In most cases, states generate money for their funds by levying tank registration and petroleum fees, which are then used to provide payments for remediation of releases beyond the deductibles paid by responsible parties. In states where funds rely on gas taxes and accept claims related to releases, these expenditures represent subsidies from the public to owners or operators responsible for releases.

The extent to which this regulation reduces the occurrence of new releases produces two welcome effects:

- **Assignment of costs**. Fewer releases imply lower expenditures from state funds. This represents a reduction in this public subsidy and a reassignment of costs from the public remediation costs to private entity prevention costs. This improves market signaling and efficiency by requiring owners and operators to focus on release prevention.

- **Competitive effects**. High-performing owners or operators are less likely to incur significant regulatory costs than low-performing owners or operators. As a result, the regulatory costs and cost savings improve the alignment of incentives to focus on private-sector prevention costs and reduce public-sector remediation costs.

To illustrate the potential magnitude of the public expenditures that could be affected by the regulation (i.e., distributional effects), we examine states that have active state funds and categorize them into those that finance their funds via petroleum and tank fees ("Tier 1"), or via only a tank fee ("Tier 2").[197]

We assume that states that are required to comply with a larger number of the new requirements will experience a greater reduction of releases, all other things equal. To estimate the distribution of avoided releases, we calculate the average number of requirements with which

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Protection Agency. "State UST Financial Assurance Funds." Accessed at: http://www.epa.gov/oust/states/fndstatus.htm.

[195] Association of State and Territorial Solid Waste Management Officials. *State Fund Survey Results 2012.* Table 1: Design Characteristics of State Financial Assurance Funds. Accessed at: http://www.astswmo.org/Files/Policies_and_Publications/Tanks/2012_State_Funds_Survey/2012-Table1-Part1.pdf.

[196] Association of State and Territorial Solid Waste Management Officials. *State Fund Survey Results 2012.* Summary of State Fund Survey Results. Accessed at: http://www.astswmo.org/Files/Policies_and_Publications/Tanks/2012_State_Funds_Survey/2012-SummaryTable.pdf. For example, representatives of the state of New Hampshire indicated that in most cases, the State Fund incurs remediation costs, except that the owner or operator typically bears the cost of immediately stopping the leak. In addition, New Hampshire indicated the owner or operator typically pays a $5,000 deductible towards the final remediation cost, and in New Mexico, the owner or operator typically pays a deductible between $0 and $10,000.

[197] For states with active financial assurance funds, see: U.S. Environmental Protection Agency. "Status of State Fund Programs." Accessed on August 12, 2014. Accessed at: http://www.epa.gov/oust/states/fndstatus.htm.

the systems in each state will need to comply.[198] We assign avoided releases based on both the number of systems in a state and the average number of requirements on each system, and we value releases based on the national profile of avoided releases and avoided groundwater incidents.[199] Using ASTSWMO data, we subtract from our estimate of the potential cost borne by the public the deductible that owners or operators would be expected to pay.[200] See Appendix N for a discussion of the methodology used.

Exhibit 5-2 presents the results of our screening-level assessment. Among states with active state funds that fall into Tier 1 or Tier 2, we find that the potential reduction in public expenditures could reach $65 million to $290 million ($170 million on average) under the Selected Option, with $50 million to $220 million ($130 million on average) in Tier 1 and $14 million to $64 million ($38 million on average) in Tier 2.[201] Reductions in public expenditures would equal approximately $120 million to $370 million ($250 on average) under Alternative 1 and $26 million to $240 million ($130 on average) under Alternative 2. These savings would be slightly lower in a scenario where deductibles are in the upper end of their ranges. We note that, to realize the savings in public expenditures in the near term, state government action would be required to lower petroleum fees. Alternatively, to the extent that funds are not constrained in their use, a redistribution of funds (e.g., to existing sites awaiting cleanup) could also represent a significant public benefit through more rapid completion of existing sites. The values presented in this table reflect discounting to account for regulatory compliance schedules.

This screening-level analysis is intended only to identify the potential magnitude of impacts on state fund liabilities. A more detailed analysis of specific state program costs and the likely distribution of avoided releases would be necessary to precisely measure potential savings. Overall, the values in **Exhibit 5-2** suggest that requiring owners and operators to focus on prevention reduces costs to state financial assurance funds, on average, by over $160 million under the Selected Option, $230 million for Alternative 1, and $120 million for Alternative 2.

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198 We use the number of times a system is affected rather than the actual number of systems affected because we lack the data to determine which units are affected by each requirement. For example, if two requirements each affect 1,000 and 500 units, respectively, they may ultimately affect between 1,000 and 1,500 units, depending upon whether any overlap exists among the two regulated universes.

199 We calculate this as avoided costs due to avoided releases divided by number of releases avoided. The procedure is similar for avoided groundwater remediation costs.

200 We rely on the ASTSWMO Fund Survey Results 2012 for the data that underlie our construction of tiers. These data are available at: http://www.astswmo.org/publications_tanks.htm.

201 Due to our calculation methods, two states with very high deductibles (Minnesota and Virginia) showed deductible amounts and avoided releases that exceed their estimated avoided release costs. We exclude them from our calculations, such that our estimates for likely underestimate the potential for redistributive effects.

Exhibit 5-2

Summary Of State Financial Assurance Fund Distributional Effects

Fund Revenue Mechanisms	Selected Option ($ millions)	Alternative 1 ($ millions)	Alternative 2 ($ millions)
Low deductible scenario (High distributional effects)			
Tier 1 (petroleum & tank fee): average value *(range of all values in italics)*	$130 *($50 - $220)*	$200 *($91 - $290)*	$96 *($19 - $180)*
Tier 2 (tank fee only): average value *(range of all values in italics)*	$38 *($14 - $64)*	$58 *($27 - $85)*	$32 *($6.5 - $59)*
Total *(range of all values in italics)*	**$170** *($65 - $290)*	**$250** *($120 - $370)*	**$130** *($26 - $240)*
High deductible scenario (Low distributional effects)			
Tier 1 (petroleum & tank fee): average value *(range of all values in italics)*	$120 *($46 - $200)*	$180 *($86 - $260)*	$88 *($18 - $160)*
Tier 2 (tank fee only): average value *(range of all values in italics)*	$36 *($14 - $59)*	$55 *($26 - $80)*	$30 *($6.1 - $55)*
Total *(range of all values in italics)*	**$160** *($60 - $260)*	**$230** *($110 - $340)*	**$120** *($24 - $210)*

5.2.5 Economic Impact Summary

EPA's sensitivity analyses show that it is unlikely that the final UST regulation will have substantial negative economic impacts on the regulated community, in part because the costs of the regulation appear to be evenly distributed across a large population of facilities, and remain modest at the facility level. Even under a highly improbable worst-case scenario in which the smallest facilities incur the highest possible costs and would have no options for passing through any cost increases, approximately three percent of the universe of retail motor fuel facilities would face costs surpassing publicly-reported (and therefore likely understated) industry average profit margins. Any market exits under even this scenario would likely coincide with the current market exit rate of approximately 2,024 facilities annually, and would likely affect out-of-date facilities that are on the brink of exiting. Therefore, the regulation will not likely create a significant additional contraction of the total market.

A more likely response by affected firms will be to adapt by increasing prices on higher margin products and services. While overall employment impacts are unclear, it is possible that there may be an increase in labor demand due to the additional requirements placed on owners and operators, and additional demand for third-party testing services.

Finally, it appears that the final UST regulation could have a positive impact on state governments that currently fund a portion of UST-related remediation costs through gasoline taxes and fees. A decrease in the number and severity of releases represents cost savings to states due to decreased demand on state financial assurance funds. Our initial screening assessment suggests that annual costs to states could be reduced by over $160 million. This represents a reduction in a public subsidy and an improvement in market signaling.

5.3 Energy Impact Analysis

Executive Order 13211, *Actions Concerning Regulations That Affect Energy Supply, Distribution, Or Use* (May 18, 2001), addresses the need for regulators to consider the potential energy impacts of the final UST regulation and resulting actions. Under Executive Order 13211, agencies are required to prepare a Statement of Energy Effects when a regulatory action may have significant adverse effects on energy supply, distribution, or use, including impacts on price and foreign supplies. Additionally, the requirements obligate agencies to consider reasonable alternatives to regulatory actions with adverse effects and the impacts that such alternatives might have on energy supply, distribution, or use.

The final UST regulation affects underground storage tanks used in the storage of motor fuel or emergency generator fuel. However, it is unlikely that this regulation will have significant impacts on energy supply, distribution, or use. To assess the energy impacts of the final UST regulation, EPA considers potential changes in energy supply and use associated with the total costs estimated in Chapter 3. The following summarizes EPA's assessment of the energy impacts that the final UST regulation will have in energy supply, distribution, and use.

Energy Supply and Distribution

The final UST regulation consists of additional regulatory requirements that apply to the owners and operators of underground storage tanks. To the extent that the final UST regulation affects the motor fuel sector, it does so at the retail motor fuel sales level, rather than the level of refineries or distributors who supply the retail stations with motor fuel. Correspondingly, we do not expect the final UST regulation to have any impacts on energy supply or distribution.

In terms of local motor fuel availability, we believe two outcomes are possible. If a motor fuel station is located in an area where competition from other stations exists, fuel prices will not likely be affected. Rather, owners and operators will seek to recover the costs of the final UST regulation by increasing the prices of services or convenience items. If a station does not sell other products or services through which it can recover these costs, it may become subject to a significant economic impact. If this impact exceeds the profit margin of the facility, it may become unprofitable in the long term and exit the market. EPA's analyses suggests that the number of facilities likely to be affected is small, and supply will not be disrupted because sufficient supply from other competitors exists to meet demand.

We do not expect market exits to occur in low-competition environments due to the market power of stations and the marginal nature of the increase in cost. If a motor fuel station is located in an area where competition is not intense (e.g., a rural setting), it may opt to directly pass on higher costs through increases in fuel or convenience goods prices. As we discuss below, even if the entire cost of the regulation is priced through to consumers, the change in fuel prices is not likely to be measurable.

Energy Use

The additional regulatory requirements contained in the final UST regulation may increase compliance costs for owners and operators of retail motor fuel stations. If the owners and operators of retail motor fuel stations affected by the final UST regulation can successfully pass through their increased compliance costs, energy use may be affected through higher energy prices caused by the final UST regulation. However, we do not expect a significant change in retail gasoline prices to result from this regulation for the following reasons:

- Economic analyses of retail fuel prices have revealed that demand for gasoline is highly sensitive to price (elastic) within localized geographic areas. As a result, individual retailers are unlikely to raise gasoline prices because local customers will select other stations. Because the regulations do not affect facilities uniformly, widespread price increases are unlikely, and raising the price of gasoline can put individual retailers at a significant competitive disadvantage in local markets.

- Retail motor fuel stations often have associated stores and/or services, such as car washes, repair operations, and convenience outlets, on which they can more successfully pass through increases in compliance costs.

When considered in the context of total fuel consumption in the United States, the final UST regulation would represent a tiny fraction of motor fuel prices even if it was fully passed through to consumers. According to the Bureau of Transportation Statistics, the United States consumed 168,597,000,000 gallons of motor fuel (including gasoline and diesel) in 2011 at an average price of $3.73.[202] This implies that U.S. consumers spent $629 billion in 2012 on motor fuel. The overall cost of the final UST regulation is roughly $160 million, less than one-tenth of one percent of the amount spent by end-users on motor fuel in 2012. In comparison, an increase of $0.01 in the average price of motor fuel in 2012 would have increased the total cost to consumers by approximately $1.7 billion. Given these circumstances, the final UST regulation should not have a measurable impact on retail prices.

5.4 Regulatory Flexibility Analysis

The Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), 5 USC 601 et seq., generally requires EPA to prepare a regulatory flexibility analysis of any regulation subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute. This analysis must be completed unless the agency certifies that the regulation will not have a significant economic impact on a substantial number of small entities. If a regulation is found to have a significant impact on a substantial number of small entities, further analysis must be

[202] 2011 is the latest year data available from Bureau of Transportation Statistics for gallons of motor fuel consumed, as reported by: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics. Accessed at: http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_09.html. The 2012 prices per gallon for all grades of retail motor gasoline and No. 2 diesel fuel (all concentrations of sulfur) were $3.63 and $3.97, respectively, as reported by: U.S. Energy Information Administration. Short-Term Energy Outlook - Real and Nominal Energy Prices for 2012. Accessed at: http://www.eia.gov/forecasts/steo/realprices/. We weight these prices according to prime supplier sales volumes in 2012 published by the Energy Information Administration, which summed to 347,234.5 thousands of gallons per day for gasoline and 143,270.6 thousands of gallons per day for all grades of diesel fuel (U.S. Energy Information Administration. Petroleum & Other Liquids. Prime Supplier Sales Volumes. Accessed at: http://www.eia.gov/dnav/pet/pet_cons_prim_dcu_nus_a.htm.).

performed to determine what can be done to lessen the impact. Small entities include small businesses, small organizations, and small governmental jurisdictions. EPA developed a screening analysis and supplemental analysis consistent with the requirements under RFA; this section presents a summary of these findings, and Appendix L provides the detailed screening analysis.[203]

For purposes of assessing the impacts of this regulation on small entities, a small entity is defined as: (1) a small business as defined by the Small Business Administration's (SBA) regulations at 13 CFR Part 121.201; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field. For the purposes of this analysis, EPA considered costs in excess of one percent and three percent of revenues as indications that the final UST regulation may have a significant impact on a given small entity, and estimates of greater than 20 percent of total small firms or 1,000 total small firms affected as indications that a substantial number of small entities may be affected by the final UST regulation.

5.4.1 Small Business Screening Analysis

We estimate that there are approximately 79,700 firms operating roughly 148,000 facilities in the U.S. retail motor fuel sales sector. [204,205] This analysis assumes that all retail motor fuels firms operate underground storage tanks (UST systems) at all of their facilities. Based on the distribution of firms across revenue categories published by the 2007 Economic Census, and SBA's revenue thresholds for NAICS 447110 and 447190, approximately 77,400

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[203] This section focuses on the retail motor fuel sector. As discussed in Appendix L, EPA's screening assessment indicates that the proposed regulation would not have a significant impact on a substantial number of small entities (SISNOSE) across all affected sectors. Because the cost per tank associated with the final UST regulation ($232, in 2012 dollars) is lower than that associated with the proposed regulation ($309, in 2008 dollars), this conclusion also applies to the final UST regulation. However, because 80 percent of all UST systems are in the retail motor fuel sector, we refined the screening assessment to further examine the potential impacts of the final UST regulation on this sector.

[204] There was a significant discrepancy between the number of establishments reported by the 2007 Economic Census by the U.S. Census Bureau and the 2008 station count published by National Petroleum News. The Census reported 118,756 stations operating in any capacity, while NPN counted 161,768 stations. EPA contacted the Census Bureau, which offered three possible reasons for this discrepancy. First, grocery stores with gas stations and wholesale truck stops with gas stations may be categorized under grocery stores or wholesale retail instead of gas stations. Second, the count reported by the Census excludes non-employer establishments (10,131), which are family-owned and only employ family members. Third, for those establishments that do not report back to the Census regularly, the Bureau is not likely to record changes in establishments that have happened at the location (personal communication with the Office of Underground Storage Tanks, November 3, 2010). NPN likely provides a more accurate reflection of the number of stations because it is an industry publication specific to the petroleum sector. This rationale has been carried forward to employ the 2013 station count published by NPN.

[205] NAICS code 447 is comprised of 447110 (Gasoline stations with convenience stores) and 447190 (Other gasoline stations). To reconcile differing estimates of the number of retail motor fuel facilities (roughly 148,000 estimated by NACS in 2012 and roughly 119,000 estimated by the Census, excluding roughly 12,000 facilities reported as not operating for the full year), a 1.38 adjustment factor was applied to the Census data to inflate the number of retail motor fuel facilities to 148,000, distributed proportionately across revenue ranges. This approach preserves the distribution of firms by size according to Census data. As a result of this approach, we estimate that there are a total of approximately 79,700 firms and 455,000 tanks in the retail motor fuel sector.

(97 percent) of these firms meet SBA's definition of a small entity.[206] Approximately 4,781 of these firms report revenues between $0 and $250,000 (the smallest revenue range published by the 2007 Economic Census), with average sales of approximately $144,000.[207]

To determine whether firms reporting revenues within a given revenue range would incur costs exceeding one percent or three percent of total revenue, EPA compares the average total compliance cost per firm with the average revenue reported by firms in the revenue range. Based on a compliance cost per system of $232 (in 2012 dollars), and assuming that firms in the smallest revenue range own one facility with three UST systems, we estimate that the 4,781 small firms in the $0-$250,000 revenue range would face average total compliance costs of $715 per firm (or $658 in 2007 dollars).[208] Any firm with annual revenues above $65,800 (in 2007 dollars) (i.e., the revenue threshold at which compliance costs would exceed one percent of the firm's revenue) is not expected to experience a significant impact. The average revenue for the 4,781 firms in the $0-$250,000 revenue bin is $144,000, suggesting that on average, firms in this category will not experience significant impacts due to estimated compliance costs.

However, because the lowest range reported by the U.S. Census reflects a distribution of firms with revenues between $0 and $250,000, it is possible that some of the 4,781 firms in this category may be significantly affected. EPA also considers estimates of greater than 20 percent of total small firms or 1,000 total small firms affected as indications that a substantial number of small entities may be affected by the final UST regulation. While the 4,781 small firms in the lowest revenue range represent only six percent of all potentially affected small firms, EPA conducted a supplemental analysis that focuses on this group of small firms in an attempt to refine the estimated number of small firms potentially affected by the final UST regulation.

5.4.2 Small Business Supplemental Analysis

The purpose of this supplemental analysis is to refine the results of the small business screening analysis. The U.S. Census Bureau provided additional data on firms in the lowest revenue bins for NAICS sectors 447110 (gasoline stations with convenience stores) and 447190 (other gasoline stations), identifying the percentage of firms with revenues in three ranges: (1)

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[206] For 447110, the SBA revenue threshold is $27 million; for 447190, the SBA revenue threshold is $9 million. To ensure that we do not underestimate the number of small entities, we assume that all firms within a revenue bin that contains a specific SBA revenue threshold value are small. For example, if the SBA small business size threshold for a sector is $7 million, we assume that all firms in the revenue range of $5 to $10 million are small.

[207] For simplicity we identify size categories in this document as described by the 2007 Census (e.g., revenues up to $250,000 in 2007 dollars), and identify compliance costs in 2012 dollars. However, in the actual screening analysis, compliance costs have been adjusted from 2012 dollars to 2007 dollars using the GDP implicit deflator. The estimated compliance cost is $232 per system in 2012 dollars, or $214 per tank in 2007 dollars. These costs exclude compliance costs associated with the removal of deferrals for AHFDSs and UST systems with FCTs. AHFDS and FCT systems are primarily owned by the Department of Defense and not by any small entities.

[208] Census data on number of facilities per firm indicate that virtually all firms earning less than $250,000 per year in 2007 had only one facility. We therefore use "firm" and "facility" interchangeably in this context.

$0-$50,000; (2) $50,000-$150,000; and (3) $150,000-$250,000.[209] Based on this information, we estimate the number of firms in the retail motor fuel sales sector (i.e., NAICS 447) for these three revenue groups at approximately 320, 2,000, and 2,500, respectively and use these data to refine our estimate of the number of significantly affected facilities.[210,211]

Given compliance costs of $658 per firm ($715 in 2012 dollars), any firm making less than $65,800 and $22,000 would be considered significantly affected at the one percent and three percent revenue thresholds, respectively. Under these assumptions, EPA estimates that 634 firms would be affected at the one percent threshold, and no firms would be affected at the three percent threshold.[212] The number of firms that would be significantly affected at the one percent threshold under these assumptions does not exceed the one thousand-firm substantial effect benchmark. Furthermore, this conclusion rests on the assumption that even these small firms operate the industry average of three tank systems.

5.4.3 Impacts to Small Governments

The *1992 Local Government Economic Impact Analysis* provides the best readily-available data on the number of governments owning UST systems, total UST systems owned by governments, average UST systems per government, and UST systems per owning government. The data include size and revenue for both general purpose (i.e., counties, municipalities, and townships) and special district governments (i.e., school districts and other special districts), dividing these governments into four size categories: very large, large, medium and small. The 1992 analysis defines a "very large" government as one that serves over 50,000 people; therefore, all other entities are considered to be small governmental jurisdictions according to the RFA/SBREFA definition. Using the data from the 1992 analysis, we estimate the number of

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[209] The information provided by the U.S. Census Bureau is considered an "unpublished data request." As such, the Census Bureau included a letter noting that "these are not 'official data' from the Census Bureau, since they do not meet the Census Bureau's quality standards. These data should be used with extreme caution, realizing the severe quality limitations that may exist." However, absent another source of information, we use this as the best data available. (This information was provided in January 2010 and relates to the 2002 Economic Census data. We use the 2002 distribution within this revenue range as a proxy for the 2007 Economic Census data.)

[210] The analysis interpolates between the lower and upper bounds of each range and assumes a uniform distribution of facilities within each range. The lowest revenue interval is bounded at $39,600, which EPA obtains from estimating the linear trend between the zero and $250,000 in revenues. The implicit assumption is that no facilities earn less than that level of revenue

[211] Although the U.S. Census Bureau reports several hundred facilities with annual revenues less than $100,000, market economics suggest that it would be difficult for a firm that relies solely on gasoline sales to be viable if earning less than $100,000 in annual revenues. Assuming $2 per gallon in sales, a facility earning $100,000 would sell less than 4,200 gallons of gasoline per month, compared with the monthly industry average throughput of approximately 130,000 gallons. Based on information from a mid-size retail fuel marketer, EPA believes that a facility requires a minimum throughput of approximately 30,000 gallons per month to remain economically viable. In addition, a facility would need $108,000 to generate enough gross profit to cover the direct cost of the wages of one full-time employee at minimum wage ($15,080 at $7.25 per hour and 2,080 hours, before accounting for employment taxes). This does not consider other costs, such as electricity, property taxes, or franchise fees.

[212] EPA estimates a total of approximately 104,000 small firms with USTs across all affected sectors; 634 is 0.6 percent of these. In NAICS 447, the 634 firms represent 0.8 percent.

small governments that own UST systems based on the total universe of UST systems today. See Appendix L for additional detail.

EPA assumes that local governments collectively own four percent of active tanks. This equates to 23,119 tanks, based on the fiscal year 2013 universe of 577,981 tanks.[213] These 23,119 tanks are distributed among all local governments, based upon the percentage of tanks owned in 1992 by local governments in each size category (the average number of tanks owned by a government varies with the size of the government from one tank for small governments to 10 or more tanks for the largest governments).

EPA then calculates, using the 1992 data on government ownership of UST systems, the average compliance cost per government entity. This is done by multiplying the cost per tank by the number of UST systems per government by size category. The average annual revenue for each size of general purpose government is calculated using 2007 Census of Governments Data and weighted-average contributions that depend on type of entity (i.e., towns, municipalities, and counties). EPA extrapolates Census data on revenues for 4,128 townships to the 16,519 townships in the country. These weighted averages are combined to obtain annual revenues in 2007 dollars for general purpose governments, then inflated to 2012 dollars. Detailed information at the special district level is not available for later years, so budget expenditures from the 1992 analysis were inflated into 2012 dollars.[214]

To calculate how many small governments face significant compliance costs exceeding one or three percent of their revenues, we compared the average compliance cost per government with the average annual revenues to determine how many exceed either threshold. At a cost of $232 (2012 dollars) per UST system, no small governments are affected under either the one percent or three percent revenue threshold (see **Exhibit 5-3**). Correspondingly, EPA does not find that the final UST regulation has any significant impact on a substantial number of small governments.

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[213] We adjusted the estimates of local government UST systems from the *1992 Local Government Economic Impact Analysis* using the 2007 Census of Governments. See: ICF. "Economic Impact Analysis of Additional Mechanisms for Local Government Entities to Demonstrate Financial Responsibility for Underground Storage Tanks." December 1992. Exhibit 3-1. Consistent with this analysis, the number of government UST systems is assumed to be one percent of all 2013 UST systems for state and federal governments and four percent of all 2013 UST systems for local governments.

[214] Typically, a RFA/SBREFA screening assessment uses revenues to assess economic impact measures for small governments. In the absence of detailed 2007 data, we use 1992 budget expenditures as a proxy for revenues.

Exhibit 5-3 Compliance Costs To Systems Owned By Governments								
Type of Gov't	**Size of Gov't[b]**	**UST Systems Per Owning Gov't[c]**	**Number of Gov'ts Owning Tanks[d]**	**2007 Est. Number of Gov'ts [e]**	**Average Annual Revenue ($2007) [f]**	**Average Cost Per Gov't ($2007) [g]**	**Gov'ts Exceeding 1% of Revenue**	**Gov'ts Exceeding 3% of Revenue**
General Purpose[a]	Very Large	10.2	505	1,463	$363,822,312	$2,182	0	0
	Large	2.5	1,429	4,044	$41,098,521	$535	0	0
	Medium	1.4	1,365	7,832	$10,029,870	$300	0	0
	Small	1.1	990	25,706	$2,045,340	$235	0	0
	Subtotal	2.7	4,289	39,044				
Special Purpose	Very Large	3.7	317	970	$496,958,943	$792	0	0
	Large	3.6	1,798	5,546	$60,843,018	$770	0	0
	Medium	1.4	2,503	14,127	$2,918,747	$300	0	0
	Small	1.0	244	29,789	$147,494	$214	0	0
	Subtotal	2.4	4,863	50,432			0	0
Overall	Total	2.5	9,152	89,476			0	0

[a] General Purpose governments include counties, municipalities and townships. Special Purpose governments include public school systems and special districts.
[b] Very large governments are considered to serve more than 50,000 people. Large governments are considered to be those that serve between 10,000 and 50,000 people, medium governments as those that serve between 2,500 and 10,000 people, and small governments as those that serve 2,500 or fewer people. According to RFA/SBREFA, small governmental jurisdictions have populations under 50,000. Therefore, all sizes of governments except for "very large" are considered to be small.
[c] From 1992 *Local Government Impact Analysis* data.
[d] Calculated as number of tanks (adjusted 1992 distribution in each size category to reflect FY 2013 tank numbers) divided by UST systems per owning government (c).
[e] General purpose and Special Purpose total number of entities from 2007 Census of Governments, size distribution extrapolated from 1992 *Local Government Impact Analysis* data.
[f] General purpose estimates from 2007 Census of Governments; Special Purpose estimates inflated from 1992 *Local Government Impact Analysis* data.
[g] Calculated as number of systems per government (c) * estimated cost per tank ($215 in $2007 or $232 in $2012).

5.5 Screening Analysis to Inform Impacts on Minority and Low-Income Populations

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629, February 16, 1994) directs federal agencies, to the greatest extent practicable and permitted by law, to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States.

To inform us about the socioeconomic characteristics of communities potentially affected by the regulation, EPA conducted a screening analysis in 2010 to examine whether a statistically significant disparity exists between socioeconomic characteristics of populations located near UST facilities and those that are not.[215] The results indicate that minority and low-income populations are slightly more likely to be located near UST facilities. An environmental justice analysis would then require an assessment of whether there would be disproportionate and

[215] Note that the affected populations identified in the screening analysis summarized here are simply defined by specific demographics surrounding UST locations. These affected populations are not necessarily equivalent to communities that others have specifically identified as "environmental justice communities."

adverse impacts on these populations. However, because all regulatory options considered in this regulation would increase regulatory stringency and reduce the number and size of releases, EPA does not anticipate that the final UST regulation will have any disproportionately high and adverse human health or environmental effects on these minority or low-income communities, or on any community. While resource constraints make it impractical to update this analysis with newer location data, it is unlikely that marginal changes in sample facility locations would affect the results of the analysis.

5.5.1 Risk Assessment Population Analysis

To characterize the extent of human health risk reductions anticipated under the final UST regulation, EPA conducted a screening-level analysis of the likely impact of the regulation on benzene-related cancer incidence.[216] This analysis used location data for nearly 60,000 U.S. gas stations with UST systems using an ESRI Business Analyst database, and examined populations within a buffer distance of 1,000 feet of facilities with UST systems. The ESRI gas station location data are supplemented with 1,600 UST systems in Indian country, based on location information compiled from EPA regional Indian country databases. After elimination of duplicates, the data set contains 59,945 UST facilities (including 727 in Indian country) (see **Exhibit 5-4**). The total data set represents over 25 percent of the roughly 200,000 active facilities with UST systems.[217]

To estimate populations near sample facilities, the analysis uses a "synthetic population" dataset developed by the Modeling of Infection Diseases Agents Study (MIDAS) to provide population estimates at a finer spatial resolution than Census blocks, while maintaining the accuracy of aggregate demographic data at the 2000 Census block group level. For more detail on this method, see Appendix M.

The modeled fate and transport of pollutants under a range of scenarios indicates that the contamination from UST releases do not typically exceed 1,000 feet.[218] The risk assessment considered population density within 1,000 feet of each UST, and incorporated estimates of the use of groundwater for drinking and bathing, along with typical exposure scenarios, to characterize the change in population risk likely to be associated with the reduction of 2,821 releases and groundwater incidents that were estimated in 2010 (i.e., the total estimated number of avoided releases and groundwater incidents resulting from the final UST regulation). The risk assessment concluded that the final UST regulation will result in a very small reduction in

[216] RTI International. "Risk Analysis to Support Potential Revisions to Underground Storage Tank (UST) Regulations." December 22, 2010.

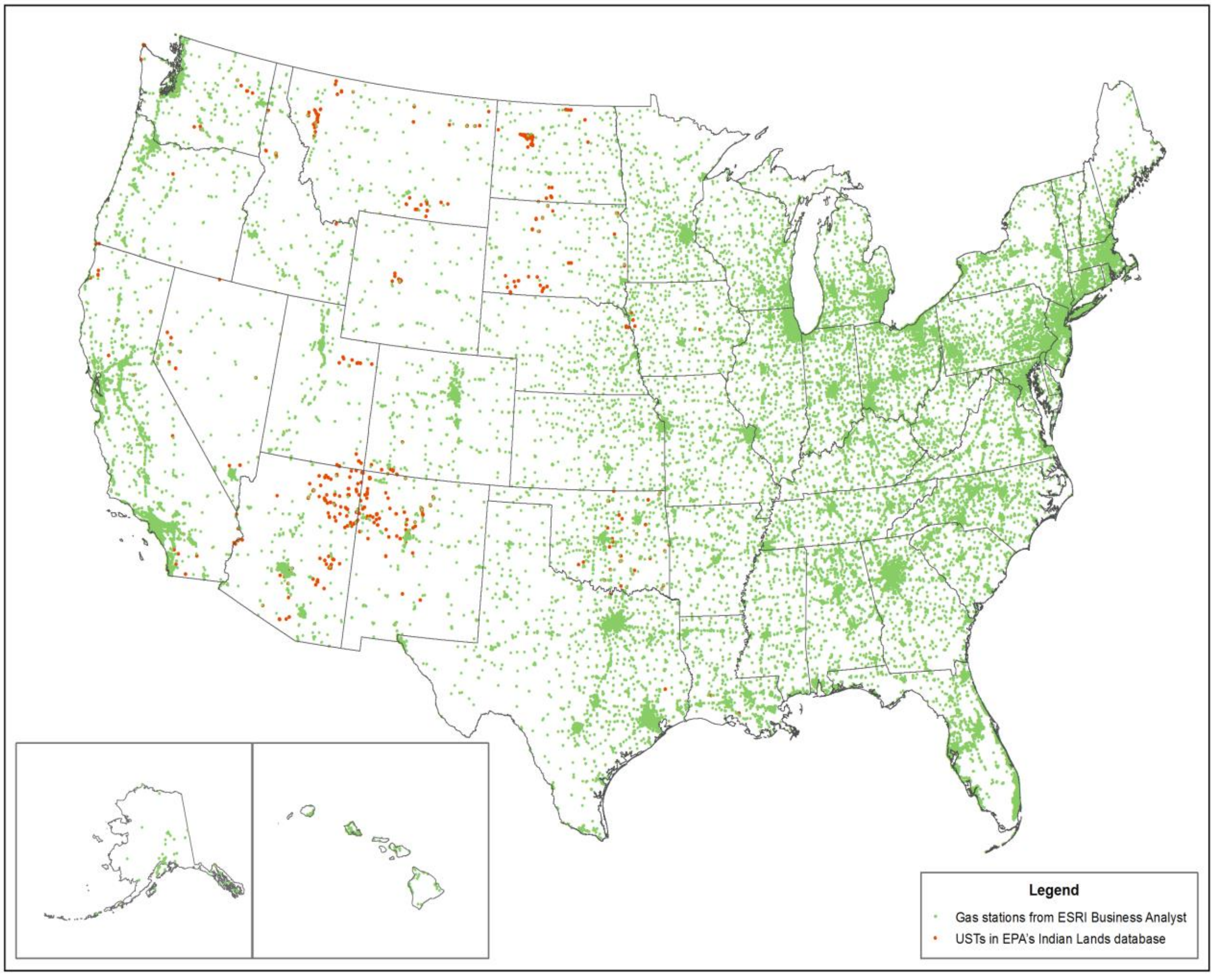
[217] ESRI. "2009 Methodology Statement: ESRI Data—Business Locations and Business Summary." ESRI, Redlands, CA. Accessed at: http://www.esri.com/library/whitepapers/pdfs/infousa-business-database.pdf. ESRI data are derived from an infoUSA database. The approach for compiling business data for this database is documented on the infoUSA website (http://www.infousa.com), and includes systematic compilation of public record, phone books, business directories, and includes frequent review for new, updated, and relocated businesses. While this methodology does not capture all locations, it is not differentially focused on any specific region or information source, and therefore likely represents a reasonable spatial distribution of facilities.

[218] RTI International. "Risk Analysis to Support Potential Revisions to Underground Storage Tank (UST) Regulations." December 22, 2010.

population risk related to cancer from benzene exposure, based on the estimated number and volume of avoided releases and groundwater incidents.

Exhibit 5-4

UST Location Data Used In Analysis. (See Appendix M for details on data sources.)



5.5.2 Demographic Analysis

The demographic analysis expands on the population data near the 59,945 gas stations in the risk assessment by characterizing demographic features of populations at each site and comparing these populations to larger (county-level) reference populations.[219] Specifically, the analysis examines the following demographic variables: percent in poverty, percent minority, and, as a verification step, percent white alone (the percentage of the population that specified their race as “white” and did not specify “Hispanic”). The analysis also identifies percent under five years old, percent under 18 years old to support the analysis required under Executive Order 13045, “Protection of Children from Environmental Health Risks and Safety Risks” (see section 5.6 below). The analysis considers the significance of the “difference in means” and “difference in median” values for each census parameter and each community. That is, the analysis identifies the differences between mean and median concentrations of each demographic group for the affected and reference populations at each of the 59,945 sites, and examines whether the differences identified across all sites are statistically different from what would be expected in a random distribution.[220]

The analysis considers the differences in demographics in two ways: unweighted (each site is given equal weight) and population weighted (results are weighted by affected persons, giving sites with larger populations more weight). A statistically significant positive difference indicates a greater percentage of target demographic in the affected population than in the larger reference population. A statistically significant negative difference indicates a smaller percentage of the target demographic in the affected population. **Exhibit 5-5** provides the unweighted results of the analysis and generally finds that minority and low-income demographics constitute a slightly larger proportion of the population surrounding UST facilities. For example, poor populations account for 13.3 percent of the population near an UST, compared with 12.2 percent of the reference (county) population. As **Exhibit 5-6** shows, although the difference is small, it is also highly statistically significant (with a p-value below .001), which suggests that the difference between the values is not a random occurrence. **Exhibits 5-7 and 5-8** summarize the results of the population-weighted analysis, and generally find slightly larger (but still small) effects.

[219] County-level statistics provide a useful comparative measure for the populations at the local facility level. Given that the area of interest is small (i.e., 1000 feet of a facility), the county-level provides an appropriate scale for comparison.

[220] See Appendix M for the complete demographic screening analysis.

Exhibit 5-5

Summary Results For Census Parameters – Unweighted

Census Parameter	Characteristics of Affected Population (1,000 ft Buffer around UST Facility)		Characteristics of Reference Population (Counties where UST Facilities are Located)		Difference between Affected Population and Reference Population			
							95% Confidence Interval of Mean Difference	
	Mean	Median	Mean	Median	Mean	Median	Lower Bound	Upper Bound
Percent White Alone	70.3	81.3	70.8	74.8	-0.44	1.29	-0.61	-0.27
Percent Under Age 5	6.7	6.5	6.7	6.7	-0.05	-0.12	-0.068	-0.032
Percent Under Age 18	24.7	24.9	25.6	25.5	-0.84	-0.54	-0.99	-0.68
Percent in Poverty	13.3	10.3	12.2	11.5	1.1	-0.64	0.99	1.13
Percent Minority	24.0	14.6	23.8	20.9	0.21	-1.48	0.06	0.36

Note: Difference summary statistics (mean and median) were calculated from the distribution of difference values (i.e., one result per facility, yielding a distribution of about 60,000 results). Mean values reflect the entire distribution, whereas the median values are based only on the 50th percentile result. For this reason, the mean difference results could also be calculated simply by subtracting the reference community mean from the potentially affected community mean (e.g., for mean percent poverty 13.3 – 12.2 = 1.1). In contrast, the median difference values do not necessarily match values derived by subtracting the median values from the underlying distributions (e.g., for median percent poverty 10.3 – 11.5 ≠ -.64). Although the primary results of the analysis are based on mean values, median results are provided for completeness and as an alternative indicator of the distributions' central tendency.

Exhibit 5-6

Standard Error, T Test, And Risk Ratio Results – Unweighted

	Characteristics of Affected Population (1,000 ft Buffer around UST Facility)	Characteristics of Reference Population (Counties where UST Facilities are Located)	Difference between Affected Population and Reference Population				
Census Parameter	SE of Mean	SE of Mean	SE of Mean	T Statistic	p-value	Ratio	SE of Ratio
Percent White Alone	0.120	0.088	0.085	-5.23	<0.001	0.99	0.001
Percent Under Age 5	0.010	0.004	0.009	-5.18	<0.001	0.99	0.001
Percent Under Age 18	0.104	0.071	0.079	-10.59	<0.001	0.97	0.001
Percent in Poverty	0.045	0.023	0.038	27.66	<0.001	1.09	0.003
Percent Minority	0.104	0.071	0.079	2.71	0.0067	1.01	0.003

Note: There are >56,033 degrees of freedom for this test (i.e. number of facilities). Note that the total number of facilities in the dataset (59,945) differs from the degrees of freedom, because a fraction of facilities have no people living within the 1000 foot buffer.

Exhibit 5-7

Summary Results For Census Parameters – Weighted By Population

Census Parameter	Characteristics of Affected Population (1,000 ft Buffer around UST Facility)		Characteristics of Reference Population (Counties where UST Facilities are Located)		Difference between Affected Population and Reference Population			
							95% Confidence Interval of Mean Difference	
	Mean	Median	Mean	Median	Mean	Median	Lower Bound	Upper Bound
Percent White Alone	53.88	59.63	58.79	57.70	-4.61	-2.55	-5.0	-4.2
Percent Under Age 5	6.91	6.78	6.80	6.85	0.11	0.04	0.073	0.14
Percent Under Age 18	24.74	24.91	25.36	25.53	-0.62	-1.57	-0.73	-0.50
Percent in Poverty	16.22	13.34	13.33	12.83	2.89	0.96	2.7	3.1
Percent Minority	36.61	29.54	33.16	31.92	3.45	0.58	3.1	3.8

Note: Difference summary statistics (mean and median) were calculated from the distribution of difference values (i.e., one result per facility, yielding a distribution of about 60,000 results). Mean values reflect the entire distribution, whereas the median values are based only on the 50th percentile result. For this reason, the mean difference results could also be calculated simply by subtracting the reference community mean from the potentially affected community mean (e.g., for mean percent poverty 16.2 – 13.3 = 2.9). In contrast, the median difference values do not necessarily match values derived by subtracting the median values from the underlying distributions (e.g., for median percent poverty 13.3 – 12.8 ≠ -0.96). Although the primary results of the analysis are based on mean values, median results are provided for completeness and as an alternative indicator of the distributions' central tendency.

Exhibit 5-8

Standard Error, T Test, And Risk Ratio Results – Weighted By Population

Census Parameter	**Characteristics of Affected Population (1,000 ft Buffer around UST Facility)**	**Characteristics of Reference Population (Counties where UST Facilities are Located)**	**Difference between Affected Population and Reference Population**				
	SE of Mean	**SE of Mean**	**SE of Mean**	**T Statistic**	**p-value**	**Ratio**	**SE of Ratio**
Percent White Alone	0.288	0.193	0.205	-22.48	<0.001	0.92	0.0035
Percent Under Age 5	0.020	0.008	0.017	6.24	<0.001	1.02	0.0026
Percent Under Age 18	0.065	0.033	0.058	-10.62	<0.001	0.98	0.0023
Percent in Poverty	0.108	0.063	0.085	34.02	<0.001	1.22	0.0064
Percent Minority	0.255	0.165	0.191	18.05	<0.001	1.10	0.0058

Note: There are >56,033 degrees of freedom for this test (i.e. number of facilities). Note that the total number of facilities in the dataset (59,945) differs from the degrees of freedom, because a fraction of facilities have no people living within the 1000 foot buffer.

Overall, the demographic analysis identifies a small but statistically significant difference between minority and low-income populations near UST systems and in the reference communities. Minority and poverty-level demographics are present at greater percentages in the vicinity of UST facilities. In contrast, a small *negative* relationship suggests that "white alone" populations are less likely to be near UST systems, i.e., minority populations are marginally more likely to reside near UST facilities. Moreover, while the unweighted analysis does not find clear patterns related to children under 18 and children under five, the population-weighted analysis finds that the distribution of all target demographics around UST facilities reflects small but significant differences from county-level populations. The population-weighted results show greater differences, suggesting that facilities in higher population areas tend to have more pronounced disparities between local, potentially affected communities and reference (county-level) communities. These differences, while small, are statistically significant with p-values less than 0.01 in all cases. This result implies that any risk reductions associated with the final UST regulation will occur in the context of a baseline condition in which minority and low-income populations are disproportionately located near USTs.

5.5.3 Summary and Limitations of the Analysis

This section summarizes a screening assessment and does not present a complete environmental justice analysis. The assessment is limited by the fact that demographic data from the U.S. Census are at the block group level, and are not as precise as the spatial distribution of population. As a result, if the demographic distribution of populations within block groups is uneven, the block group-level data may not accurately characterize populations living nearest to UST locations. The large sample of 59,945 sites, however, reduces the potential that this uncertainty could skew the results of the analysis (relative to a smaller sample of sites).

Given the results of the screening analysis, because all regulatory options considered in this regulation would increase regulatory stringency and reduce the number and size of releases, EPA does not anticipate the final UST regulation to have any disproportionately high and adverse human health or environmental effects on these minority or low-income communities, or on any community. Since the final UST regulation is not anticipated to create any new adverse human health or environmental impacts, EPA did not conduct a complete environmental justice analysis.

5.6 Children's Health Protection Analysis

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (62 FR 19885, April 23, 1997), applies to any regulation that: (1) is determined to be "economically significant" as defined under E.O. 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety effects of the planned regulation on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

This action may be subject to Executive Order 13045 because it is economically significant as defined in Executive Order 12866. EPA's screening-level risk assessment examines potential impacts to groundwater and subsequent chemical transport, exposure and risk. While the risk assessment did not specifically measure exposure to children, the general exposure scenarios reflect four exposure pathways that have the most significant potential for human health impacts. These are:

- ingestion of chemicals in groundwater that have migrated from the source area to residential drinking water wells
- inhalation of volatile chemicals when showering with contaminated groundwater
- dermal contact with chemicals while bathing or showering with contaminated groundwater
- inhalation of vapors that may migrate upward from contaminated groundwater into overlying buildings

Adults and children can potentially be exposed through all four exposure pathways considered. For adults, inhalation of vapors while showering is the most significant adult exposure pathway; for children, ingestion is the most significant pathway, because children are assumed to take baths and are therefore not exposed through shower vapor inhalation. As a result of the longer exposure from showering, adults may be the more sensitive receptor for cancer effects compared to children, particularly those under five who are assumed to take more baths and fewer showers.[221]

While the screening level risk assessment is limited in that it only examines benzene impacts, the final UST regulation would likely reduce other contaminant exposures to children in a similar pattern, and would not create significant adverse impacts on children's health.

The screening-level demographic analysis described in section 5.5 finds a statistically significant result that children under the age of 18 and children under the age of five are slightly *less* likely to be found in the vicinity of UST facilities. This suggests that the impacts of the final UST regulation will not have a disproportionate impact on children's health. Moreover, because all regulatory options would increase regulatory stringency and reduce the number and size of releases, EPA does not expect the final UST regulation to have any disproportionate adverse impact on children.

[221] U.S. Department of Health and Human Services. Public Health Service. Agency for Toxic Substances and Disease Registry. "Toxicological Profile for Polycyclic Aromatic Hydrocarbons." August 1995.

Chapter 6. Other Statutory and Executive Order Analyses

As required by applicable statutes and executive orders, this chapter summarizes our analysis of equity considerations and other regulatory concerns associated with the final UST regulation. This chapter assesses potential impacts, with respect to the following issues:

- **Regulatory planning and review**: requires examination and quantification of costs and benefits of regulating with and without the regulation.
- **Unfunded mandates:** examines the implications of the regulation with respect to unfunded mandates.
- **Federalism:** considers potential issues related to state sovereignty.
- **Tribal governments:** extends the discussion of federal unfunded mandates to include impacts on tribal governments and their communities.
- **Joint impacts of rules:** discusses how other regulations, together with the final UST regulation, will likely affect the universe of regulated facilities.

6.1 Regulatory Planning and Review

Under Executive Order 12866 (58 FR 51735, October 4, 1993), EPA, in conjunction with the Office of Management and Budget's (OMB's) Office of Information and Regulatory Affairs (OIRA), must determine whether a regulatory action is "significant" and therefore subject to OMB review and the full requirements of the Executive Order. The Order defines "significant regulatory action" as one that is likely to result in a regulation that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, the Agency has determined that this regulation is an economically significant regulatory action because it may have an annual effect on the economy of $100 million or more, as defined under part 3(f)(1) of the Order. Findings of the regulatory cost analysis (Chapter 3) indicate that the regulation will have aggregate annual compliance costs of approximately $160 million under the Selected Option, $290 million under Alternative 1, and $70 million under Alternative 2. Separately, this analysis concludes that the regulation is expected to have cost savings related to avoided costs of $120 million to $530 million under the Selected Option, $210 million to $670 million under Alternative 1, and $45 million to $420 million under Alternative 2. These cost savings effectively offset the entire cost of the regulation, resulting in a net beneficial impact on the economy. However, for the purpose of addressing Executive Order 12866, these cost savings are considered to be separate impacts rather than direct reductions in the total cost of the regulation.

6.2 Unfunded Mandates Analysis

Signed into law on March 22, 1995, the Unfunded Mandates Reform Act (UMRA) calls on all federal agencies to provide a statement supporting the need to issue any regulation containing an unfunded federal mandate and describing prior consultation with representatives of affected state, local, and tribal governments.

The final UST regulation is subject to the requirements of sections 202 and 205 of UMRA. In general, a regulation is subject to the requirements of these sections if it contains "Federal mandates" that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year. Because roughly 95 percent of conventional UST systems are privately owned, EPA estimates that the regulation will have approximately $130 million of costs to the private sector under the Selected Option, $270 million under Alternative 1, and $67 million under Alternative 2 in expenditures for the private sector and is thus subject to the following requirements of these sections.[222]

- An identification of the provision of Federal law under which the regulation is being promulgated.

- A qualitative and quantitative assessment of the anticipated costs and benefits of the Federal mandate;

    - Costs and benefits to State, local, and tribal governments and the private sector
    - Effect on health, safety, and the natural environment
    - Analysis of extent to which such costs may be paid with Federal financial assistance (or otherwise paid for by the Federal government)
    - Analysis of the extent to which there are available Federal resources to

[222] As described in Exhibit 2-3, the number of UST systems owned by state and federal governments is assumed to be two percent, and the number of UST systems owned by local governments is assumed to be four percent. Costs calculated as total compliance costs for conventional UST systems, and EGTs (including costs to read regulations), documented in Exhibit 3-8, net of local and state government compliance costs identified in Exhibit 6-2 below. As commercial airports are not typically privately-owned, we do not include them in private sector costs. However, commercial airports may be run by municipal or state-level organizations that are separately funded and/or may reflect public/private partnerships. Note that the costs to commercial airports are small enough ($1.2 million per year) that including them in the private sector does not change the total rounded private cost figures shown above.

carry out this mandate

- Estimates of future compliance costs with the mandate.

- Estimates of disproportionate budgetary effects on any type of government or segment of the private sector.

- Estimates of the effect on the national economy (if relevant and possible).

Exhibit 6-1 provides references for the analyses that EPA has performed that respond to these requirements.

Exhibit 6-1

Location Of Analyses Responding To UMRA Requirements

Requirement	**Location In This Document**
Identification of provision of federal law under which rule is being promulgated	Chapter 1
Assessment of costs and benefits to state, local, and tribal governments and the private sector	Chapters 3 and 4
Assessment of the effect on health, safety, and the natural environment	Chapter 4
Assessment of the extent to which such costs may be paid with federal financial assistance	Chapter 3; no Federal assistance is anticipated
Assessment of the extent to which there are available federal resources to carry out this mandate	Chapter 3; no Federal resources are anticipated
Estimates of future compliance costs	Chapter 3
Estimates of disproportionate budgetary effects on any type of government or private sector segment	Chapter 5
Estimates of the effect on the national economy	Chapters 3 and 5

6.3 Federalism Analysis

Executive Order 13132, *Federalism* (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure "meaningful and timely input by state and local officials in the development of regulatory policies that have federalism implications." "Policies that have federalism implications" is defined in the Executive Order to include regulations that have "substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government." EPA typically considers a policy to have federalism implications if it results in the expenditure by State and/or local governments in the aggregate of $25 million or more in any one year.

Under Executive Order 13132, EPA may not issue a regulation that has federalism implications, that imposes substantial direct compliance costs, and that is not required by statute, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by State and local governments, or EPA consults with State and local officials early in the process of developing the regulation.

Exhibit 6-2 summarizes annual government costs. Direct compliance costs for local and State governments reflect average costs per UST system; the analysis assumes that states collectively own one percent of total UST systems (5,780), and local governments own 23,119 UST systems (four percent).

In addition, under the final UST regulation, each state will incur labor costs for reading the new regulations, applying for State Program Approval (SPA), and processing one-time notification of existence for AHFDSs, and FCTs. States that do not already require notification of UST ownership change will also incur costs to process and review all ownership change notifications. (See discussion in Chapter 3, Section 3.6.)

In this scenario, total costs to all affected state and local governments (including direct compliance costs, notification costs, and state program costs) are approximately $6.8 million under the Selected Option, $14 million under Alternative 1, and $3.6 million under Alternative 2 in 2012 dollars; this is not considered to be a substantial compliance cost under federalism requirements.[223]

Exhibit 6-2

Summary Of Annual State And Local Government Costs [b]

Element	Selected Option ($ millions)	Alternative 1 ($ millions)	Alternative 2 ($ millions)
Local Compliance Costs [a]	$5.4	$11.0	$2.8
State Compliance Costs [a]	$1.3	$2.9	$0.70
State Government Administrative Costs	$0.12	$0.12	$0.12
Total State and Local Governments Costs [c]	**$6.8**	**$14.0**	**$3.6**

[a] State and local government compliance costs are included in the total compliance costs presented in Exhibit 3-8.
[b] Cost estimates were derived using a seven percent discount rate.
[c] Total may not sum due to rounding.

6.4 Tribal Governments Analysis

Executive Order 13175, *Consultation and Coordination With Indian Tribal Governments* (65 FR 67249, November 9, 2000), requires EPA to develop an accountable process to ensure "meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications." EPA has concluded that this action will have tribal implications to the extent that tribally-owned entities with UST systems on Indian country would be affected. However, it will neither impose substantial direct compliance costs on tribal governments, nor preempt Tribal law.

The data sources for the Indian country analysis are the same as those used in the small business analysis. Based on a review of information available about the types of business entities

[223] If all applicable state and local government costs were incurred in the first year, rather than annualized and discounted, state and local governments would incur approximately $3.8 million in costs under the Selected Option. This includes $0.2 million for states to apply for state program approval and to read the regulations, $0.2 million for states to process one-time notifications of AHFDSs and FCTs and ownership changes that occur in the first year, and $3.6 million for state and local government owners and operators of UST systems to comply with requirements that come into effect in the first year (approximately 80% of which would be for state and local government owners and operators to read the final UST regulation).

in Indian country, it is assumed that UST systems in Indian country represent a subset of the rest of the universe and are distributed similarly across the same sectors.[224] The total number of UST systems in Indian country is distributed proportionally among the NAICS sectors.

The cost per UST system is higher in Indian country, as the universe is smaller, and all UST systems are assumed to incur costs associated with all the requirements of the final UST regulation. At a 2012 cost of $734 per UST system, the total cost for UST systems in Indian country is approximately $1.9 million. EPA data indicates that 35 percent of all UST systems in Indian country are tribally-owned; correspondingly, the total cost to owners and operators of tribally-owned UST systems is approximately $0.67 million.

EPA consulted with tribal officials early in the process of developing this regulation to engage them to have meaningful and timely input into its development. EPA began its consultation with tribes on possible changes to the UST regulation shortly after the passage of the Energy Policy Act of 2005 (EPAct). EPAct directed EPA to coordinate with tribes to develop and implement an UST program strategy in Indian country to supplement the program's existing approach. EPA and the tribes worked collaboratively to develop this tribal strategy.

EPAct also included key provisions that apply to states receiving federal funding but the Act did not specify Indian country. Nonetheless, EPA's goal is to implement the objectives of these provisions in Indian country as an important step in achieving more consistent program results in release prevention. Both EPA and tribes recognize the importance of having policies that can help to ensure parity in program implementation between states and in Indian country. EPA committed to the tribes that we would fully implement the new provisions of the EPAct, and the final UST regulation will realize that commitment.

In addition to our early consultation with the tribes, EPA again reached out to the tribes as we started the official regulatory process and throughout the development of the UST regulation. EPA sent letters to leaders of over 500 tribes, as well as to tribal regulatory staff, inviting their participation in developing the regulation. EPA heard from both tribal officials who work as regulators as well as representatives of owners and operators of UST systems in Indian country. The tribal regulators raised concerns about ensuring parity of environmental protection between states and Indian country.

The changes to the UST regulation under this regulation are needed to ensure parity between sites in states and in Indian country. The final UST regulation will ensure equipment is not just installed but is working properly and protects the environment from potential releases.

6.5 Joint Impacts of Rules

Executive Order 12866 requires that the Agency review whether the regulation creates "a serious inconsistency" or otherwise interferes "with an action taken or planned by another agency." We do not believe that the regulation creates a serious inconsistency or interferes with

[224] For more detail, see: Industrial Economics, Inc. "Detailed Assessment of UST Universe by Tank Purpose and Design." Work Assignment 1-25, Task 6, March 24, 2009. Note that because tribal ownership and operation is defined differently than other types of government ownership, no attempts are made to isolate or identify "government" UST systems in Indian country.

any other actions planned or undertaken by other agencies. The following are the existing regulations that currently affect UST systems:

- **State UST Regulations:** A number of states have existing UST regulations that are more demanding than existing regulations under 40 CFR Part 280. To the extent that these policies are at least as demanding as the regulations under consideration, the systems in these states may already be in partial or full compliance with portions of the regulation. Chapter 2 identifies the number of UST systems in states with existing (baseline) regulations; cost estimates in Chapter 3 reflect the state regulatory programs that exist in the baseline.

- **SPCC Regulation:** Currently, a subset of UST systems in the universe is regulated by the Spill Prevention, Control, and Countermeasure regulation (SPCC); these include emergency generator tanks, airport hydrant fuel distribution systems and UST systems with field-constructed tanks. Specifically, the SPCC regulation in 40 CFR Part 112 apply to above-ground containers and completely buried tanks that are not otherwise covered by 40 CFR Part 280. SPCC regulation does not specify particular leak detection protocols, but require that plans conform to industry standards, which can often be consistent with the requirements of the regulation. To the extent that the requirements imposed on these UST systems via the regulation are more or less stringent than the SPCC regulation currently governing them, the regulation may cause an increase or a reduction in overall inspection and monitoring requirements (and costs) for these UST systems. To account for this, EPA has generated baseline assumptions for these systems using information from the Department of Defense (the owner of the majority of all FCTs and AHFDSs). EGTs are assumed to incur all incremental costs beyond state regulatory baseline costs; to the extent that these systems are regulated under SPCC, this may overstate costs.

Chapter 7. Comparison of Costs, Benefits, and Other Impacts

This chapter compares the costs, cost savings, and benefits of the final UST regulation. Cost-benefit analysis is a useful tool for economic assessments. It is used to evaluate the economic efficiency of environmental policies by measuring their costs and benefits, and hence their net impacts on society. However, adherence to a strict cost-benefit approach provides an incomplete assessment of the effects of the final regulation for two reasons, described below.

A traditional cost-benefit comparison weighs society's willingness to pay for the benefits of a regulation against the opportunity costs of the regulation. In the case of leaking USTs, though, cleanup of releases is required under RCRA Subtitle I. Therefore, although avoided remediation costs are not a measure of willingness to pay, under the current statutory and regulatory baseline, a sufficient condition for the final UST regulation to improve economic efficiency would be if the expected avoided remediation costs exceed the costs. As discussed in Chapter 4, avoided costs provide a reasonable measure of one set of positive effects of the final UST regulation. Even if avoided remediation costs do not exceed the cost of the regulation, economic efficiency could be enhanced because this analysis does not quantify additional social benefits such as improved water quality.

A traditional cost-benefit comparison also does not consider important distributional issues (e.g., what particular groups of people bear specific benefits or costs). A key effect of the final UST regulation is to reallocate costs from the public to responsible parties. As we discussed in Chapter 5, avoided remediation costs could reduce demand on state financial assurance funds by over $160 million per year.

This chapter uses two approaches to assess the effectiveness of the requirements. First, we compare the compliance costs of the final UST regulation with its total monetized avoided costs (section 7.1). We then consider cost-effectiveness measures which provide estimates of expenditures per unit reduction of releases achieved by the final UST regulation (section 7.2).

EPA's analysis shows that the final UST regulation will likely provide a net cost savings to society, but the cost-benefit and cost-effectiveness analyses presented here provide an incomplete estimate of benefits, because the final UST regulation is expected to provide other benefits that are not expressed in monetary terms. In addition, the avoided remediation costs associated with the regulation represent an equity-enhancing effect because the demand for publicly-funded remediation is reduced; all else held constant, the increased compliance costs will fall on the specific operators who are not currently implementing the practices and technologies identified in the regulation. This may result in some facilities bearing additional costs, but should improve overall equity and efficiency by ensuring that operators who are adhering to best practices already (in the baseline) are not at a competitive disadvantage because other operators rely on the availability of publicly-funded remediation.

OMB Circular A-4, numerous statutes, and Executive Orders require EPA to consider not only the costs and benefits of the regulation but also distributional impacts (e.g., impacts on minority and low-income populations, children's health, and energy distribution). As such, the final regulatory decision is a policy judgment that must take into account a number of factors in addition to the benefits and costs.

In addition, the selection of a discount rate for estimating the present value of future costs and benefits is a complex issue. To reflect a range of possible future costs and benefits, we present two estimates of discounted costs and benefits (section 7.3); one based on a seven percent discount rate, and one based on a three percent discount rate.

7.1 Cost Benefit Comparison

In this section, we compare the total costs of the regulation with its total monetized and non-monetized avoided costs and benefits. **Exhibit 7-1** summarizes total costs and monetized avoided costs of the final UST regulation. The costs in the exhibit represent the compliance costs of the final UST regulation, including state government administrative costs.

The exhibit also identifies the social benefits of the proposed requirements that are not captured in avoided costs. As discussed in Chapter 4, a number of benefits could not be monetized. These include groundwater protection, mitigation and avoidance of acute events, ecological benefits, and human health risks compared to the baseline in which the releases occur and are remediated. Finally, EPA did not estimate benefits or avoided costs associated with changes in regulation at facilities with FCTs or AHFDSs.

Exhibit 7-1 demonstrates that the final UST regulation will likely avoid more costs than it creates, generating cost savings to society. EPA estimates that the Selected Option could generate $160 million per year in savings to society (reflecting the average of four estimates: $39 million in net costs, and $120 million, $180 million, and $370 million in savings). Alternatives 1 and 2 could also have a net benefit of $160 million (reflecting the average of four estimates for each alternative: $81 million in net costs and $140 million, $220 million, and $380 million in savings for Alternative 1; or $25 million in net costs and $150 million, $150 million, and $350 million in savings for Alternative 2). These estimates only include cost savings for conventional UST systems and EGTs.

Exhibit 7-1

Comparison Of Annual Compliance Costs And Cost Savings[f,d]

	Selected Option (2012$ millions)	**Alternative 1 (2012$ millions)**	**Alternative 2 (2012$ millions)**
Annual Avoided Costs[a]			
Releases and groundwater incidents: average value *(range of all values in italics)*	$300 *($110-$510)*	$440 *($200-$650)*	$220 *($44-$410)*
Vapor intrusion: average value *(range of all values in italics)*	$4.5 *($1.7-$7.9)*	$5.9 *($2.5-$9.1)*	$3.1 *($0.56-$6.0)*
Product loss *(range of all values in italics)*	$3.1 *($0.86-$6.5)*	$3.8 *($0.78-$7.6)*	$2.4 *($0.36-$5.2)*
Annual Compliance Costs			
Conventional UST systems[b]	$130	$280	$63
Emergency generator tanks (EGTs)	$2.0	$2.3	$2.0
Airport hydrant fuels distribution systems (AHFDSs)	$10	< $0.1	N/A
UST systems with field-constructed tanks (FCTs)	$11	< $0.1	N/A
Cost to owners/operators to read regulation	$5.5	$5.5	$5.5
State government administrative costs[c]	$0.12	$0.12	$0.12
Total Annual Avoided Costs *(range of all values in italics)*	**$310** *($120-$530)*	**$450** *($210-$670)*	**$230** *($45-$420)*
Total Annual Compliance Costs[d]	**$160**	**$290**	**$70**
Net Cost (Savings) to Society[d,g] **[Total Compliance Costs *less* Total Avoided Costs]** *(range of all values in italics)*	**($160)** *$39- ($370)*	**($160)** *$81 - ($380)*	**($160)** *$25 - ($350)*
Non-Monetized Benefits[e]			
Groundwater protected (billion gallons)	130 (50-240)	170 (74-270)	92 (17-180)
Acute events and large-scale releases (e.g., releases from AHFDSs and FCTs)	Not estimated	Not estimated	Not estimated
Ecological benefits	Not estimated	Not estimated	Not estimated
Human health risks	Not estimated	Not estimated	Not estimated

[a] Avoided costs are estimated for conventional UST systems and emergency generator tanks (EGTs) only. Avoided remediation costs from releases and groundwater incidents are the costs related to site remediation. Avoided vapor intrusion costs include additional avoided costs associated with the remediation of vapor intrusion cases; the RIA does not address human health risk associated with vapor intrusion. Avoided product loss costs are also separate and additive.

[b] Conventional UST systems include all systems that are not AHFDSs, FCTs, or EGTs.

[c] The costs for UST systems directly owned or operated by local, state, and federal government entities are included in the estimates of compliance costs within the other categories. Costs shown here reflect the administrative costs for state governments to read the regulation, apply for state program approval, process notifications of ownership changes, and process one-time notifications of existence for AHFDS and UST systems with FCTs.

[d] Compliance costs include direct compliance costs and state oversight costs. For this regulatory impact analysis, direct compliance costs and state oversight costs provide a reasonable proxy to assess the final UST regulation's social costs. See Chapter 3.1 for further discussion.

[e] Due to data and resource constraints, EPA is unable to monetize some of the positive impacts of the final UST regulation. Chapter 4 of this document provides a qualitative discussion of these benefits.

[f] Totals may not add up due to rounding. Cost estimates were derived using a seven percent discount rate.

[g] The results show that all but one of the four estimates of cost savings for conventional systems exceed total regulatory costs (including FCT and AHFDS systems). As explained in Chapter 4 and Appendix H, one of the four experts provided estimates of avoided releases and averted groundwater incidents that do not result in net cost savings to society from the Selected Option. However, this expert also assumed a high level of noncompliance with the final UST regulation that is not consistent with the assumption of 100 percent compliance in the cost estimates. As a result, this low-end estimate of potential cost savings represents likely understates the cost savings that would be associated with a consistent, 100 percent compliance scenario. See Chapter 4 and Appendix H for detailed discussion of how these assumptions affect net benefits of the final UST regulation as calculated using responses from Expert 2.

7.1.1 Net Costs of the Regulation: Potential Underestimates of Cost Savings and Benefits

The results show that three of the four estimates of cost savings for conventional systems exceed total regulatory costs for all systems, including both costs to conventional systems and costs to FCT and AHFDS systems (for which cost savings were not estimated). As explained in Chapter 4 and Appendix H, one of the four experts provided estimates of avoided releases and averted groundwater incidents that do not result in net cost savings to society from the Selected Option. However, this expert also assumed a high level of noncompliance with the final UST regulation that is not consistent with the assumption of 100 percent compliance in the cost estimates. As a result, this low-end estimate of potential cost savings likely understates the cost savings that would be associated with a consistent, 100 percent compliance scenario.

In addition, this analysis may understate avoided costs for the following reasons:

- This analysis does not monetize benefits associated with groundwater protection, mitigation and avoidance of acute events, ecological benefits, human health risks, and avoided property devaluation relative to the baseline.

- This analysis does not monetize avoided costs associated with FCT and AHFDS systems. Compliance costs for these systems are monetized.

- This analysis does not quantify avoided remediation costs associated with reductions in release size (i.e., extent), other than the change in incidence of groundwater contamination. The same reductions in release volume that lower the incidence of groundwater contamination would likely also reduce the number of large extent releases of all types and decrease the average size of smaller releases.

7.1.2 Net Costs of the Regulation: Cost Savings to Public and Private Entities

While EPA opted to express all cost savings as "benefits to society" in this analysis, it is also common practice in RIAs to calculate the costs of a regulation by subtracting cost savings from cost increases to affected entities.[225] Under this regulation, the cost savings of avoided releases would in some cases reduce burden on state funds, but a portion of the remediation costs would also be borne directly by regulated entities. One option for presenting total costs of the regulation, therefore, would have been to present the net costs to regulated facilities *after* accounting for avoided remediation costs. However, because it is impossible to predict which facilities would enjoy cost savings, EPA opted to present industry costs and industry-related avoided costs separately in the main analysis.

This section considers the net cost impact on facilities when accounting for avoided remediation costs. **Exhibit 7-2** provides a more detailed breakout of the estimated cost savings

[225] The practice of subtracting cost savings from cost increases to estimate the net costs of a regulation is consistent with OMB Circular A-4. Circular A-4 explains: "You should also try to monetize any cost savings as a result of an alternative and either add it to the benefits or subtract it from the costs of that alternative." (U.S. Office of Management and Budget. Circular No. A-4. September 17, 2003.)

for conventional systems and EGTs. The exhibit compares cost savings directly to the private-sector compliance costs of the regulation for those systems.

The exhibit shows that, in general, the net cost of the regulation to private-sector entities falls well below $100 million in the Selected Option and Alternative 2 when avoided costs to the private sector are considered. Only under Alternative 1 do net costs to the private sector exceed $100 million under expert estimates.

Exhibit 7-2

Summary Of Net Costs To Private Sector for Conventional Systems and EGTs (2012$ millions)

Selected Option					
	Expert 1	Expert 2	Expert 3	Expert 4	Average
Private Sector Compliance Cost	**$130**				
Total Cost Savings[a]	**$330**	**$120**	**$270**	**$530**	**$310**
Public Sector Cost Savings[b]	$190	$65	$150	$290	$170
Private Sector Cost Savings	$150	$52	$120	$240	$140
Net Cost to Private Sector [Private Sector Compliance Cost – Private Sector Cost savings]	**($17)**	**$77**	**$6**	**($110)**	**($11)**
Alternative 1					
	Expert 1	Expert 2	Expert 3	Expert 4	Average
Private Sector Compliance Cost	**$280**				
Total Cost Savings[a]	**$500**	**$210**	**$420**	**$670**	**$450**
Public Sector Cost Savings[b]	$290	$120	$240	$370	$250
Private Sector Cost Savings	$210	$88	$190	$300	$200
Net Cost to Private Sector [Private Sector Compliance Cost – Private Sector Cost savings]	**$67**	**$190**	**$93**	**($15)**	**$85**
Alternative 2					
	Expert 1	Expert 2	Expert 3	Expert 4	Average
Private Sector Compliance Cost	**$65**				
Total Cost Savings[a]	**$220**	**$45**	**$220**	**$420**	**$230**
Public Sector Cost Savings[b]	$130	$26	$120	$240	$130
Private Sector Cost Savings	$92	$19	$99	$190	$99
Net Cost to Private Sector [Private Sector Compliance Cost – Private Sector Cost savings]	**($28)**	**$45**	**($34)**	**($120)**	**($35)**

Notes:

[a] As explained in Chapter 4 and Appendix H, one of the four experts provided estimates of avoided releases and averted groundwater incidents that do not result in net cost savings to society from the Selected Option. This expert also assumed a high level of noncompliance with the final UST regulation that is not consistent with cost modeling. See Chapter 4 and Appendix H for detailed discussion of how these assumptions affect net benefits of the final UST regulation as calculated using responses from Expert 2.

[b] Values are estimated in Chapter 5.2.4. To provide a conservative estimate of net costs to the private sector, this table presents the low deductible scenario results. These values represent potential reductions in public expenditures in states with active state funds. We note that to realize the savings in public expenditures in the near term, state government action would be required to lower petroleum fees. Alternatively, to the extent that funds are not constrained in their use, a redistribution of funds (e.g., to existing sites awaiting cleanup) could also represent a significant public benefit through more rapid completion of existing sites.

7.1.3 Alternative Baseline: Potential Decreases in Future Cost Savings

In addition to the primary analysis presented above, we also consider the comparison of costs and benefits of the final UST regulation in the alternative baseline scenario, where the universes of releases and UST systems decline over time in accordance with historical trends. In this alternative baseline, the universe of releases is smaller relative to the original baseline than the universe of UST systems; as described in Chapters 3 and 4, estimates of compliance costs do not change substantially under the alternative baseline, while estimates of avoided costs decrease by approximately 31 percent. However, even in this scenario, the final UST regulation may avoid more costs than it creates, potentially generating cost savings to society. EPA estimates that the Selected Option in the alternative baseline could generate $60 million per year in savings to society (reflecting the average of four estimates: $74 million in net costs, $32 million, $75 million, and $210 million). Alternative 1 could generate $25 million per year in savings to society (reflecting the average of four estimates: $140 million in net costs, $7 million, $61 million, and $170 million), while Alternative 2 could generate savings of $87 million (reflecting the average of four estimates: $39 million in net costs, $81 million, $84 million, and $220 million). These results are presented in **Exhibit 7-3**.

Exhibit 7-3

Comparison Of Annual Compliance Costs And Cost Savings Under Alternative Baseline[c,e]

	Selected Option (2012$ millions)	Alternative 1 (2012$ millions)	Alternative 2 (2012$ millions)
Total Annual Avoided Costs[a,b] *(range of all values in italics)*	$220 *($81-$360)*	$310 *($140-$460)*	$160 *($31-$290)*
Total Annual Compliance Costs[c]	$160	$290	$70
Net Cost (Savings) to Society[c,d] **[Total Compliance Costs *less* Total Avoided Costs]** *(range of all values in italics)*	**($60)** *$74- ($210)*	**($25)** *$140 – ($170)*	**($87)** *$39 - ($220)*

[a] Avoided costs are estimated for conventional UST systems and emergency generator tanks (EGTs) only.
[b] Due to data and resource constraints, EPA is unable to monetize some of the positive impacts of the final UST regulation. Chapter 4 of this document provides a qualitative discussion of these benefits.
[c] Compliance costs include direct compliance costs and state oversight costs. For this regulatory impact analysis, direct compliance costs and state oversight costs provide a reasonable proxy to assess the final UST regulation's social costs. See Chapter 3.1 for further discussion.
[d] The results show that all but one of the four estimates of cost savings for conventional systems exceeded total regulatory costs (including FCT and AHFDS systems). As explained in Chapter 4 and Appendix H, one of the four experts provided estimates of avoided releases and averted groundwater incidents that do not result in net cost savings to society from the Selected Option. However, this expert also assumed a high level of noncompliance with the final UST regulation that is not consistent the assumption of 100 percent compliance in the cost estimates. As a result, this low-end estimate of potential cost savings represents likely understates the cost savings that would be associated with a consistent, 100 percent compliance scenario. See Chapter 4 and Appendix H for detailed discussion of how these assumptions affect net benefits of the final UST regulation as calculated using responses from Expert 2.
[e] Totals may not add up due to rounding. Cost estimates were derived using a seven percent discount rate.

7.2 Cost-Effectiveness Analysis

We measure cost-effectiveness by considering the expected cost per release avoided. This cost-effectiveness measure is useful for comparing the resources required to eliminate a single release under each alternative. For the purpose of this analysis, we consider avoided releases to be both releases altogether avoided and groundwater incidents averted due to the final UST regulation. As presented in **Exhibit 7-4**, we find that the cost per release avoided is approximately $43,000 to $200,000 under the Selected Option, compared with $68,000 to $250,000 under Alternative 1 and $25,000 to $270,000 under Alternative 2. In general, this compares favorably with average release remediation costs presented in **Exhibit 4-2** in Chapter 4, which range between $98,000 and $210,000.[226]

This regulatory impact analysis suggests that, in addition to improving the alignment of incentives, release prevention is likely to be less costly than release remediation under the Selected Option and Alternative 2 and in some instances under Alternative 1.

Exhibit 7-4

Cost-Effectiveness: Number Of Avoided Releases And Groundwater Incidents[a]

	Selected Option	Alternative 1	Alternative 2
Avoided releases and groundwater incidents	2,073 (772-3,646)	2,708 (1,148-4,213)	1,427 (257-2,753)
Compliance cost[b] ($ million)	$160	$290	$70
Cost per release avoided ($ million)	**$0.08 ($0.04 - $0.20)**	**$0.11 ($0.07 - $0.25)**	**$0.05 ($0.03 - $0.27)**

[a] Cost estimates were derived using a seven percent discount rate.
[b] Compliance cost includes direct compliance costs and state oversight costs. For this regulatory impact analysis, direct compliance costs and state oversight costs provide a reasonable proxy to assess the final UST regulation's social costs. See Chapter 3.1 for further discussion.

7.3 Costs and Beneficial Effects Under Alternative Discount Rates

The selection of the rate at which to discount future costs and benefits is complex. To assess the sensitivity of our results to our choice of discount rate, **Exhibit 7-5** presents a summary of total compliance costs and avoided remediation costs considering an alternate discount rate of three percent. Costs change little because a reduction in interest rates both reduces time value of money (TVM) costs and increases costs that have a delay before

[226] The one exception to this conclusion is Expert 2. As explained in Chapter 4 and Appendix H, one of the four experts provided estimates of avoided releases and averted groundwater incidents that do not result in net cost savings to society from the Selected Option. This expert also assumed a high level of noncompliance with the final UST regulation that is not consistent with the cost modeling, and likely understates the cost savings associated with the 100 percent compliance that is assumed in the cost analysis. See Chapter 4 and Appendix H for detailed discussion of how these assumptions affect net benefits of the final UST regulation as calculated using responses from Expert 2.

implementation.[227,228] The net result of a change from a discount rate of seven percent to a discount rate of three percent is an overall increase in the cost of the regulation of less than $10 million per year, indicating that TVM and delayed-implementation cost effects essentially offset each other.

Discount rates are also involved in our estimate of annual avoided costs. In particular, we use them to obtain constant annual avoided costs for those requirements in which the affected universe grows over time and to calculate the delay until positive impacts accrue.[229] Here, the effect of lowering interest rate is more significant, as all requirements are discounted by at least one period. As **Exhibit 7-5** shows, a change in the discount rate increases avoided costs from a range of $120 million - $530 million using a seven percent discount rate to $130 million - $610 million using a three percent discount rate. This increase is largely due to the fact that we discount all avoided costs by at least one year, as outlined in **Exhibit 1-2**.

We conclude that, while a reduction in the discount rate to three percent leaves annual compliance costs essentially unchanged at $160 million, avoided costs increase by $16 million to $84 million per year. As such, annual savings to society would increase from a range of $39 million in net costs to $370 million in net savings, to a range of $25 million in net costs to $450 million in net savings if EPA relies on a three percent discount rate.

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[227] When amortizing a value over time, if all other factors are held constant, a reduction in the rate of interest decreases the annual payment.

[228] The rate of discount enters into our calculation of time value of money costs. Higher discount rates increase these costs, while lower discount rates cause them to decrease. See Appendix D for details.

[229] Requirements for which the universe is assumed to grow over time are the elimination of flow restrictors as overfill prevention for new tanks and when overfill prevention equipment is replaced, closure of lined tanks that cannot be repaired, and all Energy Policy Act requirements in Indian country, with the exception of operator training.

Exhibit 7-5

Compliance Costs And Beneficial Impacts Under Alternative Discount Rates[d,e]

Avoided Cost	**Selected Option 7 percent discount rate ($ millions)**	**Selected Option 3 percent discount rate ($ millions)**
Annual Avoided Costs[a]		
Releases and groundwater incidents	$300 ($110-$510)	$350 ($130-$590)
Vapor intrusion	$4.5 ($1.7-$7.9)	$4.7 ($1.7-$8.2)
Product loss	$3.1 ($0.86-$6.5)	$3.3 ($0.89-$6.8)
Annual Compliance Costs		
Conventional UST systems[b]	$130	$130
Emergency generator tanks (EGT)	$2.0	$2.1
Airport hydrant fuels distribution systems (AHFDSs)	$10	$12
UST systems with field-constructed tanks (FCTs)	$11	$12
Cost to owners/operators to read regulation	$5.5	$3.9
State government administrative costs[c]	$0.1	$0.1
Total Annual Avoided Costs	**$310 ($120-$530)**	**$360 ($130-$610)**
Total Annual Compliance Costs[d]	**$160**	**$160**
Net Cost (Savings) to Society[d,f] [Total Compliance Costs *less* Total Avoided Costs]	**($160) $39 - ($370)**	**($200) $25 - ($450)**

[a] Avoided costs are estimated for conventional UST systems and emergency generator tanks (EGTs) only.

[b] Conventional UST systems include all systems that are not AHFDSs, FCTs, or EGTs.

[c] The costs for UST systems directly owned or operated by local, state, and federal government entities are included in the estimates of compliance costs within the other categories. Costs shown here reflect the administrative costs for state governments to read the regulation, apply for state program approval, process notifications of ownership changes, and process one-time notifications of existence for AHFDS and UST systems with FCTs.

[d] Compliance costs include direct compliance costs and state oversight costs. For this regulatory impact analysis, direct compliance costs and state oversight costs provide a reasonable proxy to assess the final UST regulation's social costs. See Chapter 3.1 for further discussion.

[e] Totals may not add up due to rounding.

[f] As explained in Chapter 4 and Appendix H, one of the four experts provided estimates of avoided releases and averted groundwater incidents that do not result in net cost savings to society from the Selected Option. This expert also assumed a high level of noncompliance with the final UST regulation that is not consistent with cost modeling. See Chapter 4 and Appendix H for detailed discussion of how these assumptions affect net benefits of the final UST regulation as calculated using responses from Expert 2.

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