



**VCU**

Virginia Commonwealth University  
**VCU Scholars Compass**

---

Theses and Dissertations

Graduate School

---

2011

## The Superfund Program Past and Present Funding Implications

Nicole Franklin

*Virginia Commonwealth University*

Follow this and additional works at: <https://scholarscompass.vcu.edu/etd>

 Part of the Environmental Sciences Commons

---

© The Author

---

Downloaded from

<https://scholarscompass.vcu.edu/etd/2461>

This Thesis is brought to you for free and open access by the Graduate School at VCU Scholars Compass. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of VCU Scholars Compass. For more information, please contact [jibcompass@vcu.edu](mailto:jibcompass@vcu.edu).

The Superfund Program Past and Present Funding Implications

A Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science, Environmental Studies at Virginia Commonwealth University.

By

Nicole A. Franklin  
Bachelor of Science in Biology  
Old Dominion University, 1993

Thesis Director: Dr. Peter L. deFur  
Research Associate Professor, Center for Environmental Studies

Virginia Commonwealth University  
Richmond, Virginia  
May 2011

## Acknowledgements

I would like to thank my committee members for their continued guidance and patience extended to me during my research and thesis completion process. I owe my deepest gratitude and thanks to Dr. Peter L. deFur who served as my advisor throughout my tenure in the Environmental Studies Graduate Program. I greatly appreciate his interest in my chosen thesis topic, the guidance, and advice he provided that allowed me to complete my thesis. I would also like to thank Dr. Jeffery G. Chanat for his guidance and patience with reviewing my data and statistical analysis methods during the completion of my research. To Dr. Peter L. deFur, I would like to express my upmost appreciation for the opportunity to complete my graduate studies at VCU and encouraging me to complete a thesis to culminate my studies.

I would like to extend a special thanks to my son Louis L. Franklin III and my parents Mr. and Mrs. Cornell S. Ballard for their continued patience, encouragement, and support afforded to me during the completion of my graduate degree. The completion of a graduate degree has been a long standing personal goal of mine and I am very fortunate in being given this opportunity to continue my education and further my career goals. Finally, I would like to thank the staff in the VCU Office of Environmental Health and Safety for their continued support and providing the flexibility needed to complete my graduate studies while working full time.

## Table of Contents

Acknowledgements	2
List of Tables	5
List of Figures	5
Abstract	6
Introduction	8
Objectives	11
Literature Review	12
Superfund Process	12
Preliminary Assessment and Site Investigation	12
NPL Listing Process	12
Remedial Investigation and Feasibility Study	14
Record of Decision	17
Remedial Design/Remedial Action	17
Construction Completion	18
Post-Construction Completion	18
Site Deletion and Reuse	21
Methods	24
Results	27
Program Accomplishments and Performance Measures	29
Government Performance and Results Act	29
Site wide Ready for Anticipated Use	30

Superfund Environmental Indicators	30
Final Assessment Decision and Construction Completion	32
Strategic Plan	33
2009/2010 Superfund National Accomplishments and Funding	36
American Recovery and Reinvestment Act of 2009	38
Superfund Appropriation History	41
Case Studies	49
Atlantic Wood Industries, Portsmouth Virginia	49
Chisman Creek, York County, Virginia	51
Discussion	54
References	57
Vita	61

**List of Tables**

1. NPL Site Status by Fiscal Year	26
2. ANOVA Results	28
3. American Recovery and Reinvestment Act Performance Measures by Fiscal Year and Quarter	41
4. Superfund Appropriations by Fiscal Year	44
5. General Fund Share of Superfund Appropriations by Fiscal Year	46
6. Superfund Trust Fund Share by Fiscal Year	48

**List of Figures**

1. Superfund Appropriations for Fiscal Years 1981 to 2010	43
2. General Fund Share of Appropriations by Fiscal Year	45
3. Superfund Trust Fund Share of Appropriations by Fiscal Year	47

## Abstract

The present research examines the impact of not reauthorizing the Superfund taxes on the operations of the program. EPA NPL site status data were obtained from the EPA CERCLIS database for analysis in this study. Data were selected for the fiscal years 1981 to 2009 in four NPL listing status categories: proposal to the NPL, final NPL listing, deletion from the NPL, and achievement of construction completion. Since the Superfund tax expired in 1995, data from the 1981 to 1995 fiscal years and data from the 1996 to 2009 fiscal years were analyzed to determine if there were mean differences in NPL status achievements for those time frames potentially caused by lack of funding. The data in the fifth category (partial NPL deletion) were not analyzed because the EPA did not begin tracking this category as a program goal until 1997. EPA uses the status of sites in these categories to track achievement of program goals and effectiveness. The null hypothesis for this study is that there is no difference between program outcomes (NPL site status data reported by fiscal year) for the time period from 1981 to 1995 and 1996 to 2009 meaning that the failure to re-authorize the Superfund tax has not affected the clean-up of contaminated sites and how they are managed. The alternative hypothesis is that failure to re-authorize the Superfund tax has affected the clean-up of contaminated sites and how they are managed. In support of the alternative hypothesis, there were mean differences (for time frames 1981 to 1995 and 1996 to 2009) for NPL site status achievements for the following milestones: final listing on the NPL, deletion from the NPL, and achieving construction completion status on the NPL. These results suggest that variations in funding may have some impact on NPL status achievements.

Annual funding trends from program inception to 2010, achievement of Superfund program goals for the 2009 and 2010, and the impact of the 2009 American Recovery and Reinvestment Act funding on the program were also examined. Although program goals were generally met or exceeded, limited funds will continue to impact the cleanup of existing and future Superfund sites.

## Introduction

In 1980, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was passed in response to the Love Canal contamination disaster in Niagara Falls, New York. Superfund is the actual fund established by CERCLA that provided the Environmental Protection Agency (EPA) with financial resources to clean-up contaminated sites. Superfund paid for the clean-up of sites contaminated with hazardous waste where no other responsible parties could pay for clean-up by assessing taxes on petroleum and chemical industries. Over a five year period, \$1.6 billion was collected and placed in a trust fund cleaning up sites identified as abandoned or uncontrolled hazardous waste sites. CERCLA was later amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 increasing the size of the trust fund to \$8.5 billion. The federal funding has been depleted since the 1986 amendments (Probst, 2005).

The tax authority for Superfund expired in 1995, but money was available in the fund until the end of fiscal year 2003. The fund was partially replenished by cost recovery lawsuits against responsible parties and additional funds are allocated from general revenue to Superfund projects by congressional appropriations. Members of Congress have introduced various bills over the years to reinstate the Superfund tax, but have not received the necessary support. In the fiscal years 2004-2007 the Bush Administration did not request renewal of the Superfund taxes in the budget submissions for those years

(Sapien, 2007). The majority of Superfund site clean-ups are paid for by potentially responsible parties (PRPs), which are usually previous, or current owners or operators of the sites. The EPA estimates that PRPs conduct the cleanup of 70% of the sites listed on the National Priorities List (NPL). The EPA cannot ascertain PRPs or the PRPs located do not have adequate financial resources to cleanup the remaining 30% of sites on the NPL (Probst, 2005). There are currently 1,290 sites listed on the NPL in addition to 63 proposed sites. A total of 347 sites have been deleted from the NPL by the end of 2010 (EPA, 2011). Despite the decrease in federal funding for the Superfund sites, the program is still addressing sites requiring massive cleanup or where no PRPs are available to take responsibility for site cleanup.

There are additional hazardous waste sites placed on the NPL for various reasons. Among these sites are Formerly Used Defense Sites or FUDS which have been formerly owned, leased, possessed or operated by the U.S. Department of Defense (DOD). In 1982, the EPA and the U. S. Corp of Engineers entered into an agreement where the Corp would provide assistance to EPA in implementing CERCLA. The Superfund Amendments and Reauthorization Act (SARA) of 1986 established the Defense Environmental Restoration Program (DERP), which authorizes the identification, investigation, and cleanup of sites under DOD's FUDS program (GAO, 2001). Other hazardous waste sites are subject to cleanup under Subtitle C Corrective Action Authorities under the Resource Conservation and Recovery Act (RCRA). Since CERCLA was implemented, numerous sites have been dropped from the NPL or repropose for listing on the NPL due to changes in the site's RCRA status. Other sites may meet the



criteria for being placed on the NPL but have not been identified by the state or sites have been identified, but are awaiting approval for addition to the NPL (proposed sites) (EPA, 2010).

## Objectives

The primary objective of this study is to determine if the failure to reauthorize the Superfund taxes in 1994 decreased program effectiveness. The EPA utilizes five categories to track accomplishment of program goals by fiscal year: number of sites proposed for NPL listing, number of sites formally listed on the NPL, number of sites deleted from the NPL, number of sites reaching construction completion status, and the number of sites reaching partial deletion status. Congressional failure to reauthorize Superfund taxes has decreased the amount of funds available in the trust fund, thus decreasing the funds available for NPL site clean-up. In addition to evaluating achievement of annual goals, funding trends from program inception to current times were examined and the impact of supplemental funds made available to EPA through the 2009 American Recovery and Reinvestment Act on annual program outcomes was investigated. The management and site status of two Virginia Superfund sites was investigated to determine the impact of funding on site outcomes. A comparison of the outcomes from program inception to 1995 and 1996 to 2009 was completed because the Superfund taxes expired in 1995 and have not been reauthorized since.

## Literature Review

### Superfund Process

#### Preliminary Assessment and NPL Listing

Several steps are involved in the process of identifying and cleaning up a contaminated site. Contaminated sites are identified and presented to EPA for listing in various ways. Site information may be contained in reports of hazardous substance releases submitted to the EPA, investigations by local or state government agencies, and citizens' complaints. Once a site is brought to the EPA's attention, a step by step process is followed to determine if the site qualifies for listing on the NPL. Sites with reported releases or threatened releases are listed in the Comprehensive Environmental Response and Liability Information System (CERCLIS) for potential evaluation. CERCLIS is EPA's official database inventory of CERCLA sites and facilitates site planning and tracking (Sullivan, 2007).

Once a site is identified, a preliminary assessment and site inspection is completed. This preliminary assessment involves collecting historical information on the site and other information regarding site conditions to evaluate whether the site poses a potential threat to human health or the environment through the release of hazardous substances. This assessment also helps to determine if a site may require immediate or short-term

response actions. A preliminary assessment may be conducted by reviewing the historical data; or if warranted, a physical site inspection including air, water and/or soil testing is conducted to determine the scope of the hazards present at the site. The findings determined during the preliminary assessment are used to assign a score under the EPA Hazard Ranking System (Sullivan, 2007).

The Hazard Ranking System is the primary means that EPA uses to determine if a site qualifies to be listed on the NPL. This numerical scoring system uses information gathered during the preliminary assessment to determine the potential of a site to present a threat to human or the environment. The priority a site receives regarding funding of remediation activities is not determined by the HRS score because the information used to score a site is not extensive enough to determine the level of contamination of or the appropriate remedial response for the site. The EPA typically utilizes more extensive studies completed during the remedial investigation and remedial study phase of the process to prioritize sites. Scoring a site under the HRS involves assigning a numerical value to risk based factors due to conditions of the site. There are three categories in which factors are grouped to include, whether a release has occurred at a site or the potential for a site to release hazardous substances into the environment, waste characteristics, susceptible people or environments affected by a release. The extent or potential for ground water, surface water, soil, and air migration are also used to score sites under HRS. If a site scores at or above an established level, the site will qualify for cleanup under the Superfund Program and is proposed for listing on the NPL (EPA, 2010).



After a site is scored under the HRS and is found to be eligible for listing, the site is first proposed to the NPL in the Federal Register. During a sixty day period the EPA accepts and responds to public comments regarding the site. The documents that the EPA basis the evaluation and scoring of sites on are contained in public dockets located at EPA headquarters, regional EPA offices, or online. After the comment period, the EPA considers relevant comments and will make a decision to formally list a site if the site continues to meet the listing criteria. There are three means by which a site may be placed on the NPL list. The first is by a site obtaining a qualifying HRS score, the second involves an allowance for individual states to designate a high priority site regardless of the HRS score, and thirdly a site may be listed by meeting three minimum requirements involving current sites conditions. The three minimum requirements are: the Agency for Toxic Substances and Disease Registry (ATSDR) issues a health advisory recommending residents be evacuated from the site, the EPA expects that the use of emergency removal authority may be less cost effective than using remedial authority only available to NPL sites, and the site is deemed to be an immediate threat to public health (EPA, 2010).

#### Remedial Investigation/ Feasibility Study

The first significant event to occur after a site is formally listed is the completion of a Remedial Investigation/Feasibility Study (RI/FS). These investigations are an essential part of the cleanup process because it determines the scope of remedial action to be

completed. The purpose of the RI/FS is to evaluate site conditions and examine potential remedial actions to the extent needed to selection. The remedial investigation serves to collect data in order to determine the characteristics of the waste, characterize site conditions, evaluate the risk to human health and the environment, and to conduct treatability testing to assess the cost and effectiveness of potential treatment methods. After enough technical information is collected to analyze potential remedies, a feasibility study is completed to develop remedial alternatives. The feasibility study is a comprehensive evaluation of potential remedies that takes into account the findings in the remedial investigation. This evaluation determines the extent to which remedial alternatives complies with site cleanup criteria in CERCLA Section 121(Sullivan, 2007).

The entire RI/FS process includes five phases; scoping, site characterization, development and screening of alternatives, treatability investigations, and detailed analysis. Scoping is the initial planning phase of the RI/FS process which usually includes determination of Applicable or Relevant and Appropriate Requirements (ARARs) as specified in CERCLA Section 121, identifying data required to make decisions regarding remedy selection, form a technical advisory committee to monitor progress of the study; and preparing relevant documents outlining the site work, sampling, health and safety, and community relations plans. During the site characterization phase, laboratory analysis of field samples is used to prepare a preliminary site characterization summary. This summary is useful in determining feasibility of potential remedial technologies and providing support in determining ARARs. The summary may also be utilized by the Agency for Toxic Substances and Disease Registry (ATSDR) to

complete health assessments. A risk assessment is developed during this phase to identify existing and potential risk to human health and the environment which impacts the evaluation and remedy selection during the feasibility study (EPA, 2010).

The alternative development phase of the RI/FS usually begins during scoping when response actions are initially identified. During this phase remedial action objectives are identified, potential treatment methods are identified, treatment methods are screened based on effectiveness, ease of implementation, and costs; and finally remedial methods including any containment or disposal requirements are identified as alternatives for contaminated media at the site. The primary goal of the fourth phase, the treatability investigation, is to provide adequate data to enable the evaluation of treatment methods in support of remedial design and to reduce costs. The last phase in the process, detailed analysis, involves evaluation of treatment methods using nine criteria to address criteria under CERCLA. The nine criteria include: overall protection of human health and the; long term effectiveness and permanence; compliance with ARARs; reduction of toxicity, mobility, or volume; implementability; short term effectiveness; cost; community acceptance, and state acceptance. Once each treatment method is evaluated individually based on the nine criteria, comparisons are made to evaluate potential strengths, weakens, and possible trade offs that must be considered for each site. A decision is made utilizing the results of the analysis to select a suitable remedy consistent with CERCLA requirements (EPA, 2010).

## Record of Decision and Remedial Design/Remedial Action

The Record of Decision (ROD) is a formal document issued by the EPA identifying the selected remedy and the factors that led to the selection. The ROD documents in all the analysis of facts and site specific policy determinations based on the results of the RI/FS. Information regarding the sites history, physical characteristics, community participation, enforcement activities, contaminated media, and characteristics of the contamination is contained within the ROD. An explanation of how the remedy is to protect public and the environment, how ARARs will be met, cost effectiveness of the remedy, and evidence that permanent solutions were selected to the maximum extent possible is also included in the document. The ROD must also contain any responses to public comments on the remedy selection (EPA, 2010).

The Remedial Design phase in the Superfund cleanup process involves creating a detailed design permitting the construction and operation of the remedy. The remedial action phase involves implementation of remedy where costs can easily exceed \$50 million dollars. The more costly remedies are those mostly involved with the restoration of aquifers after groundwater contamination has occurred. CERCLA requires the EPA to consult with states where cleanup sites are located prior to determining remedial actions. The EPA cannot proceed with remedial action using funds from Superfund until a state enters into a cooperative agreement. This cooperative agreement requires a state to

provide future maintenance of remedial actions, a hazardous waste disposal facility, and ensure payment of a minimum of ten percent of the remedial actions costs to include future maintenance. A state's failure to comply with the funding requirements may pose a considerable threat to the EPA's ability to initiate remedial actions (EPA, 2010).

#### Construction Completion and Post-Construction Complementation

When the Superfund program was initially implemented, progress in cleaning up sites was measured by the number of sites deleted from the NPL. This measure did not take into account substantial construction completion and the reduction of risk to human health and the environment. In March of 1990, a construction completion category for NPL sites was created to more accurately demonstrate progress at a cleanup site. The Superfund Construction Completion List (CCL) was created to simplify the system of categorizing sites based on the level of construction completion. The placement of a site on the CCL does not have any legal significance. The EPA provides guidance specifying the requirements for achieving the construction completion milestone. A site may qualify for this milestone when; any required physical construction is complete, the EPA determines the response action does not require construction, and the site qualifies for deletion from the NPL (EPA, 2010).

The purpose of Post Construction Completion activities are to ensure that Superfund remedial and response actions provide for the long term protection of human health and the environment. Construction completion has been one of the primary measures of

progress for the Superfund Program and is a 1993 Government Performance and Results Act (GPRA) goal. GPRA requires government agencies to develop strategic and measurable plans for accomplishing program goals as well as requiring agencies to be financially accountable. When a site reaches construction completion it is often times mistaken to mean that the site clean up is complete, when there are usually additional measures must be taken to achieve remediation objectives. Some sites that reach construction completion have remedies completed that only allow for limited usage because of residual contamination remaining on the site. Other sites where ground water contamination is involved may require continuous remediation activities to achieve acceptable reduction in risk levels (EPA, 2010).

The post construction completion strategy includes five goals: to ensure that remedies remain protective and cost effective, to ensure that institutional goals required as a part of the remedy are implemented and effective, to assure adequate financing and capability to conduct post construction completion activities, to support appropriate reuse of sites while assuring remedy reliability, and improve site records management to better ensure remedy reliability. The goals of this strategy are of growing importance since more than 60 percent of sites have reached construction complete status since the inception of the program. The goals are achieved by a combination of the following: activities Long Term Response Action, Operation and Maintenance, Five-Year Reviews, Institutional Controls, Remedy Optimization, and NPL Deletion. During Long-term Response Action, which is usually the first ten years of Superfund financed ground and surface water restoration, the EPA retains operating responsibility for activities during this

phase prior to transferring responsibility to state agencies. After the Long-term Response Action period is complete, the Operation and Maintenance phase is the responsibility of potentially responsible parties and state agencies. During Operation and Maintenance, measures are taken to ensure the remedy performs as expected to include maintenance of containment structures, operating ground water remediation systems, monitoring of bioremediation, soil vapor extraction, or air sparging. Institutional Controls are implemented during or immediately after remedy implementation to minimize potential exposure to contamination and maintain the integrity of the remedy for as long as necessary. If residual contamination restricts the use of a site or ground water aquifer, Institutional Controls are utilized to supplement engineering controls in use at a site (EPA, 2005).

Five-Year Reviews are required under Section 121 of CERCLA when hazardous substances, contaminants, or pollutants remain above levels that allow for unrestricted use of the site or where the completion of the remedy may take longer than five years to reach clean up goals. The purpose of a Five-Year Review is to evaluate the implementation and performance of a remedy and to identify potential problems with a remedial action. The findings of this review may be used to change the Operation and Maintenance activities as needed. The EPA usually is usually responsible for conducting the reviews as long as there are restrictions on site use. Remedy Optimization Reviews are conducted to improve the performance and to potentially reduce annual operating costs of ground water remediation systems or soil remediation technologies, particularly when these systems have been functioning for an extended period of time. These



reviews are performed by independent experts working with the site manager and operator. Recommendations made based on findings may apply to above ground treatment systems, extraction wells, monitoring and sampling protocols, and data management. A site may qualify for deletion from the NPL once all response activities are completed and all the clean up goals have been met. EPA is responsible for starting the process for site deletion with agreement from the responsible state agencies. Deleted sites may still require five-year reviews to assess continued protectiveness of the remedy. If site conditions are warranted after a site is deleted from the list, additional response actions may be initiated using Superfund monies or funding by potentially responsible parties. Under these circumstances relisting is not required, but sites may be relisted if extensive remedial action is required (EPA, 2005).

#### Site Deletion from the NPL and Reuse

A site may be deleted from the NPL if the EPA determines that no further response is required to protect human health or the environment. The criteria used to determine if a site qualifies for deletion includes; a determination by the state and EPA that the responsible parties have implemented all appropriate response actions required under CERCLA and no further response is required or a Remedial Investigation/Feasibility Study has demonstrated that any releases of hazardous substances do not pose a significant threat to human health or the environment; therefore, a remediation response is not needed. If these criteria are met the EPA issues a close-out report that lists all appropriate remedial actions if required and publishes a notice in the Federal Register.

The EPA then responds to comments and if the site is still eligible a deletion notice is published. In 1995, the EPA implemented the Partial Deletions Rule which allows the EPA to delete a portion of a site from the NPL. This rule was implemented because the cleanup of an entire site may take years, leaving portions of a site ready for productive use but unable to be utilized because of the listing status. A partial deletion of a site may be approved to designate uncontaminated areas of a site when portions are cleaned up and are available for unrestricted use. The requirements for partial deletion are the same as full deletion (EPA, 2010).

EPA's ultimate goal for each Superfund site is to return the sites to productive use. The Superfund Redevelopment Program assists communities with reuse of previously contaminated sites. The EPA is working to integrate potential use of future properties into the cleanup process in addition to working with communities where sites have already been cleaned up to ensure long-term success of site remedies and promoting reuse. In 2004, the Return to Use (RTU) Initiative was developed to facilitate removal of barriers to reusing Superfund sites after cleanup has been completed. Many Superfund sites remain unused or under utilized due to site ownership issues, stigmas attached to Superfund sites, and lack of information regarding appropriate reuse of sites. EPA promotes public education regarding incentives for site reuse that are beneficial to communities such as adding recreational amenities, providing commercial property, regaining valuable open space, and increasing surrounding property values. During the first six years of the Return to Use Initiative 58 sites have been established as demonstration projects. These demonstration projects consist of efforts by community

groups, government officials, site owners, and potentially responsible parties to achieve appropriate site reuse. Thirty-six of the 58 eight sites have been returned to full or partial reuse. The EPA continues to support reuse objectives at the remaining sites and utilizes better ways to facilitate support for reuse among stakeholders (EPA, 2010).

## Methods

The purpose of this research study is to determine if the lack of federal funding from taxes has had an impact on the program's effectiveness and site management. Program effectiveness will be determined by utilizing available EPA data on NPL site status. A comparison between the number of sites proposed to the NPL, the number of sites in final listing status on the NPL, sites deleted from the NPL, and sites that have reached the construction completion stage pre and post 1995, will be used to determine the effects, if any of not reauthorizing the tax for the program. The null hypothesis is that there is no difference between program outcomes (NPL site status data reported by fiscal year) for the time period from 1981 to 1995 and 1996 to 2009 meaning that the failure to re-authorize the Superfund tax has not affected the clean-up of contaminated sites and how they are managed. The alternative hypothesis is that failure to re-authorize the Superfund tax has affected the clean-up of contaminated sites and how they are managed. The four categories include the number of sites proposed by to the NPL by fiscal year, final listing of sites on the NPL, deletion of sites from the NPL and the number of sites reaching construction completion by fiscal year. Information obtained in this study may give an indication of the impact of less funding on achievement of future program goals.

NPL data retrieved from the EPA CERCLIS database for the fiscal years 1982 to 2009 were obtained for data analysis (**Table 1**). Data was selected from four categories of

NPL listing milestones: proposal to the NPL, final listing on the NPL, deletion from the NPL, and construction completion. A test for autocorrelation was completed for each data set to determine if the observations in the data set were independent for purposes of completing a One-Way ANOVA (analysis of variance). An ANOVA test was completed for each data set, to determine if there are any differences in each of the four categories of data for time periods between 1981 to 1995 and 1996 to 2009. The software program SAS version 9.1.3 was utilized to perform the data analysis completed for this study.

In addition to the analysis of the EPA NPL data, annual Congressional funding appropriations from 1981 – 2010 were examined to identify trends from program inception to the present. EPA Superfund Program Accomplishments (FY 2009-FY 2010) were examined to determine if program goals were achieved and 2009 American Recovery Act funding impacts on the overall program goals for 2009 and 2010 were investigated. Two Virginia Superfund sites were selected as case studies to demonstrate the impact of ARRA funding and the potential future impact of reduced funding on pending site activities. The Atlantic Wood site was selected due to the site being awarded a portion of ARRA funds for initiation of cleanup activities and the complex activities that are required for site remediation. The Chisman Creek site was selected to demonstrate the length of time it takes from proposal to NPL to reach the construction completion stage and the activities required after a site is returned to partial restricted use.

Table 1. NPL Site Status by Fiscal Year

FY	PROPOSAL TO NPL (Group A)	FINAL LISTING ON NPL (Group B)	DELETION FROM NPL (Group C)	Construction Complete (Group D)	PARTIAL NPL DELETION
1982	7	0	0	0	
1983	552	406	5	5	
1984	0	132	0	0	
1985	317	3	0	3	
1986	45	170	8	8	
1987	71	99	0	3	
1988	246	0	5	12	
1989	64	101	10	10	
1990	25	300	1	8	
1991	22	7	9	12	
1992	30	0	2	88	
1993	52	33	12	68	
1994	36	43	13	61	
1995	9	31	25	68	
1996	27	13	34	64	
1997	20	18	32	88	6
1998	34	17	20	87	7
1999	37	43	23	85	3
2000	40	39	19	87	5
2001	45	29	30	47	4
2002	9	19	18	42	6
2003	14	20	9	40	7
2004	26	11	16	40	6
2005	12	18	18	40	5
2006	10	11	7	40	3
2007	17	12	7	24	3
2008	17	18	9	30	3
2009	23	20	8	20	3

\*Partial Deletion totals not tracked until 1997

(EPA CERCLIS Database 3/18/2010)

## Results

The data set groups A, B, C, and D as listed in Table 5 consist of NPL site status data for each fiscal year from 1982 to 2009. Completion of a one-way ANOVA of the data in Group A, the number of sites proposed to the NPL for the time period between 1981 and 2009, revealed insufficient evidence that the means between the two groups are different, therefore we fail to reject the null hypothesis for this group. Completion of a one-way ANOVA of the data in Group B, the number of sites listed on the NPL, revealed sufficient evidence that means between the 2 groups are different, therefore we reject the null hypothesis in favor of the alternative hypothesis for this group. Completion of a one-way ANOVA of the data in Group C, the number of sites deleted from the NPL, revealed sufficient evidence that the means between the two groups are different, therefore we reject the null hypothesis in favor of the alternative hypothesis for this group. Completion of a one-way ANOVA of the data in Group D, NPL sites achieving construction complete status, revealed sufficient evidence that the means between the two groups are different, therefore we reject the null hypothesis in favor of the alternative hypothesis for this group. The results of the one-way ANOVA for each group are listed in **Table 2**.

After examining data on annual appropriations for the Superfund Program it was determined that the expiration of taxes in 1995 had minimal effect on the funding of the program initially because money was being added to the fund from cost recovery efforts. In addition to funds from cost recovery efforts, contributions from the general fund were

increased starting in 1993. Even with these increases in the fund balances, the trust fund did not reach the levels achieved when tax collections were the primary source of funding for the program. Annual Superfund Program Congressional Appropriations (**Figure 1, Table 4**), Superfund Trust Fund Share Appropriations (**Figure 3, Table 6**), Annual General Fund Share Appropriations (**Figure 2, Table 5**), and Annual ARRA Performance Measures (**Table 3**) are listed in Superfund Appropriation History Section of this writing.

Table 2. ANOVA Results

Test Statistic:  $F = \text{MSB}/\text{MSW}$ ,  $\alpha = 0.05$

Group	F statistic	p-value
A (Sites Proposed to NPL)	3.7	0.0655
B (Sites listed on the NPL)	4.9	0.0346
C (Sites deleted from the NPL)	13.26	0.0012
D ( Sites achieving construction complete status)	6.76	0.0152

SAS version 9.1.3

## **Program Accomplishments and Performance Measures**

### Government Performance and Results Act

The Government Performance and Results Act (GPRA) of 1993 holds federal agencies accountable for achievement of program goals and appropriate use of financial resources. GPRA requires federal agencies to develop plans for goals they intend to meet, measure outcomes, adjust program activities based on outcomes, and report performance to the public. Agencies are required to develop a five-year strategic plan, annual performance plans to achieve goals of the strategic plan, and annual performance and accountability reports that document the agency's achievement of goals. There are four key elements in the GPRA requirements that are tied together in the evaluation process; planning to accomplish goals and objectives, budgeting to ensure that appropriate resources are available to accomplish goals, measuring progress, and reporting achievements. EPA integrates these four elements into an integrated approach to maintain consistency and accountability. Superfund's GPRA tracking measures include: Sitewide Ready for Anticipated Use (SWRAU), Human Exposure Under Control (HEUC), Ground Migration Under Control (GMUC), Final Assessment Decision (FAD), and Construction Completed (CC) (EPA, 2009).

### Sitewide Ready for Anticipated Use (SWRAU)

The SWRAU measure tracks sites on the final NPL where the construction remedy has been determined to be completed; required cleanup goals have been met to reduce risk to human health and the environment, and institutional controls have been implemented. The tracking of this measure began in 2006 to assess the total number of NPL sites that would meet the SWRAU criteria. The site data gathered during 2006 served as a benchmark for establishing goals in subsequent years. In 2007 a goal of making 30 NPL sites ready for anticipated use each year. In FY 2009 the national goal was increased to making 65 sites ready for anticipated use (EPA, 2009)

### Superfund Environmental Indicator Measures

The Site-Wide Human Exposure Under Control Indicator (HEUC) and the Contaminated Groundwater Migration Under Control Indicator (GMUC) are the two environmental indicators for the Superfund Program. Environmental Indicators are measures of program accomplishments with regard to achievement of goals to protect public health and the environment through site remediation activities. Environmental indicators are used to report the number of sites where human exposure to hazardous substances is below levels recommended by the EPA and the number of sites where contamination ground water migration has been controlled to prevent human exposure and prevent discharges into surface water, sediments, or ecosystems (EPA, 2010).

The HEUC Environmental Indicator was designed to track long-term human health exposure prevention for all NPL sites by measuring progress in controlling human exposures above levels recommended by EPA. There are three categories designated for this environmental indicator to include current human exposure under control, insufficient data to determine exposure control status, and current human exposures not under control. A site is assigned to the human exposure under control category when it is determined that no unacceptable sources of human exposure exist site wide. A site is categorized under the insufficient data to determine human control status when control of human exposures is unable to be determined due to insufficient data. A site is assigned to the current human exposures not under control category when data indicate that there are sources of human exposure at unacceptable levels for the site. The HEUC indicator is evaluated for all NPL sites at least once annually or when changes in site condition occur. During FY 2010 1,338 NPL sites reached full HEUC status (EPA, 2010).

The Groundwater Migration Under Control Indicator (GMUC) evaluates stabilization of migrating contaminated ground water to prevent discharge into surface water. Sampling and monitoring is conducted to determine if affected ground water remains in the original area of contamination. This indicator is normally limited to sites where there is known groundwater contamination. There are three categories to which NPL sites are assigned as applicable, contaminated ground water migration under control, insufficient data to determine migration control status, and contaminated ground water migration not under control. If a site meets the requirements for the category of contaminated ground water

under control it is expected that monitoring and sampling results obtained for any known groundwater contamination have been acceptable. During FY 2010, 1,030 sites reached full GMUC status (EPA, 2010).

#### Final Assessment Decisions and Construction Completion Measures

Final Remedial Assessment decisions (FADs) is a measure used to indicate progress toward the completion of remediation assessment work at sites entered into CERCLIS at discovery. A FAD indicates no further assessment work is required under Superfund Program requirements. A FAD may be assigned to a site if any of the following conditions are met: a site has been proposed to or placed on the NPL, determination that no additional remedial assessment is required, a site is remediated under a state agreement, a site is being remediated under a Super Alternative Agreement, the site is in the process of being cleaned up by appropriate cleanup standards, or the site has been archived from the active CERCLIS site inventory. A FAD designation must be deleted if conditions change indicating the site no longer meets any of the required conditions. If new information is received regarding a site with a FAD designation, the new information must be evaluated to determine if the FAD designation should be removed. Each EPA region is responsible for maintaining FAD designations and related information in CERCLIS. If a site does not have record of completed discovery actions it is not measured for GPRA reporting purposes. During FY 2010 a total of 365 final assessment decisions were completed (EPA, 2010). The Superfund Construction Completion status

measure and the Construction Completion List also included in the Superfund GPRA reporting requirements were discussed earlier in this writing.

### Strategic Plan

The EPA is required to develop a Strategic Plan as a part of the performance measurement process. The EPA Strategic Plan describes the measurable environmental and human health outcomes and how these outcomes are to be achieved to the public. The plan also serves to identify where program improvements and adjustments need to be made to achieve better results. The Strategic Plan is developed to cover a five year period and is released for a 60-day public review and comment period before the final plan is approved. A combination of input from agency leaders, stakeholders, and the public is used to prepare the final draft. The plan includes five goal categories: Clean Air and Global Climate Change, Clean and Safe Water, Land Preservation and Restoration, Healthy Communities and Ecosystems, and Compliance and Environmental Stewardship (EPA 2009).

The EPA 2006-2011 Strategic Plan included the five program goals in the previous plan with an increased emphasis on achieving more with respect to measurable environmental goals. Goal three of the 2006-2011 plan pertains to land preservation and restoration. The objectives of this goal include preserving land, restoring land, and enhancing science and research. The achievement of measurable goals for the Superfund Program falls under objective 3.2. that states “by 2011, control the risks to human health and the environment by mitigating the impact of accidental or intentional releases and by cleaning up and restoring contaminated sites or properties to

appropriate levels" (EPA 2006). The target goals to be reached by this objective specific to the Superfund Program include: to complete 975 Superfund hazardous substance removal actions, control identified human exposure from soil and/or groundwater at 85% of Superfund sites, control migration of contaminated groundwater through remedial actions at 74% of Superfund sites, to complete construction remedies at 75% of Superfund sites, to ensure that 36% of final and deleted construction complete NPL sites are ready for reuse, to initiate enforcement action or reach a settlement to fund a site cleanup at 95% of Superfund sites with viable responsible, and evaluate Superfund costs greater than 200,000 for all sites with statute of limitations cases (EPA, 2006).

Strategic Plan goals and objectives for the Superfund Program are achieved by a combination of cooperative efforts between federal, state and local government agencies. The One Cleanup Program developed by the EPA is a long-term initiative that encourages the coordination of cleanup programs with all levels of government. The program also ensures that adequate remediation occurs, cleanup activities are properly communicated to the public, the use of resources is coordinated and to address potential environmental justice concerns within communities. The Superfund cleanup process includes initial assessment, site stabilization when needed for immediate control of exposure risks, site investigation, appropriate remedy selection, completion of remedial actions, and promoting site reuse after cleanup all of which contribute to attaining program goals and objectives relating to mitigating environmental contamination and human exposure. There are two strategies utilized to maximize the participation and financial contributions from viable responsible parties. The "Enforcement First Strategy"

and cost recovery are implemented to require responsible parties to pay for cleanups in an effort to conserve federal funds (EPA, 2006). The Enforcement First Strategy involves initiating enforcement actions against liable potentially responsible parties requiring them to pay for and/or perform cleanup activities. The EPA has developed a national strategy to ensure responsible party compliance with financial requirements as a part of the Strategic Plan. Cost recovery is a method used to require liable responsible parties to reimburse EPA with funds used to complete cleanup activities (EPA, 2009).

## **2009/2010 Superfund National Accomplishments and Funding**

The EPA prepares annual reports detailing the funding allocated for cleanup activities and annual accomplishment of program objectives. The public is not only interested in seeing the cleanup of sites, but also returning the sites to productive use for the community. The Integrated Cleanup Initiative was introduced by the EPA in 2010 to address current program challenges in improving program performance and providing the public with increased transparency. The current challenges of the program differ from those early in the program in that many of the sites are larger, more complex sites that require a more significant portion of Superfund resources. The program goals met or exceeded in the fiscal year 2009 include (EPA, 2010):

- An annual target of 10 additional NPL sites where potential or actual exposures are under control.
- Completed construction of remedies at 20 Superfund sites.
- A total of 400 final assessment decisions under Superfund.
- A target of 65 Superfund sites ready for anticipated use.
- Control of human exposures from site contamination at 10 Superfund sites.
- Control of ground water migration at 15 Superfund sites.

During 2009, of 1,607 sites listed on the NPL, 66 sites were ready for anticipated use, construction completion occurred at 20 sites, control of human exposures occurred at 11 sites, ground water migration control was achieved at 16 sites and 400 final site assessment decisions were completed (EPA, 2010).

In a continuing effort to locate viable responsible parties, the “enforcement first” strategy is utilized by the EPA. This strategy allows the conservation of Superfund monetary resources so that these resources may be used for funding sites where potentially responsible parties lack funds or do not exist. The “Enforcement First” strategy involves the aggressive use of enforcement tools, including administrative orders and consent decrees. Potentially responsible parties are sought throughout the removal and remedial process for the completion of site work and cost recovery when appropriate. Superfund had several enforcement goals for 2009. The first goal was to reach a settlement or initiate an enforcement action by the start of site remediation at 95 percent of non-federal Superfund sites with viable liable parties. The second goal was to address cost recovery at NPL and non-NPL sites with a statute of limitations on past costs totaling or greater than \$200,000. During 2009, 66 of 338 sites where cost recovery was addressed were found to have statute of limitation concerns. Private party commitments for cleanup and cost recovery exceeded \$2.4 billion in 2009 (EPA 2010).

During 2010, a total of 1,627 sites were listed on the NPL, construction of the final remedy was completed at 1,098 sites and 475 sites were ready for anticipated use. The program goals met or exceeded include (EPA, 2010):

- A total of 18 NPL sites where potential or actual exposures are under control, exceeding the goal of 10.
- Completed construction of remedies at 18 Superfund sites, not achieving the goal of 22.

- A total of 365 final assessment decisions under Superfund, exceeding the goal of 330.
- A total of 66 Superfund sites ready for anticipated use, exceeding the goal of 65.
- Control of ground water migration at a total of 18 Superfund sites, exceeding the goal of 15.
- Nearly 1.6 billion in private party commitments for cost recovery and cleanup activities was secured in FY 2010.

### **American Recovery and Reinvestment Act of 2009**

The American Recovery Act (ARRA) of 2009 provided \$600 million dollars in supplemental funds for Superfund site remediation activities. These funds were designated for use to start new construction projects and accelerate ongoing cleanup activities at 51 Superfund sites. The supplemental funding was also projected to accelerate the return of sites to productive use and the use of green remediation technology. A portion of the ARRA funding, \$18 million, was allocated by EPA to fund internal program activities including oversight, management, and fulfilling reporting requirements of ARRA. The remaining \$582 million was allocated for cleanup activities at designated Superfund sites. The EPA considered several factors to determine which projects would receive additional funding. The level of human and ecological risk, construction readiness, opportunities to shorten project schedules, and opportunities to reduce project costs were among the factors considered during the site selection process. The Superfund Program's annual appropriations and ARRA funds are different

in that the ARRA funds had a specific time frame for expenditure or designation to be used for a specific site. The funds had to be designated for expenditure by September 30, 2010 and must be spent by September 30, 2017. ARRA also included requirement to track additional information such as job creation and requires more frequent reporting of program activities (EPA, 2009).

Once the funding was designated for expenditure for specific sites, ARRA requires EPA to use performance measures to track cleanup progress at each site. Six new performance measures will only be used for ARRA reporting purposes. The performance measures are as follows:

- The number of NPL sites where ARRA funds were allocated.
- The number of projects at NPL sites where ARRA were allocated.
- The number of NPL sites where ARRA funds were designated for new construction.
- Percentage of ARRA funds allocated for expenditure during a reporting period.
- Number of ARRA funded projects reaching the completion phase.
- Number of sites achieving construction completion with ARRA funds.
- Number of sites achieving Human Exposure under Control (HEUC) with ARRA funding.

The last two performance measures listed are existing performance measures under GPRA and will also be used to track ARRA accomplishments. The primary

objectives for use of ARRA funding for Superfund remedial actions are to accelerate cleanup activities at NPL sites, create jobs, reduce human and environmental exposures, and promote economic recovery. These objectives will be achieved by accelerating current remedial projects; starting new projects, accelerating the reuse of remediated sites, and job creation through increased activities at current and new projects. In addition to the primary objectives, ARRA activities will be implemented in ways to promote greener, more efficient methods to cleanup Superfund sites. Clean diesel technologies, green remediation methods, and the use of renewable resources will be considered as appropriate and permitted by law (EPA, 2009).

Commencement of on-site construction was achieved with ARRA funding at 22 sites by September 30, 2009. A total of 33 sites initiated on-site construction with new and ongoing projects and 100% of ARRA funds had been designated for expenditure by December 31, 2009. Funding was designated for expenditure at 51 sites and 61 projects, of which 26 projects were new by September 30, 2010. **Table 3** lists ARRA performance measures and achievements by quarter and fiscal year (EPA 2010).

Table 3. American Recovery and Reinvestment Act Performance Measures by Fiscal Year and Quarter (Superfund Projects) Source: EPA Recovery Act Report, 2010

Performance Measure	Qtr 4 FY 09	Qtr 1 FY 10	Qtr 2 FY10	Qtr 3 FY 10	Qtr 4 FY 10	Long-term Target	Percent Complete
Projects in receipt of ARRA funds	60	61	61	61	61	60	100 %
Sites in receipt of ARRA funds	50	51	51	51	51	50	100%
Sites achieving construction completion	1	1	1	1	4	5	80%
Sites achieving human exposures under control	2	2	3	4	4	5	80%
Sites with new construction	25	26	26	26	26	25	100%
Projects with new construction	0	0	1	1	8	16	50%
Projects achieving completion	0	0	1	1	8	16	50%

### Superfund Appropriation History

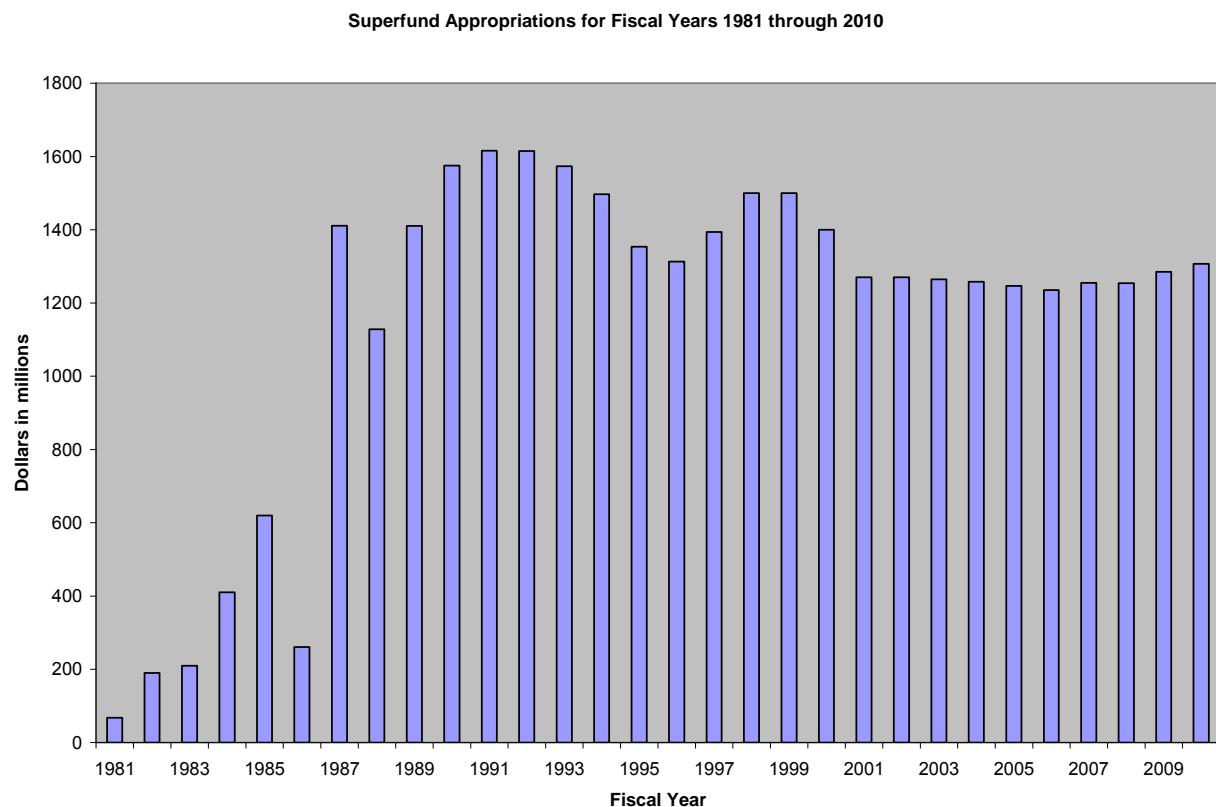
Revenue for the Superfund trust fund originates from four sources. The sources include excise taxes on crude oil and certain chemicals, environmental income taxes from corporations, appropriations from the general fund, monies recovered from responsible parties, and interest earned on the balance of the fund. The taxes that initially provided

revenue for the fund expired at the end of 1995. A final agreement could not be reached on reauthorization since, thus the taxes have not been reinstated as of this writing. After the taxes expired in 1995 the Office of Management and Budget reported that the fund had a balance nearly \$4 billion. The expiration of taxes had minimal effect on the funding of the program initially (**See Figure 1 and Table 4**) because money was continually being added from cost recovery efforts. The contribution of general funds to the total annual appropriation (**See Figure 2 and Table 5**) was increased to \$250 million annually from fiscal years 1993 to 1998 to extend the life of the fund. Additional increases between \$634 million and \$1.1 billion were made in fiscal years 2000 to 2004. The fund actually started with a balance of 0 in fiscal years' 2004 and 2005. However, there was an ending balance of \$97 million for fiscal year 2005 enabling the fund to start fiscal year 2006 with a balance. During subsequent fiscal years (2007- 2009) this trend continued; however, the balances do not come close to the levels when tax collections were the primary source of the fund (**See Figure 1 and Table 4**). (OMB,2011)

In the fiscal year 2010 budget proposal, \$1.3 billion was allocated to increase the number of sites ready for anticipated use. The FY 2010 budget also proposed reinstating expired Superfund taxes beginning in 2011. The projected revenue from the taxes is \$1.2 billion for 2011 with an expected increase of 2 billion per year by 2019. However, this funding may be in jeopardy due to the current budget crisis for FY 2011 and the potential loss of 1.6 billion in funding by the EPA (OMB, 2011). There are currently three bills pending in Congress relating to reauthorizing Superfund taxes, restoring polluter pay

financial responsibilities and allocation of program funds (Thomas-Library of Congress, EPA, 2011).

Figure 1



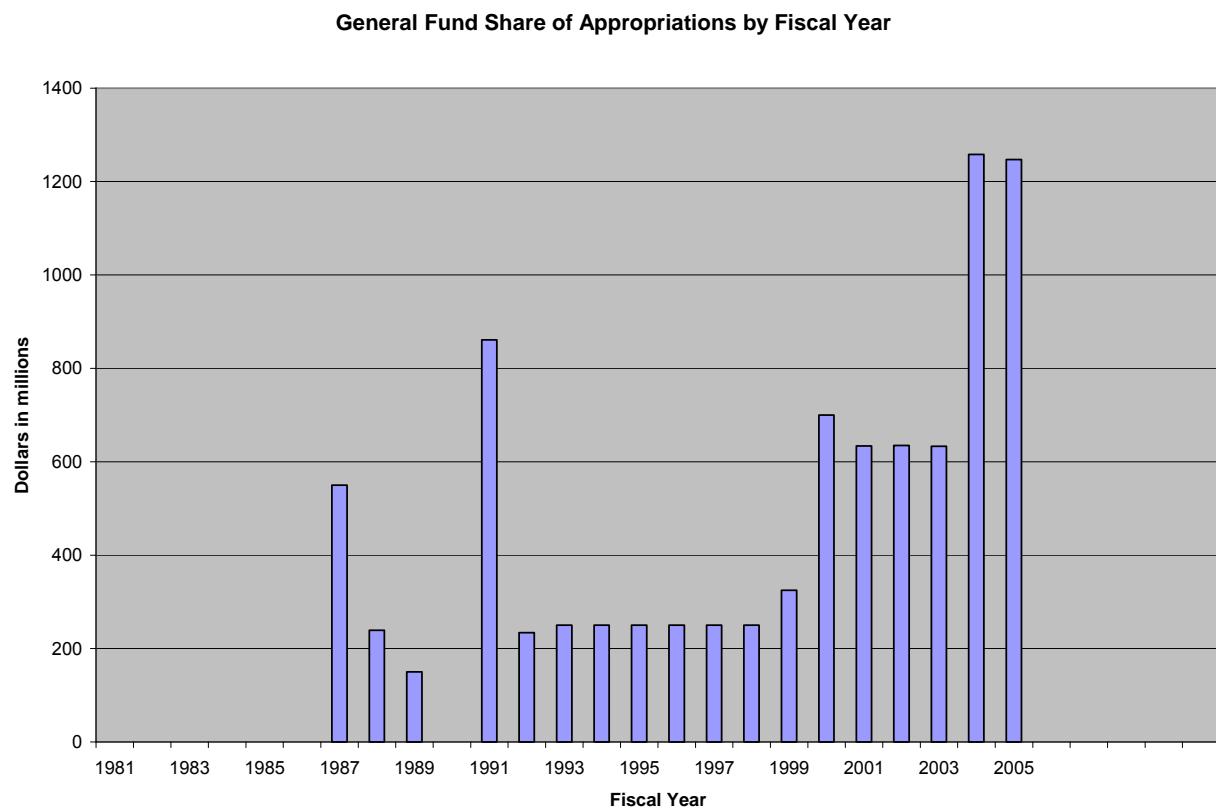
Source :EPA, 2010

Table 4. Superfund Appropriations by Fiscal Year

Fiscal Year	Dollars in Millions
1981	68
1982	190
1983	210
1984	410
1985	620
1986	261
1987	1411
1988	1128
1989	1410
1990	1575
1991	1616
1992	1615
1993	1573
1994	1497
1995	1354
1996	1313
1997	1394
1998	1500
1999	1500
2000	1400
2001	1270
2002	1270
2003	1265
2004	1258
2005	1247
2006	1235
2007	1255
2008	1254
2009	1285
2010	1307

Source: EPA,2010

Figure 2



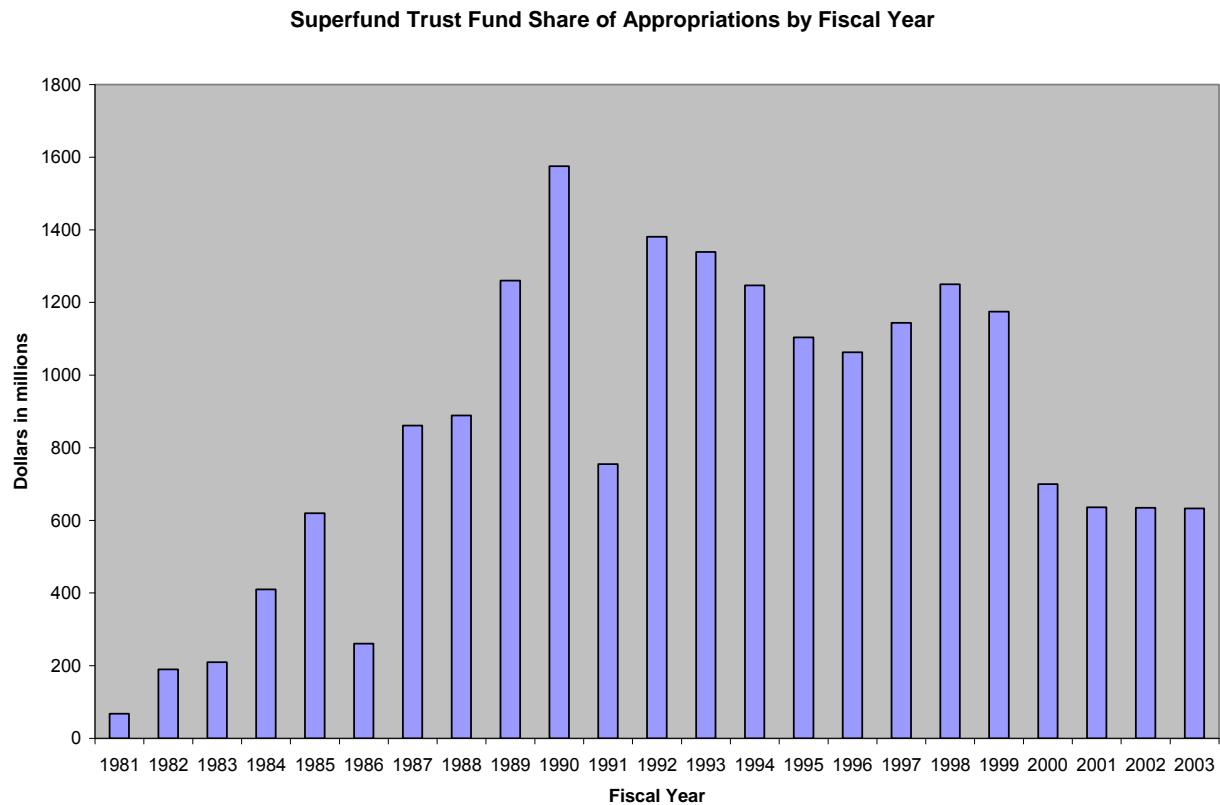
Source: EPA, 2010

Table 5. General Fund Share of Superfund Appropriations by Fiscal Year

Fiscal Year	Dollars in Millions
1981	0
1982	0
1983	0
1984	0
1985	0
1986	0
1987	550
1988	239
1989	150
1990	0
1991	861
1992	234
1993	250
1994	250
1995	250
1996	250
1997	250
1998	250
1999	325
2000	700
2001	634
2002	635
2003	633
2004	1258
2005	1247

Source: EPA, 2010

Figure 3



Source: EPA, 2010

Table 6. Superfund Trust Fund Share of Appropriations by Fiscal Year

Fiscal Year	Dollars in Millions
1981	68
1982	190
1983	210
1984	410
1985	620
1986	261
1987	861
1988	889
1989	1260
1990	1575
1991	755
1992	1381
1993	1339
1994	1247
1995	1104
1996	1063
1997	1144
1998	1250
1999	1175
2000	700
2001	636
2002	635
2003	633

Source: EPA, 2010

## Case Studies

### Atlantic Wood Industries, Inc. Portsmouth, Virginia

The Atlantic Woods Industries (AWI) site was originally proposed to be listed on the NPL in June 1986 and formally added to the list in February 1990. The site consists of 48 acres of land in the industrialized section of waterfront in Portsmouth, Virginia. The property is surrounded by other smaller industrial properties, a public school operations center, and the Southern Branch of the Elizabeth River. There is also 35 acres of contaminated sediment in the river included in this site. A wood treating facility that operated on the site from 1926 to 1992 was the primary source of contamination. The primary contaminants of this site are creosote and pentachlorophenol (PCP) used in the wood treatment operation, storage of treated wood, and wastes generated during the process. The U.S. Navy also leased a portion of the property from AWI to use as a site for sand blasting naval equipment and disposal of sludge generated from acetylene production in a wetland bordering the property. Sediment in the Elizabeth River, soil, and ground water at the site are all heavily contaminated with creosote, PCPs, metals, dioxins, and polynuclear aromatic hydrocarbons (PAHs). Due to the contamination of the property and surrounding area, ground water is not used as a drinking water source and a “do not eat advisory” has been issued for blue crab hepatopancreas from the river (EPA, 2011).

This site is designated as Human Exposure Not under Control due to the continued risk of recreational users of the river coming in direct contact with contaminated sediment,

consumption of a high level of contaminants by eating large quantities of shellfish, and the risk of current AWI and Norfolk Naval Shipyard employee exposure to contaminated soils. This area consists or work locations for 14,000 employees including AWI employees which currently operate a pre-stressed concrete manufacturing facility on-site. In an EPA initial PRP removal action completed in 1995, AWI dredged an estimated 660 cubic yards of contaminated sediment from the inlet of the Elizabeth River. Later in September 2005, A Record of Decision (ROD) was issued by EPA primarily addressing contaminated sediment and soil in a wetlands area on the site. The selected remedy included most of the soil and sediment be excavated and treated using bioremediation. In the event target cleanup levels could not be reached through bioremediation, low temperature thermal desorption would be used to achieve target cleanup levels. During the design phase of the cleanup, analysis of contaminated media revealed higher levels of contamination than originally thought. Therefore, the original selected remedy was not the most appropriate solution. A new feasibility study was conducted to determine a more appropriate action considering the higher levels of contamination found at the site (EPA, 2011).

In 2002, The U.S. Navy and AWI agreed to a removal action to remove sludge created during acetylene sludge from the wetland bordering the property. The removal of the sludge and restoration of the wetland area was completed in 2003. The removal of the abrasive blast media generated from sand blasting naval equipment disposed of on the site was not included in this removal action. The intention was to include the removal of the disposed abrasive blast media during the soil cleanup remedy. A new ROD was

issued in December 2007 replacing the 1995 ROD which addressed all site contamination including ground water contamination. The remedy selected included excavation of creosote hot spots on the AWI property, a clean soil cover over area with contaminated soil, placement of a sheet pile wall in the Southern Branch of the Elizabeth River to prevent creosote migration into the river, monitored natural attenuation of groundwater, the creation of new land by disposing of dredged sediment behind the newly placed sheet pile wall, and enhanced monitoring natural recovery of sediment (EPA, 2011). The estimated cost of the cleanup for this site is \$44.9 million. Clean up of this site is being partially funded by ARRA funding of \$3.7 million. This additional funding allowed the start of cleanup activities to begin in the Spring 2010, earlier than originally anticipated (EPA, 2011).

### **Chisman Creek, York County, Virginia**

This site was proposed to the NPL in December 1982 due to the high level of ground water contamination posing a risk to public health. The site was formally added to the NPL in September 1983. This site consists of four former sand and gravel pits used to dispose of fly ash generated from the Yorktown Power Generating Station from 1957 to 1974. The fly ash was moved from one of the pits and placed in another location during the 1970's. After a homeowner reported discolored well water in 1980's, Virginia state agencies conducted an investigation that revealed heavy metal contamination in Chisman Creek and groundwater near the fly ash disposal areas. EPA conducted a remedial investigation confirming that the contamination was localized in the area of the disposal pits. At that time, 50 to 1,000 residents lived within 1 mile of the site (EPA, 2010).

The primary ground water contaminants of the site were vanadium and nickel. Virginia Power, the potentially responsible party, installed public water lines for homes in the immediate area with contaminated groundwater. In a 1987 Consent Decree, Virginia Power agreed to design and construct a remedy for one operable unit on the property. The remedy consisted of a collection and treatment system for groundwater, post-closure monitoring of ground water and surface water, construction of a low permeability soil cap, a soil cover and deed restrictions. Construction was completed by December 1998 and more than 23 million gallons of contaminated groundwater were treated at the on-site treatment system. At the community's request, EPA agreed to allow the construction of softball fields and soccer fields maintained by York County in one operable unit after the remedial action was completed. An agreement was reached for the second operable unit in March 1988 that included surface drainage modifications and implementation of a water quality program for each pond, a tributary, and the estuary. The second operable unit reached construction completion in December 1990 (EPA,2010).

Three five-year reviews have been completed for the Chisman Creek site. Five-year reviews are required when the site has limited use due to the level of contamination at the site. Since the Chisman Creek site has been limited to recreational use in one operable unit, the site does not meet criteria for Site-wide Ready for Anticipated Use. Institutional controls including the prevention of using groundwater on the site are in place to ensure the site posses no additional human health and environmental risks. After the third five-year review was completed in December 2006, EPA determined the

site remedy was only provided short term protection. The extent of vanadium contamination of the groundwater is still in question and the site will require additional sampling in the future. The estimated cost for cleanup of this site is \$10 million, even though the site has reached the construction completion stage funds are still required to support EPA reviews, sampling and future remediation efforts. The next five-year review for this site is scheduled for December 2011 (EPA, 2010).

## Discussion

This research study identified mean differences from NPL site status achievements for the following milestones: final listing on the NPL, deletion from the NPL, and achieving construction completion status on the NPL. These results suggest that funding variations over nearly a 30 year period has some impact on the operation of the Superfund program and the pace in which Superfund sites reach specified program goals. Even though Congress has increased the general fund appropriations to Superfund in an effort to maintain a level of funding needed for EPA to successfully cleanup NPL sites, the funding levels are lower than when excise tax collections peaked after the inception of the program. Superfund cleanup efforts are becoming increasingly expensive and more complex. The process can take many years from the time a site is proposed to the NPL to attain construction completion status. The Chisman Creek site in York County, Virginia was proposed to the NPL in 1982 and reached construction completion in 1990, still requires EPA Superfund resources for completion of five year reviews and associated activities. The Atlantic Wood Industries site in Portsmouth, Virginia was proposed in 1986 and requires ongoing extensive remedial design and action that has been accelerated due to additional funds obligated to the site through ARRA.

Since 2001, appropriations from the general fund have been the largest source of funding for Superfund. The monies collected from responsible parties fluctuate from one fiscal year to the next. Because of limited resources due to reduced funding and budget

cuts, the cleanup of many sites is delayed, which can result in increased cost overtime. EPA projected costs of remedial construction at NPL sites for the fiscal years 2010 through 2014 ranges from \$335 million to \$681 million. Agreements have been reached with responsible parties to fully fund remedial actions at 206 sites, for an additional 11 sites the EPA does not expect to pay for additional costs of construction completion because these activities have been previously funded (GAO, 2010). The number of sites listed on the NPL is expected to increase over the next five years with an average of 20-25 sites added to the list per year. EPA officials expect an increase in the listings partially due to the current economic conditions making it difficult for states to clean up certain sites under state funded programs. The average cost for EPA to cleanup Superfund sites has also increased from \$7.5 million in 1999 to \$10.2 million in 2007. GAO, 2009). The limited funding, increased cleanup costs, and potential increase in NPL sites will prove to be a challenge to EPA's continuing efforts to meet Superfund program goals.

Many times the type and extent of contamination is unknown making it difficult to estimate the cost of site clean-up. The costs of construction remedies are generally higher than initial estimates because contamination of the site may be found to be more extensive requiring more complex site remediation similar to the circumstances of the Atlantic Wood site discussed earlier in this paper. Other factors that may cause an increase in cost include: a change in acceptable contaminant levels at a site, increased energy costs, and increased costs for labor and construction materials. The EPA regions allocate funds on a site by site basis with priority going to sites with ongoing construction

activities. In a 2010 GAO report, EPA officials were surveyed and reported that funds for ongoing construction and preconstruction activities have been insufficient for fiscal years 2000 through 2009 causing delays in site cleanup activities. These delays increase the time it takes for site cleanup, potentially increase the cost of cleanup, and increase the time of exposure to site contaminants. In addition to the potential increase in sites proposed to the NPL due to economic factors, the number of sites eligible for clean-up may increase due to the assessment of vapor intrusion of subsurface hazardous materials that may have migrated into homes and commercial properties. The EPA HRS does not currently assess sites based on this risk unless there is also groundwater contamination that has occurred with vapor intrusion. If vapor intrusion assessments are included as a part of the listing process, up to 37 sites could be eligible for listing as of 2010 (EPA, 2010).

## References

Cook, Michael B. Superfund Cost Management Measures. EPA Office of Solid Waste and Emergency Response. Washington, DC, October 24, 2005.

Probst, Katherine. Superfund's Future: What Will it Cost/A Report to Congress. Washington, DC: Resources for the Future, 2001.

Probst, Katherine and Diane Sherman. Success for Superfund: A New Approach for Keeping Score. Washington, DC: Resources for the Future, April 2004: 1-27.

Probst, Katherine. Superfund at 25: What Remains to be Done. Washington, D.C. Resources for the Future, 2005.

Probst, Katherine. Critical Issues Facing the Superfund Program. Congressional Testimony to Senate Environment and Public Works Committee/Subcommittee on Superfund and Waste Management. Washington, DC: Resources for the Future, 2006.

Sapien, Joaquin. Superfund Today Massive undertaking to clean up hazardous waste sites has lost both momentum and funding. The Center for Public Integrity, April 2007.

<http://www.publicintegrity.org/Superfund/report.aspx?aid=851>.

Sullivan, Thomas. Environmental Law Handbook. 19. New York: Government Institutes, 2007.

Congressional Research Service Report for Congress. Superfund Taxes or General Revenues: Future Funding Issues for the Superfund Program. The Library of Congress, March 2006.

US Environmental Protection Agency. National Strategy to Manage Post Construction Completion Activities at Superfund sites, (OSWER 9355.0-105). October 2005

US Environmental Protection Agency. 2006-2011 EPA Strategic Plan: Charting Our Course. 30 September 2006 Environmental Protection Agency 16 March 2010  
[http://www.epa.gov/ocfo/plan/2006/entire\\_report.pdf](http://www.epa.gov/ocfo/plan/2006/entire_report.pdf).

US Environmental Protection Agency. Superfund 20th Anniversary Report. 19 September 2007.  
Environmental Protection Agency. 16 Dec 2008 <http://www.epa.gov/superfund/20years/>.

US Environmental Protection Agency. EPA Strategic Plan. 30 October 2009. Office of the Chief Financial Officer 14 April 2010 <http://www.epa.gov/ocfo/plan/plan.htm>.

US Environmental Protection Agency. Superfund Accomplishments and Performance Measures. 30 March 2009. Environmental Protection Agency. 16 March 2010  
<http://www.epa.gov/superfund/accomplishments.htm>.

US Environmental Protection Agency. American Recovery and Reinvestment Act Quarterly Performance Report (Cumulative Results as of December 31, 2009). 16 February 2010. Environmental Protection Agency. 24 March 2011 [http://www.epa.gov/recovery/pdfs/2010\\_Q1\\_Perf\\_Rpt](http://www.epa.gov/recovery/pdfs/2010_Q1_Perf_Rpt)

US Environmental Protection Agency. American Recovery and Reinvestment Act Quarterly Performance Report (Cumulative Results as of September 30, 2010). 16 February 2010. Environmental Protection Agency. 24 March 2011 [http://www.epa.gov/recovery/pdfs/2010\\_Q4\\_Perf\\_Rpt.pdf](http://www.epa.gov/recovery/pdfs/2010_Q4_Perf_Rpt.pdf)

US Environmental Protection Agency. Superfund Environmental Indicators. 01 March 2010. Environmental Protection Agency. 16 March 2010. <http://www.epa.gov/superfund/accomp/ei/ei.htm#sitewide>.



US Environmental Protection Agency. The U. S. Environmental Protection Agency's FY 2009 Performance and Accountability Report. 01 March 2010. Environmental Protection Agency. 19 March 2010  
<http://epa.gov/ocfo/par/2009par/index.htm>.

US Environmental Protection Agency. Superfund Site Progress Profile Chisman Creek 04 March 2010. Environmental Protection Agency. 07 March 2010  
<http://cfpub1.epa.gov/supercpad/cursites/csitinfo.cfm?id=0302756>.

US Environmental Protection Agency. Superfund Cleanup Process. 17 March 2010. Environmental Protection Agency. 16 March 2010 <http://www.epa.gov/superfund/cleanup/index.htm>.

US Environmental Protection Agency. History of RCRA. Environmental Protection Agency. 19 August 2010. <http://www.epa.gov/waste/laws-regulations/rcrehistory.htm>.

US Environmental Protection Agency. The Office of Solid Waste and Emergency Response FY 2010 End of Year Report. 28 February 2011. Environmental Protection Agency. 24 March 2011  
[http://www.epa.gov/oswer/docs/oswer\\_eoy\\_2010.pdf](http://www.epa.gov/oswer/docs/oswer_eoy_2010.pdf)

US Environmental Protection Agency. Superfund Accomplishments and Performance Measures. 28 February 2011. Environmental Protection Agency. 24 March 2011  
<http://www.epa.gov/superfund/accomplishments.htm>.

US Environmental Protection Agency. Superfund Implements the Recovery Act: Atlantic Wood Industries. 28 February 2011. Environmental Protection Agency. 16 April 2011  
[http://www.epa.gov/superfund/eparecovery/atlantic\\_wood.html](http://www.epa.gov/superfund/eparecovery/atlantic_wood.html).

US Environmental Protection Agency, "National Priorities List." National Priorities List. Environmental Protection Agency. 24 March 2011. Environmental Protection Agency. 24 March 2011 <http://www.epa.gov/superfund/sites/npl/>.

US Environmental Protection Agency. Superfund Site Progress Profile Atlantic Wood Industries, Inc. 15 April 2011. Environmental Protection Agency. 16 April 2011  
<http://cfpub1.epa.gov/supercpad/cursites/csitiinfo.cfm?id=0302836>

US General Accountability Office. Environmental Contamination: Cleanup Actions at Formerly Used Defense Sites. July 2001.

US Government Accountability Office. Superfund: Litigation Has Decreased and EPA Needs Better Information on Site Cleanup and Cost Issues to Estimate Future Funding Requirements. 15 July 2009.

US Government Accountability Office. Superfund EPA's Costs to Remediate Existing and Future Sites Will Likely Exceed Current Funding Levels. 22 June 2010.

US Office of Management and Budget . President's Budget Appendices Fiscal Years 2006- 2010. 24 March 2011.

US Office of Management and Budget. Budget of the United States Government, Fiscal Year 2012 Library of Congress- Thomas. Bill Summary and Status. 19 April 2011. <http://thomas.gov/cgi-bin/thomas>.

### Vita

Nicole A. Franklin was born on December 18, 1971 in Portsmouth, VA. She graduated from I.C. Norcom High School, Portsmouth, Virginia in 1989. She received her Bachelor of Science in Biology from Old Dominion University, Norfolk, Virginia and subsequently worked in the food and dairy manufacturing industries in several quality control positions. She later began her career in public health with the Virginia Department of Health as an Environmental Health Specialist. She is currently a Senior Safety Engineer with the Virginia Commonwealth University Health System.