Regulatory Analysis for Final Rule - Decommissioning Planning

U.S. Nuclear Regulatory Commission
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EXECUTIVE SUMMARY

The Nuclear Regulatory Commission (NRC) has published a final rule (RIN: 3150-AH45) to amend its regulations to improve decommissioning planning and reduce the likelihood that any currently operating facility will become a "legacy site." A "legacy site" is a facility that is in decommissioning status with complex issues and an owner who cannot complete the decommissioning work for technical or financial reasons.

There are a small number of NRC and Agreement State legacy sites that may someday need to rely on State or Federal government funding to decommission the site consistent with unrestricted use criteria. This government response is unpredictable, time consuming and expensive. Legacy sites are potential radiological hazards, and the delay in cleanup introduces additional risk to occupational and public health and safety during later decommissioning.

Past experience indicates two contributing factors to licensees' inability to fund decommissioning: 1) licensees' underestimation of residual radioactivity during operations; and 2) insufficient funds assigned by the licensee to the financial instrument used as an assurance to complete decommissioning. For licensees that operate source, byproduct and special nuclear material facilities, site decommissioning usually occurs soon after the facility shuts down. For power reactor licensees, site decommissioning is more complex and starts several years after the reactor has been shut down. For all licensees, lowering the risk of becoming a legacy site is an important regulatory topic that is best addressed during facility operations when there is time to plan and assure adequate funds for decommissioning.

NRC staff estimate that a small number of material licensees are at risk to have significant residual radioactivity in their subsurface environment and would need to perform additional site surveys, by the effective date of the final rule, to identify the residual radioactivity, as required in amended 10 CFR 20.1406 and 20.1501. Staff has no basis that other licensees will need to perform additional surveys, including power reactors, fuel cycle facilities, and the large majority of source and byproduct material facilities, by the effective date of the final rule. About 45 licensees will be affected by tighter controls and additional reporting requirements in changes to the parent guarantee and self guarantee decommissioning financial assurance regulations. A few licensees will be affected by additional reporting requirements under changes to 10 CFR 50.82. About 20 licensees will be affected by the elimination of the escrow account and will have a one-time cost to switch to a trust agreement as financial assurance. About 500 NRC licensees and about 1,000 Agreement State licensees will have a one-time labor effort of about 90 minutes per licensee to read the final rule changes to 10 CFR Part 20 and to read the related guidance document for survey and monitoring requirements under amended 10 CFR 20.1406 and 20.1501. New reporting requirements in 10 CFR 72.30(b), (c) and (d) will apply to ISFSI General and Site-Specific licensees.

This Regulatory Analysis provides an evaluation of three alternatives. The preferred alternative is Alternative 2 which amends regulations as specified in the final rule. This alternative is less costly than the other two and provides a risk-informed regulatory framework to reduce the likelihood of a future legacy site compared to current regulations.

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CD	Certificate of Deposit
DCE	Decommissioning Cost Estimate
LOC	Line of Credit
DFP	Decommissioning Funding Plan
DFSR	Decommissioning Fund Status Report
FA	Financial Assurance
gm	gram
ISFSI	Independent Spent Fuel Storage Installation
LTR	License Termination Rule
mCi	milli-curie
NRC	Nuclear Regulatory Commission
OMB	Office of Management and Budget
pCi	pico-curie
SFMF	Spent Fuel Management Fund
S&P	Standard and Poor's
TF	Trust Fund
TL	Total Liabilities
TNW	Tangible Net Worth
UCC	Uniform Commercial Code
µCi	micro-Curie

1. INTRODUCTION

The Nuclear Regulatory Commission (NRC) has amended its regulations to improve decommissioning planning and thereby reduce the likelihood that any of NRC's licensed facilities will become a "legacy site." A "legacy site" is a facility that is in decommissioning status with complex issues and an owner who cannot complete the decommissioning work for technical or financial reasons. The NRC terminates several hundred licenses each year and most of the licensed sites require little, if any, remediation to meet NRC's license termination criteria. A few licenses can only be terminated after several years of complex decommissioning efforts. The license termination process for these complex sites continues to be slow and expensive for both the owners and regulatory agencies.

In 2006, NRC regulated 32 complex decommissioning sites. Of those sites, 8 were legacy sites. There were 6 legacy sites in December 2007. If a legacy site is incapable of funding site remediation, the last option available to NRC is to pursue Congressional funding for site cleanup with another agency (State or Federal) directing the remediation efforts.

Legacy sites have two common characteristics: subsurface residual radioactivity in amounts greater than anticipated, and insufficient funds to remediate the radiological contamination to levels that will meet the NRC's license termination criteria. The issue of subsurface residual radioactivity often receives scant attention from licensees during operations because their spills, leaks and effluent releases are typically far below radiation protection standards. In addition, the below ground site surveys are normally done after a facility is permanently shut down as part of required decommissioning planning. Licensees are able to plan their characterization work, in part, on documentation of spills and leaks that occurred during facility operations. If a licensee first learns of significant subsurface residual radioactivity at the start of decommissioning, after the facility has been shut down and the owner has no operating revenue, there is the possibility of a legacy site. Delays in remediating the subsurface residual radioactivity allow the low-activity radioactive material to spread and further increase the cost to terminate the license.

1.1 Description of the Final Rule

One action evaluated in this Regulatory Analysis is a set of linked amendments to (a) revise 10 CFR 20.1406 to make it applicable to licensees as well as applicants; and (b) revise 10 CFR 20.1501(a) by replacing its undefined term "radioactive material" with "residual radioactivity," a term already defined in 10 CFR Part 20. This defined term includes subsurface contamination within its scope. Due to the need to better ascertain the extent of existing contamination within the subsurface during facility operations, both 10 CFR 20.1406(c) and 20.1501(a) have been worded to include subsurface contamination within their scope. Consistent with this approach, both provisions contain the "residual radioactivity" term, which serves to reinforce the intended linkage between these provisions. These changes are consistent with NRC policy that licensees conduct operations so as to minimize the generation of waste, in order to facilitate later facility decommissioning and to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA) during operations and decommissioning. The purpose of these amendments is to focus licensee attention on subsurface residual radioactivity as a potential radiological hazard in later decommissioning activities.

The second major part of the action is a set of amendments in decommissioning planning and financial assurance requirements in 10 CFR Parts 20, 30, 40, 50, 70, and 72 to better ensure that:

- The licensee has accurate information about its decommissioning work scope and has reported this to the NRC with cost estimates required for license termination, and
- The licensee's decommissioning financial assurance will be available when needed, even if the licensee enters bankruptcy with its assets vulnerable to attachment by creditors.

The amended regulations require licensees to report additional details of their decommissioning cost estimates, including estimated cleanup costs for subsurface contamination. The amended regulations eliminate two currently approved financial assurance mechanisms, and modify the parent company guarantee and Self-Guarantee financial assurance mechanisms to reduce the likelihood that operating facilities will become legacy sites. The amended regulations require decommissioning power reactor licensees to report additional information on the costs of decommissioning and spent fuel management. The set of amendments to change decommissioning planning and financial assurance requirements impose additional information collection and reporting requirements on certain licensees.

1.2 Need for the Final Rule

Existing licensees are already required by 10 CFR Part 20 to have radiation protection programs aimed towards reducing exposure and minimizing waste (Reference 1). The current § 20.1101(a) requires each licensee to implement a radiation program to ensure compliance with the regulations in 10 CFR Part 20. The current § 20.1101(b) requires each licensee to use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. These operating procedures and controls need to include methods to evaluate potential radiological hazards and to minimize and control waste generation during facility operations, to achieve doses that are ALARA.

Current regulations in 10 CFR 20.1501 give licensees some latitude in using surveys to assess the degree of radiological contamination that may be present at their site. Licensed facilities that have fluid processes typically have effluent releases and minor leaks that, over time, can produce significant amounts of residual radioactivity in the onsite subsurface. Effluent releases are regulated as an annual limit by specific radionuclide in Appendix B of 10 CFR Part 20, and for power reactors in Appendix I of 10 CFR Part 50. Abnormal releases that exceed a regulatory limit are rare at licensed facilities. On the other hand, the accumulation of residual radioactivity from small leaks (e.g., 0.1 gallons per minute) at a facility over a long period of time has been a primary cause of sufficient funds not being available for decommissioning activities. Current Part 50 licensees may operate their facilities as long as 60 years and, as a result, need to diligently document their surveys and recordkeeping to consider waste in the form of residual radioactivity that may affect decommissioning financial assurance. Nuclear power reactor and fuel cycle facility licensees have monitoring systems to identify effluent release and ground-water contamination, and prepare effluent release reports that are available for NRC and public review.

Since 1998, the NRC has required licensees to document radioactive spills and leaks that occur during facility operations and are important to the decommissioning of the facility. The documentation of these spills, leaks, and onsite abnormal releases into the environment are required in 10 CFR Parts 30.35(g), 40.36(f), 50.75(g), 70.25(g), and 72.30(d). The conditions that qualify a spill or leak as important for decommissioning are site specific, and are widely interpreted. The conditions include radionuclide half-life, quantity, form, concentration, adsorption, and the amount of time the release occurs prior to the start of decommissioning.

Regulatory guidance before this final rule did not specify criteria for reporting these conditions. NRC inspectors have cited byproduct material licensees for not maintaining adequate records important for decommissioning and to satisfy license termination requirements (Reference 2).

The operators of materials facilities who have a license to possess relatively small amounts of radioactive material are permitted to use a Certification Amount of funding as decommissioning financial assurance. About 150 of these licensees currently use certification as decommissioning funding assurance. The Certification Amount, established by regulation and not often changed, is typically lower than a decommissioning cost estimate especially if there has been a significant spill, leak or abnormal release at the facility. Even if there has been a significant release at a facility, the licensee may decrease its Certification Amount held as decommissioning financial assurance, or remove it altogether, by amending its license to reduce its radioactive material possession limit. This final rule requires the licensee to increase its decommissioning funding assurance following a spill if the licensee decides to defer remediation to a later date. Amendments to sections 30.35(c), 40.36(c) and 70.25(c) require materials licensees who experience a significant spill, leak or abnormal release to replace the Certification Amount with a DFP and a decommissioning cost estimate used as the basis for decommissioning financial assurance.

Several materials licensees have fallen short of their decommissioning funding obligations because they assumed, in their license applications, that they would terminate the license under the restricted use provisions of 10 CFR 20.1403, but determined later that they were required to meet unrestricted use under the provisions of 10 CFR 20.1402. An example is the Fansteel site in Oklahoma, where the decommissioning cost estimate was initially for restricted release using onsite disposal of contaminated soils. This resulted in a relatively low estimated decommissioning cost. When Fansteel later found that it was unable to meet the criteria for restricted use with onsite disposal, its auditors required an increase in its decommissioning cost estimate from $4.5 million to $57 million to account for offsite disposal costs for the contaminated soils and Fansteel was unable to raise the additional funds. Prior to this final rule, regulations did not require NRC approval of the licensee's initial decommissioning cost estimate, increasing the likelihood for underestimation of decommissioning costs by materials licensees. Amendments to 30.35(e), 40.36(d) and 70.25(e) require materials licensees to plan unrestricted use of the site, unless the licensee demonstrates it can meet the provisions of restricted use, and to submit the DFP to the NRC for review and approval at time of license renewal and at least every 3 years. The Part 72 licensee submittal period is at license renewal and at least every 2 years.

Several nuclear power reactor licensees estimated their decommissioning cost lower than the actual cost to complete license termination. For example, the Connecticut Yankee Nuclear Plant experienced higher decommissioning costs than planned, due in part to an initial site characterization that underestimated the volume of soil contamination (Reference 3). Other decommissioned nuclear power plants have experienced substantially higher costs than initially estimated. All of these sites have successfully terminated their license at the higher cost because the licensee's status as a regulated public utility provided access to cost of service rate recovery to help provide additional funds. This source of funding for decommissioning may not exist for newly licensed plants whose licensees are permitted to operate as a merchant plant not subject to rate regulation or rate recovery of cost of service. When it ceases operation, a merchant plant may have no source of funds and shortfalls in decommissioning funding may jeopardize timely completion of decommissioning. Amendments to 50.82(a) require power reactor licensees undergoing decommissioning to submit an annual financial

status report to identify yearly decommissioning expenditures, the remaining balance of decommissioning funds, and a cost estimate to complete decommissioning.

This final rule has additional reporting requirements for decommissioning power reactor licensees regarding their long-term funding of spent fuel management. Such expenses are at risk of being under-funded by licensees who operate a merchant plant. Regulations prior to the final rule required only one report to be submitted, the Post-Shutdown Decommissioning Activities Report (PSDAR), prior to or within 2-years following permanent cessation of operations. In this one-time report, the licensee must identify its plan to manage and provide funding for spent fuel. There was a risk of this information becoming outdated. Amendments to 50.82(a) require an annual report from decommissioning power reactors identifying the amount of funds accumulated to manage irradiated fuel, and the projected cost of managing the irradiated fuel until title and possession is transferred to the Secretary of Energy.

NRC anticipates that some licensees will be able to demonstrate they are able to meet the provisions of restricted use in 10 CFR 20.1403. For these licensees, the regulations before this final rule allowed financial assurance mechanisms that were typically used in short-term transactions to be used over the long period of time when institutional controls are required to maintain the site. An escrow account, normally used to bridge a short-term financial transaction, is not a long-term financial instrument and may be vulnerable during bankruptcy. Other approved mechanisms are likely to lose their legal standing over the long term. Surety mechanisms, such as insurance and other forms of a guarantee, depend on an enforceable contract or a renewal payment to remain effective. If a contract becomes void because a company ceases to exist, or if an insurance payment is not made, the financial assurance mechanism is no longer viable and the decommissioning financial assurance is gone. An amendment to 20.1403(c) requires a trust fund to be used as the financial assurance mechanism to support restricted release license termination.

There is a risk of investment loss while funds are held in decommissioning financial assurance accounts. Regulations before this final rule did not require the licensee to monitor investment balances in the funds held for decommissioning. Nor were licensees required to replace investment losses in a timely manner if the funding assurance fell below the decommissioning cost estimate. In one case, a licensee estimated its decommissioning cost at $12.5 million and established a decommissioning trust fund using the common stock of a single company. On June 30, 2000, the fund value was $27 million. The fund value was $10 million two years later (Reference 4). Amendments to 30.35(h), 40.36(g), 70.25(h), and 72.30(g) require the licensee to monitor the investment balance and to replenish the fund within a certain amount of time if there is investment loss that reduces the fund below the decommissioning cost estimate.

Before this final rule, two authorized financial assurance mechanisms were considered a risk during corporate bankruptcy. The escrow account is vulnerable to being seized by creditors. The United States Environmental Protection Agency (EPA) concluded that a trust was more protective of funds than an escrow because, under trust law, the title to property in a trust is transferred to the trustee, while in an escrow account, title to the property remains with the grantor. (46 FR 2802, 2827) Thus, escrowed property is more likely to be subject to a creditor's claim than property held in trust. In addition, the law of trusts places obligations on the trustee to act in the interest of the beneficiary. In contrast, an escrow agent is responsible only for what is specified in the escrow agreement. The line of credit is also likely to be vulnerable in bankruptcy. About 20 NRC licensees use the escrow account and none use the

line of credit. In Agreement States, at least 12 licensees use an escrow account and fewer licensees are assumed to use a line of credit. This final rule eliminates the escrow account and the line of credit as approved financial assurance mechanisms.

NRC staff described these and other recommendations for proposed changes to the regulations in SECY-03-0069 (Reference 5). The Commission approved the staff's recommendation to proceed with a proposed rulemaking in its Staff Requirements Memorandum (SRM) SECY-03-0069 dated November 17, 2003.

In 2005 and continuing into 2006, power reactor licensees reported ground-water contamination due to inadvertent release of tritium at the Braidwood, Indian Point and other nuclear plants. Groundwater samples identified high tritium values onsite and offsite at Braidwood, and a likely migration offsite at Indian Point. The NRC Executive Director of Operations established a Task Force on March 10, 2006, in response to these and other unplanned, unmonitored releases of radioactive liquids into the environment. In its Final Report dated September 1, 2006 (Reference 6), the Task Force concluded that the levels of tritium and other radionuclides measured thus far do not present a health hazard to the public, and presented a list of findings and recommendations that the Task Force believed would improve public confidence in nuclear plant operations.

SECY-07-0177, dated October 3, 2007, requested Commission approval to publish a proposed rule consistent with the recommendations approved in SRM-SECY-03-0069. The Commission approved staff's request in SRM-SECY-07-0177, dated December 10, 2007. The proposed rule on Decommissioning Planning was published on January 22, 2008 (73 FR 3812) for a 75-day public comment period. The Nuclear Energy Institute (NEI) and several other stakeholders requested an extension of 90 days to provide review of issues raised in the proposed rule. The NRC extended the comment period by 30 days, until May 8, 2008 (73 FR 14946). The NRC received 35 comment letters on the proposed rule. One comment said that NRC did not include one-time implementation costs in the Regulatory Analysis for certain licensees to become familiar with the final rule changes to 10 CFR 20.1406(c) and 20.1501. The NRC agreed with that comment and has revised the Regulatory Analysis to account for this one-time cost borne by about 500 NRC licensees and about 1,000 Agreement State licensees.

The recommendations in the Reference 6 Final Report are being addressed by NRC program offices, but one recommendation is being completed in concert with this final rule to improve decommissioning planning. That is to develop guidance to define acceptable methods to survey and monitor ground water and subsurface soil for radionuclides (Reference 7).

2. TECHNICAL BASIS FOR THE FINAL RULE

Section 2.1 identifies the technical basis for amendments to clarify regulations associated with residual radioactivity. A predictable basis for decommissioning planning is the intended result.

Section 2.2 identifies the technical basis for amendments to decommissioning financial assurance regulations and reporting requirements.

2.1 Residual Radioactivity

The technical basis for changes to regulations related to residual radioactivity is organized below in four groups of sources: (1) stakeholder input collected during public meetings; (2) staff assessments; (3) risk assessments and regulatory guides; and (4) regulations prior to this final rule. Residual radioactivity issues at certain types of licensees, and the extent to which the amendments would affect these licensees, are then discussed.

Stakeholder Input at Public Meetings

On April 20-21, 2005, NRC sponsored a decommissioning workshop (Reference 8) that about 135 stakeholders attended. One session was dedicated to operating changes that would reduce the likelihood of legacy sites. Stakeholders were generally supportive of the position that facilities that have significant subsurface contamination are at risk of a shortage of funds for decommissioning, and that additional reporting requirements may be required of licensees that have a potential for subsurface contamination. Licensees whose processes used large volumes of water were considered at risk for subsurface contamination. The transcript and summary notes of this meeting were posted to the NRC web site at the following location: http://www.nrc.gov/about-nrc/regulatory/decommissioning/public-involve.html.

On January 10, 2007, NRC sponsored a public roundtable meeting (Reference 8), attended by 70 stakeholders. Some stakeholders said that NRC ground-water monitoring requirements, for the purpose of addressing the risk of subsurface contamination on the decommissioning cost estimate, should be done on a license condition basis as needed based on spills, leaks and abnormal releases reported by a licensee. Some stakeholders also said that subsurface contamination was not a significant element of total decommissioning costs, and that the uncertainty in cost of contaminated soil disposal was more significant than the volume of contaminated soil or ground water. The transcript and summary notes of this meeting are noted in Reference 8. NRC is proceeding with this final rule to ensure that those of its licensees who are required to have decommissioning financial assurance are aware of significant subsurface residual radioactivity at their sites, and have factored this into their decommissioning planning. NRC experience indicates that sites with greater than anticipated subsurface contamination have significantly higher decommissioning costs than planned, in excess of the funds assured using a planned contingency factor.

Staff assessments

In 2005, NRC staff conducted an evaluation (Reference 9) of 82 active and completed decommissioning sites to identify the key operational and technical issues which underlie legacy sites. The evaluation concluded that low level specific activity radioactive process leaks, spills, and controlled and uncontrolled effluents were common to legacy sites. Over the short-

term, these are below the threshold for reportable effluent release. Over the long-term, these chronic releases accumulate in the subsurface environment and are often not considered for remediation in the decommissioning cost estimate, upon which decommissioning financial assurance is based. Staff qualitatively considered three elements of the risk related to subsurface contamination: (1) what can go wrong at current operating sites, based on knowledge of past operating experiences at similar sites that have undergone (or are undergoing) decommissioning; (2) how likely are future events, based on current operating practices and/or the existence of same or similar operations within the U.S.; and (3) what is the potential for future subsurface contamination at current operating sites. Staff assembled a list of currently decommissioning sites and recently completed decommissioned sites and surveyed cognizant NRC project managers to ascertain whether ground water and/or subsurface contamination exists at these sites. Even if the presence of contamination was identified, NRC staff did not collect data to determine whether or not the dose levels from concentrations were above or below any regulatory standards, limits or guidelines. Where such contamination did exist, the project managers were asked to identify which radionuclides were present and the potential origin or source of the contamination. Of the 82 sites evaluated, 54 had subsurface contamination and ground-water contamination. The evaluation concluded that the following types of sites were generally at higher risk of becoming future legacy sites and were recommended for detailed analysis:

- Power reactors
- Test and research reactors
- Fuel manufacturing facilities
- Depleted uranium munitions manufacturing and testing sites
- Sewage treatment plants

In 2006, the NRC's Executive Director for Operations chartered a lessons-learned task force (Reference 6) to review incidents of inadvertent releases of radioactive liquids to the environment from nuclear power plants. The task force was assembled in response to low specific activity tritium releases at power reactors. Tritium has a half-life of 12.5 years and is a weak beta emitter. The Liquid Radioactive Release Lessons Learned Task Force (LRR LLTF) Final Report was an assessment of these radioactive liquid releases that were neither planned nor monitored. The Final Report covered releases from 14 nuclear power plants going back to a release discovered in December 1986. The Final Report identified a large volume of subsurface and ground-water tritium contamination from power reactors due to undetected leaks in spent fuel pools, component cooling water tanks, condensate holding tanks, refueling water storage tanks, borated water storage tanks, buried piping, and ventilation systems. It also identified other radionuclides, including mixed fission products, cobalt-60, cesiums-137, and strontium-90, that were inadvertently released into the onsite environment at two power plants. At Callaway, radioactive cobalt and cesium were detected in surface soil inside manholes where the isotopes were believed to have leaked from air-relief valves for the blowdown discharge pipeline. At Indian Point, the isotopes were suspected to have leaked from the Unit 1 spent fuel pool where fuel assemblies with degraded cladding will be stored until 2008. The recommendations in the Final Report are being addressed by NRC program offices, with the following four relevant to this analysis:

- NRC should evaluate the need to enact regulations and/or provide guidance to address remediation.
- NRC should require adequate assurance that leaks and spills will be detected before radionuclides migrate offsite via an unmonitored pathway.

- NRC should develop guidance to define the magnitude of the spills and leaks that need to be documented by the licensee under 10 CFR 50.75(g). Also clearly define "significant contamination." Summaries of spills and leaks documented under 10 CFR 50.75(g) should be included in the annual radioactive effluent release report.
- NRC should develop guidance to define acceptable methods to survey and monitor onsite ground water and subsurface soil for radionuclides.

Risk Assessments and Regulatory Guides

NUREG-1496, the final Generic Environmental Impact Statement (GEIS) (Reference 10) supporting the 1997 rulemaking that added Subpart E to 10 CFR Part 20, analyzed the costs and benefits of different dose estimates for potential radionuclide contamination levels at time of license termination. The analysis was done for the following four reference facilities: nuclear power plant, uranium fuel fabrication plant, sealed source manufacturer, and a rare metal extraction facility. Appendix C of the GEIS presented an analysis of ground-water remediation with licensees divided into three classes based on their likelihood for significant soil and ground-water contamination:

- Little contamination and very low potential for soil and ground-water contamination: sealed source manufacturers, short-lived radionuclide users, and other small licensees with little contamination, including small research reactors.
- Low to Medium indicators for soil and ground-water contamination: research reactors, certain sealed source manufacturers, broad scope R&D facilities, and some power reactors.
- Medium to High indicators for soil and ground-water contamination: complex decommissioning sites, large uranium/thorium facilities, and some power reactors.

Of the three types of licensees identified in the GEIS as having Medium to High indicators for soil and ground-water contamination, only rare earth extraction facilities licensed under 10 CFR Part 40 are considered plausible candidates to be affected by final rule amendments to 10 CFR 20.1406 and 20.1501. Complex decommissioning sites and power reactors are not considered plausible candidates to be affected by the amendments, by the effective date of the final rule, because these licensees have implemented effective ALARA prevention and monitoring programs to identify residual radioactivity in areas at their sites. Uranium recovery facilities including solution mining facilities are not affected by the amendments to 10 CFR 20.1406 and 20.1501, as discussed in the final rule *Federal Register Notice*.

SECY-00-0048, dated February 24, 2000, provided the results and staff plans for use of a completed risk analysis for nuclear byproduct material regulated under 10 CFR Parts 30 through 36 and 39 (Reference 11). This was an assessment of radiological risk associated with 40 different nuclear byproduct material systems. Radiological risk was defined in terms of dose calculations to workers and to the public under normal and off-normal conditions. Other risks were considered, including "contamination cost," which was the potential for environmental release. Of the 40 systems, only the Waste Disposal (incineration) system was considered a High contamination risk because of the potential loss of confinement or spills during incineration of mixed wastes, which have biohazard or chemical hazard with radiological hazard. Since 2000, there has been no evidence of significant spills or leaks from incinerated waste processes and these types of releases are not chronic. As a result, Waste Disposal by incineration is not considered a plausible candidate as an affected licensee in this Regulatory Analysis.

Regulations Prior to this Final Rule

10 CFR 20.1406(a) and (b), Minimization of Contamination, applies only to license applicants, not to operating facilities. These sections identify reporting requirements during license application. Regulatory Guide 4.21, Minimization of Contamination and Radioactive Waste Generation in Support of Decommissioning, provides guidance to assist license applicants in effectively implementing those reporting requirements (Reference 13).

Prior to this final rule, 10 CFR 20.1501 required licensees to conduct surveys that are reasonable under the circumstances to evaluate the extent and concentrations of radioactive material and potential radiological hazards, throughout the site. Licensee practice prior to this final rule had been to conduct surveys when needed for occupational dose assessment, not for environmental records important to decommissioning.

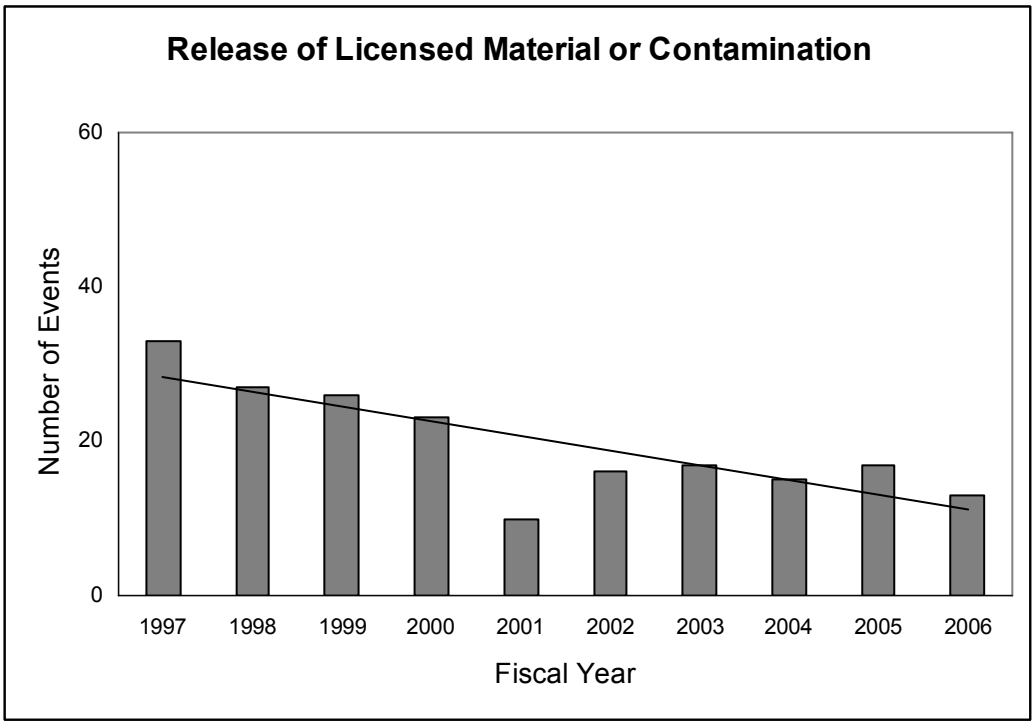
Appendix A of 10 CFR 50, General Design Criteria Number 64, Monitoring Radioactivity Releases, requires the nuclear power reactor licensee to monitor "the plant environs for radioactivity that may be released from normal operations, including anticipated operational occurrences, and from postulated accidents." Licensee practice has not included monitoring releases to the subsurface (e.g., from subsurface tanks and transfer lines). As a result, there are few historical data files of subsurface contamination at power reactor sites.

10 CFR 30.35(g), 40.36(f), 50.75(g), 70.25(g), and 72.30(d) require the licensee to collect and maintain records important for decommissioning. These records should be kept for spills, leaks and other unusual occurrences that result in the spread of contamination, after cleanup procedures, or if the contamination is likely to have spread to inaccessible areas. Licensees' practices vary widely concerning what should be documented because of the great diversity of radioactive materials handled and different site conditions. For example, even large spills of short-lived isotopes may not be considered important to decommissioning, and not documented, because the spill will have decayed to acceptable license termination levels before decommissioning begins. These records are maintained by the licensee and are not required, by regulation, to be reported to the NRC. However, the fuel cycle facilities licensed under Parts 40 and 70 are required (10 CFR 40.65 and 70.59) to report effluent data to the NRC on a semi-annual basis. The conclusion from evaluation of this data reported over the past 10 years is that the 6 nuclear fuel fabrication facilities and the single UF_6 conversion facility have consistently maintained their effluent releases to the environment well below regulatory limits.

The Nuclear Material Events Database (NMED) was reviewed for this Regulatory Analysis. NMED contains "events", reportable by NRC and Agreement State licensees, from January 1990 to the present. NRC and Agreement State licensees are required to report any radioactive material release to the environment that exceeds regulatory limits. Of the nine categories of NMED event types, the "Release of Licensed Material or Contamination" (RLM), is relevant to this Regulatory Analysis. The NMED Report for the Fourth Quarter FY 2006 (dated January 2007) identified 197 RLM events from FY 1997 through FY 2006. The trend of these events shown in Figure 2-1 represents a statistically significant decrease in the number of events per year. The majority of the decrease in events is due to a decrease in surface contamination. About 39 percent of the RLM events shown in Figure 2-1 involved other types of contamination (air, water or personnel) – an RLM event can involve more than one release type. The NMED data confirm a low level of reportable releases from all licensees. The unit of measure in reporting the release is the likelihood of the RLM being an "Abnormal Occurrence"

which is a dose-based standard. Although there is a low and decreasing level of reportable releases by licensees, experience has shown that significant quantities of residual radioactivity may still accumulate at sites over a long period of facility operations at certain types of licensed facilities with the potential for subsurface contamination.

Figure 2-1
Long-Term Trend of Release of Licensed Material or Contamination Events



Source: NMED Quarterly Report, 2006 4Q, page 14.

2.1.1 Nuclear Power Reactors

There are 104 nuclear power reactors at 64 plant sites. Reference 6 identifies current NRC regulations and regulatory guidance that require power reactor licensees to maintain adequate control over radioactive effluent discharges and identifies the characteristics of licensees' radiological environmental monitoring programs (REMP). The results of each licensee's REMP and effluent controls program are reported to the NRC on an annual basis. The REMP generally does not include onsite monitoring wells, because onsite ground-water monitoring for general detection and monitoring purposes is only required if the ground water at the site is tapped for drinking or irrigation purposes.

Reports of residual radioactivity and ground-water contamination events at power reactors occurred in late 2005 (Reference 6). In response, the Nuclear Energy Institute (NEI) worked with licensees to develop voluntary guidance, referred to as the Ground Water Protection Initiative (GPI) (Reference 14). Information about the GPI is in section 6 of this Regulatory Analysis. The voluntary GPI, if implemented by licensees, includes site characterization of geology and hydrology to provide an understanding of predominant ground

water gradients based upon current site conditions, a site risk assessment, and sampling and analysis protocols for ground water and soil. In May 2008, NRC staff issued Temporary Instruction 2515/173 in its Inspection Manual to review the implementation of the industry GPI. The Temporary Instruction is publicly available in ADAMS (ML072950622).

Power reactor licensees must provide decommissioning financial assurance from the time of license application through plant operations until completion of decommissioning and license termination. Licensees are required to submit periodic reports to the NRC on the status of their decommissioning financial assurance. Regulatory Issue Summary 2006-09 (Reference 15) identifies NRC's procedure to review the biennial decommissioning funding assurance reports submitted by the power reactor licensees. Most power reactor licensees are regulated electric utility companies (i.e., Category 1 licensees), who either: (1) recover the estimated total cost of decommissioning through rates established by cost of service regulation; (2) are able to establish their own rates and are able to recover all of their decommissioning costs; or (3) are able to recover the total cost of decommissioning from non-bypassable charges. "Merchant" power reactor licensees (i.e., Category 2 licensees) are non-electric utilities and have no regulatory authority to collect decommissioning funds. As of the end of 2006, there were 11 Category 2 power reactor licensees. To date, all of the decommissioned power reactors that have terminated their licenses were owned and operated by Category 1 licensees. Although some of the licensees that have terminated their licenses have had significantly higher than planned decommissioning expense, none were considered a potential legacy site because of the licensee's access to state-regulated recovery of funds for decommissioning.

The same certainty of funds to complete license termination does not exist for the Category 2 licensees, even though these licensees must post a prepayment, during license application, of the amount estimated for decommissioning costs. For example, the Category 2 licensee may need more funds than what is in the decommissioning financial assurance to complete license termination. It is, and will continue to be, important for NRC staff to ensure that the licensee has performed diligent and accurate decommissioning planning to serve as the basis for decommissioning financial assurance.

NRC staff considered the technical basis information in section 2.1, and concludes that the monitoring and survey processes and related reports prepared at power reactor sites likely would provide sufficient information to satisfy the amendments to 10 CFR 20.1406(c) and 20.1501, by the effective date of the final rule. NRC is not requiring licensees to submit reports but the information must be available for review. It is not expected that power reactor licensees will need to install new capital or modify existing operating procedures to satisfy the amendments to 10 CFR 20.1406(c) and 20.1501, by the effective date of the final rule.

The amendment to 10 CFR 20.1406(c) is compatible with the requirements imposed on license applicants under 10 CFR 20.1406(a) and (b). NRC has published guidance for license applicants to implement a program to satisfy those requirements (Reference 13). NRC is publishing guidance with this final rule for licensee implementation of 10 CFR 20.1406(c), as noted in Reference 7.

2.1.2 Research and Test Reactors

There are about 30 operating research and test reactors (non-power reactors) and about 15 permanently shut down research and test reactors licensed by NRC. Non-power reactors are much smaller than power reactors and are used for research, testing, training, and

can be used to produce irradiated target materials. There are also compact, self-contained, low-power (less than 5 watts) tank-type reactors.

In Reference 9, research and test reactors were considered high risk facilities for subsurface contamination because survey results showed several instances of ground-water contamination. Some research and test reactors have buried piping and ventilation systems that are located outside the reactor building and may contain low specific activity contaminated liquid. In addition, neutron activation in the zone surrounding the reactor core was considered a potential source of subsurface contamination. As described in Reference 9, NRC visited a total of 17 research and test reactors and found evidence of ground-water contamination at two (University of Virginia and Westinghouse Waltz Mill).

During the public meeting on January 10, 2007 (Reference 8), representatives from research and test reactors disputed the conclusion in Reference 9 that research and test reactors are a high risk for subsurface contamination. Instead, they said that ALARA procedures are enforced by reactor personnel, there have been no significant incidents at any of the currently operating reactors, and the coolant water in these types of reactors is well below the dose criterion for unrestricted use following license termination.

NRC staff reviewed inspection reports of currently operating research and test reactors. These reports supported the licensee statements made at the January 10, 2007, public meeting. The inspection reports show minimal effluent release. In addition, the NMED data over the period 1991 to 2006 for release type of "Water" showed only one reportable event at a research and test reactor which occurred in April 1996 and was for a discharge of 84 mCi of insoluble radioactive material to municipal sewage. This discharge is not significant for decommissioning planning. The current inspection experience supports a conclusion of minimal effluent release from currently operating research and test reactors.

NRC staff considered the technical basis information in section 2.1 and concludes that none of the research and test reactor licensees will be affected by the amendments to 10 CFR 20.1406(c) and 20.1501, by the effective date of the final rule. Additional monitoring and reporting could be required at these facilities after the effective date of the final rule if significant residual radioactivity is identified above current levels.

2.1.3 Uranium Fuel Fabrication Plants

There are 6 operating uranium fuel fabrication plants licensed by the NRC. Five of the plants receive UF_6 enriched in its uranium-235 isotope to less than 5 weight percent, chemically convert the enriched feed material into uranium oxide pellets, load the pellets into fuel rods, and prepare the completed fuel bundles for shipment to power reactors. One of the plants, Areva Lynchburg, does not have chemical conversion processes because it starts its fabrication production by receipt of uranium oxide pellets, as feed material, which have been produced at a different plant.

Reference 9 considered uranium fuel fabrication plants with chemical conversion processes a high risk for subsurface contamination. The chemical conversion process sometimes uses large amounts of uranium-bearing liquids. There was also a tendency in the past for these plants to use low-level radioactive waste treatment lagoons that leaked into the subsurface and ground water. Several also used low-level waste burial practices, permissible at the time. In preparing Reference 9, NRC visited 13 fuel fabrication plants and found

evidence of ground-water contamination at 7 of these plants, all of which are currently in a decommissioning status. The Salmon River site, in North Fork, Idaho, has the potential to become a legacy site with about 9 million cubic feet of contaminated soil.

Reference 8 cites comments, made at the January 10, 2007, public meeting, from representatives of operating uranium fuel fabrication plants who dispute the conclusion that any of these operating plants are a high risk of becoming a legacy site due to subsurface contamination. Instead, they said that ALARA procedures are enforced by their management and operating personnel. They suggested that their environmental monitoring and liquid effluent releases are evidence of low releases to the environment, in most cases substantially lower than allowed under regulations. These effluent releases are reported semi-annually to NRC, as a requirement of 10 CFR 70.59.

NRC staff reviewed the effluent reports at the 5 uranium fuel fabrication plants that have uranium chemical conversion processes. These reports show negligible effluent release over the period January 1999 through December 2006. NRC staff also reviewed the NMED reports over the period 1991 to 2006 for release type of “Water” and there was only one reportable event at uranium fuel fabrication plants. This event was for discharge of 1.2 µCi of insoluble low-enriched uranium from its contaminated laundry cleaning facility to municipal sewage. This record of minimal effluent release is not significant for decommissioning planning and reinforces the statements made by representatives from fuel fabrication facilities during the January 10, 2007, public meeting.

NRC staff considered the technical basis information in section 2.1, and concludes that the existing monitoring and survey processes and related reports prepared at uranium fuel fabrication plants would likely contain sufficient information to satisfy the amendments to 10 CFR 20.1406(c) and 20.1501, by the effective date of the final rule. NRC is not requiring licensees to submit reports but the information must be available for review. It is not expected that uranium fuel fabrication plant licensees will need to install new capital or modify existing operating procedures to satisfy the amendments to 10 CFR 20.1406(c) and 20.1501, by the effective date of the final rule.

The amendment to 10 CFR 20.1406(c) for operating facilities is compatible with the requirements imposed on license applicants under 10 CFR 20.1406(a) and (b). NRC has published guidance for license applicants to implement a program to satisfy those requirements (Reference 13). NRC is publishing guidance with this rule for licensee implementation of 10 CFR 20.1406(c) as noted in Reference 7.

2.1.4 Critical Mass Facilities

The licensees of critical mass facilities include universities, a Federal government agency, and other institutions that may use small quantities of special nuclear material in classroom demonstrations, laboratory experiments, and to provide health physics support to other institutional nuclear materials users. Eight of these facilities are licensed under 10 CFR Part 70, and 6 of these 8 are required to have decommissioning financial assurance.

Reference 9 did not cite these research facilities as a high risk for subsurface contamination. NRC staff reviewed the NMED reports over the period 1991 to 2006 for release type of “Water” and these showed no reportable events at the critical mass facilities.

NRC staff considered the technical basis information and concludes that none of the critical mass licensees will be affected by the amendments to 10 CFR 20.1406(c) and 20.1501, by the effective date of the final rule. Additional monitoring and reporting could be required at these facilities after the effective date of the final rule if significant residual radioactivity is identified above current levels.

2.1.5 Decommissioning and Permanently Shutdown Facilities

The licensee of a facility that permanently shuts down submits a license amendment request to have its decommissioning plan approved by the NRC. The regulations in Subpart E of 10 CFR 20 identify monitoring and survey requirements for these sites. The regulatory guidance in NUREG-1757,consolidated decommissioning guidance, Volumes 1 through 3, provides acceptable survey methodology to complete license termination. The monitoring and survey requirements are already defined for decommissioning and permanently shut down facilities. As a result, none of these licensees are affected by the amendments to 10 CFR 20.1406(c) or 20.1501.

2.1.6 Fuel Enrichment Plants

The two Department of Energy (DOE) gaseous diffusion plants, leased for operation by United States Enrichment Corporation (USEC), are certified under 10 CFR Part 76. Both facilities have substantial subsurface and ground water contamination from operations during the time these facilities were under the control of the Atomic Energy Commission and the DOE, and prior to certification by NRC. The DOE is currently conducting an extensive ground water monitoring program at both plants. In addition, decommissioning of the gaseous diffusion plants is the responsibility of DOE.

10 CFR part 76 regulations do not require USEC to submit effluent reports. However, since 2001, USEC has provided copies of the annual National Emissions Standards for Hazardous Air Pollutants (NESHAP) radionuclide emissions reports to the NRC for both gaseous diffusion plants.

NRC staff reviewed the recent radionuclide emissions reports from the gaseous diffusion plants. These reports show negligible effluent release through 2006. NRC staff also reviewed the NMED reports over the period 1991 to 2006 for release type of “Water” and found no reportable events at the gaseous diffusion plants.

NRC staff considered the technical basis information and concludes that neither of the gaseous diffusion plants will be affected by the amendments to 10 CFR 20.1406(c) and 20.1501, by the effective date of the final rule.

Gas centrifuge enrichment plants do not use large amounts of fluids in their production processes and are not, at this time, thought to pose risks of subsurface contamination. Louisiana Energy Services received a license from NRC in June 2006, to construct and operate a gas centrifuge uranium enrichment plant in Lea County, New Mexico. USEC received a license from NRC in April 2007, to construct and operate a gas centrifuge uranium enrichment plant in Piketon, Ohio. NRC staff concludes that the gas centrifuge enrichment plants will not be affected by the amendments to 10 CFR 20.1406(c) or 20.1501 because they do not use large amounts of fluids in their production processes. Additional monitoring and reporting could

be required at these facilities after the effective date of the final rule if significant residual radioactivity is identified after the plants begin their operations.

2.1.7 UF_6 Production Plants

There is one UF_6 conversion/de-conversion plant with an NRC operating license. The plant is located in Metropolis, Illinois, and is not considered a risk for subsurface contamination.

Reference 9 did not cite UF_6 production plants as a high risk for subsurface contamination. NRC staff reviewed the NMED reports over the period 1991 to 2006 for release type of "Water" and found no reportable events at this production plant.

The licensee of the plant maintains a routine ground-water compliance monitoring network that consists of ten wells - two upgradient, seven downgradient, and a tenth well that is used for ground water surface elevation determination only. The licensee collects and analyzes samples from the nine monitoring wells quarterly for pH, specific conductance, fluoride, gross alpha and gross beta. The results are routinely reported to the State of Illinois environmental protection agency.

NRC staff concludes that the UF_6 conversion/de-conversion plant will not be affected by the amendments to 10 CFR 20.1406(c) and 20.1501, by the effective date of the final rule. Additional monitoring and reporting could be required at this facility after the effective date of the final rule if significant residual radioactivity is identified above current levels.

2.1.8 Uranium Mills, Solution Mining Facilities, and Sewage Treatment Plants

Uranium mills and solution mining facilities, known as in-situ leach (ISL) facilities, are licensed by NRC under 10 CFR Part 40 Appendix A. Reference 9 concluded that uranium mills were a high risk of subsurface contamination because of the large amounts of liquids and uranium and thorium bearing ores. Uranium mills and ISL facilities are required to install ground-water monitoring wells and to have process leak detection methods under 10 CFR Part 40, Appendix A, Criterion 5 and Criterion 7. Criterion 7A is the requirement for subsurface monitoring to detect leaks of hazardous constituent material. Criterion 5 incorporates the ground water protection standards imposed by the EPA under 40 CFR Part 192 which apply during operations and prior to the end of mill closure. Because of these monitoring activities at sites licensed under 10 CFR Part 40 Appendix A, these sites are not affected by the changes to 10 CFR Part 20 in this final rule.

10 CFR 40.65 requires uranium mill and ISL licensees to submit semi-annual effluent reports identifying the quantity of each principal radionuclide released to unrestricted areas. The NMED reports over the period 1991 to 2006 for solution mining show only one reportable event. This event was for a leak in an injection well. The leak breached a diversion berm and entered a creek. The maximum release was estimated to be 38.8 μCi for radium-226 and 78.9 μCi for natural uranium. These releases are not significant for decommissioning planning.

Sewage treatment plants were identified in Reference 9 as a high risk of subsurface contamination based on the large volume of water processed at these plants. Reference 9 does not mention an extensive study by the Interagency Steering Committee on Radiation Standards (ISCORS) (Reference 16), done in November 2003. The ISCORS conclusions, based on over 300 samples collected from publicly owned treatment works (POTWs), were that

no excessive concentrations of radioactive material were observed in the sewage sludge or ash and that no widespread concern to public health and safety was identified. The concentration of radioactive material at POTWs primarily contained naturally occurring radioactive material such as radium, and most of the samples other than those containing radium were at or near the limit of detection and comparable to what is found in soil and fertilizer. In a related activity, the Commission approved staff's denial of petition for rulemaking in SECY-04-0226 (Reference 17) that was submitted by the Northeast Ohio Regional Sewer District. Although the petition was based on concern for public health and safety, NRC staff considered in its review of the petition related issues regarding long-term effects of releases of radioactive materials into sanitary sewer systems. The staff concluded that no widespread public health and safety risk exists from releases of licensed materials into sanitary sewer systems under the current regulatory structure. Since then, ISCORS has released guidance for a POTW if it encounters a concern with radioactive materials in its sewer systems. This guidance is available at http://www.iscors.org/pdf/FinalRecommendations.pdf

NRC staff concludes that the uranium mills and ISL facilities licensed under Appendix A of 10 CFR Part 40 will not be affected by this final rule. Sewage treatment plants will not be affected by the amendments to 10 CFR 20.1406(c) and 20.1501, by the effective date of the final rule. Additional monitoring and reporting could be required at these types of facilities after the effective date of the final rule if significant residual radioactivity is identified above current levels.

2.1.9 Source Material Facilities Other Than Mills and ISL's

There are other NRC and Agreement State licensees that possess or use source material for purposes other than milling or production of uranium or thorium. These other types of source material facilities use uranium or thorium to fabricate a product or to perform tests on the characteristics of these metals in different commercial and military uses. These licensees also may be involved in rare earth extraction and manufacturing processes.

In the past, a few source material facilities were responsible for abnormal and chronic releases of residual radioactivity to the subsurface environment. In general, these facilities were never issued an NRC license and others terminated their licenses prior to NRC regulations in 1988 to establish decommissioning financial assurance. The contaminated areas included ground-water contamination at low concentration levels with the very long uranium and thorium half-lives.

There are currently about 30 NRC licensees holding source material licenses that are not engaged in uranium milling or ISL operations. These facilities have similar operating characteristics compared to some of the sites evaluated in Reference 9 that were considered a high risk for subsurface contamination.

NRC staff assumes that one rare earth extraction and manufacturing licensee will be affected by the amendments to 10 CFR 20.1406(c) and 20.1501. An assumption is made that four Agreement State rare earth extraction and manufacturing licensees will be affected by the final rule. The specific input assumptions used in a cost-benefit analysis of the final rule amendments are described in Section 4 of this document. The results are presented in Section 5 of this document.

2.1.10 Byproduct Material Facilities

Reference 9 noted that among the byproduct material facilities, subsurface and ground-water contamination was caused primarily from permissible onsite burials under the now-rescinded regulations in 10 CFR 20.304. Reference 9 stated that currently operating byproduct material sites were not expected to be legacy sites because of more effective waste disposal regulations implemented in 10 CFR Parts 20 and 61.

Among the byproduct material facilities, there are about 300 broad scope academic and R&D licensees with long-lived radionuclides. The very large majority of broad scope licensees have an active and thorough program for detection of residual radioactivity during operations and for the survey and release of laboratories during decommissioning. NRC staff reviewed the NMED reports over the period 1991 to 2006 for release type of “Water” and found 2 reportable events, both in the year 2000, at these types of facilities. One was at the University of Oklahoma, where the licensee reported an unauthorized release (injection) of 65 µCi of sulphur-35 (S-35) labeled sodium sulfate into a test injection well. The licensee attempted to recover the radioactive material from the test injection well and was able to recover about 80 percent of the total S-35 approximately three weeks after the injection. The remaining activity was less than the limits specified in 10 CFR 20.1302 and Table 2 of Appendix B to 10 CFR 20. The other reportable event was at the University of Chicago, where the licensee reported the loss of a one-gallon jug of aqueous tritiated thymidine containing 3.3 mCi of H-3. The licensee's investigation revealed that, because of limited space at the facility, the storage room was shared by several researchers, one of whom inadvertently poured the material down the sink and placed the original container into a dry solid waste container. To prevent recurrence, the licensee enhanced the security, inspection, and storage conditions in their laboratories.

NRC staff considered the technical basis information and concludes that none of the byproduct material broad scope academic and R&D licensees will be affected by the amendments to 10 CFR 20.1406(c) and 20.1501, by the effective date of the final rule. Additional monitoring and reporting could be required at these facilities after the effective date of the final rule if significant residual radioactivity is identified above current levels.

Also among byproduct material facilities, an additional 100 new NRC licenses are expected by the year 2010 as a result of a final rule establishing regulations for certain radium sources, accelerator-produced radioactive material, and certain discrete sources of naturally occurring radioactive material (hereafter referred to as NARM). The NARM final rule regulates radium-226 as a discrete source and adds a general license category for any person to possess, among other items, luminous gauges and other items containing radium-226 installed in air, marine, or land vehicles including any former military use vehicle no longer in control of the military. The general license requires the disposal of the product only by transfer to a *specific licensee* authorized to receive it or to a disposal facility authorized to dispose of the material in accordance with any Federal or State solid or hazardous waste law. Applicants for specific licenses to possess discrete sources of radium-226 will need to evaluate the requirement to obtain decommissioning financial assurance based on their licensed possession limit for radium-226. The requirement is based on a minimum possession limit of 1 µCi of Ra-226, which may represent a single gauge used for industrial purposes. The NRC and Agreement States are aware of the existence of facilities and sites which have the potential to become contaminated with significant amounts of radium-226 from past practices or operations, or from the accumulation of significant quantities of radium-226 discrete sources. The NRC

and Agreement States will address these situations on a case-by-case basis as they are identified following the effective date of the NARM final rule. At this time, there is not enough information to include these sites in the final rule Regulatory Analysis as licensees affected by changes to 10 CFR 20.1406(c), 20.1501, and 30.35(e).

2.2 Financial Assurance

The technical basis for changes to regulations related to decommissioning financial assurance and reporting requirements is organized below in four groups of sources: (1) stakeholder input collected during public meetings; (2) staff assessments, (3) risk assessments and regulatory guides, and (4) current regulations.

Stakeholder Input at Public Meetings

The workshop on April 20-21, 2005, (Reference 8) was intended to provide program evaluation and stakeholder feedback on a wide range of decommissioning topics. One of the breakout sessions on the first day included detailed discussions of potential changes to financial assurance and changes to facility operations to prevent future legacy sites. The second day was devoted to discussions of decommissioning lessons learned. The workshop was specifically designed to provide stakeholder input for future rulemaking and development of supporting guidance (e.g., revisions to NUREG-1757) to prevent future legacy sites.

In the financial assurance breakout session: stakeholders discussed 8 topics: (1) whether off-balance-sheet liabilities should be included in the evaluation of parent company and self-guarantees; (2) the frequency of monitoring and adjustment of decommissioning funds; (3) protection of decommissioning funds in bankruptcy; (4) the level of assurance provided by corporate parent guarantees; (5) whether onsite property damage insurance should be required; (6) should NRC formally approve decommissioning cost estimates; (7) should decommissioning cost estimates be based on unrestricted release criteria; and (8) what type of fund status reports should NRC receive for permanently shutdown reactors undergoing decommissioning? A wide range of viewpoints were expressed that the NRC staff has taken into account in developing this final rule.

The lessons learned component of the workshop also identified factors affecting decommissioning that are being addressed in this final rule. One of these is that especially severe decommissioning problems may occur when significant site contamination is first detected during or shortly before decommissioning. In such cases, revenues from the facility's operations may be insufficient to increase the decommissioning financial assurance to the level needed. Adequate advance planning and reporting are therefore important to prevent such problems.

In the public roundtable meeting on January 10, 2007, about 70 stakeholders addressed similar financial assurance issues as those discussed in 2005. A new topic was whether firms providing a parent guarantee or self-guarantee should also be required to provide collateral to secure the funds promised in the guarantee. Stakeholders raised a number of issues related to this topic. They pointed out that the collateral would need to be monitored, that collateral in the form of real property would be particularly problematic, that conflicts could arise over collateral pledged to more than one purpose, that pledges of collateral could place considerable operating constraints on firms and raise their cost of borrowing to obtain working capital, and that setting up collateral in inventory and accounts receivable would impose significant

transaction costs. Stakeholders also argued that in many cases requiring very large firms providing parent guarantees to also supply collateral would not measurably increase the level of assurance provided to NRC. One stakeholder argued that bankruptcy of a subsidiary would be unlikely to affect the degree of assurance provided by its parent. Several stakeholders encouraged NRC to amend the financial tests associated with the guarantees, if necessary, rather than adopting a collateral requirement. Stakeholders also encouraged NRC to retain the possibility for firms to self-guarantee.

A second new topic addressed in the January 2007 stakeholder meeting was whether the definition of net worth should be changed to allow intangible assets to be counted in determining whether a firm passes the financial test for parent guarantee or self guarantee. One stakeholder asserted that modern accounting standards, including Financial Accounting Standard 142, have evolved to the point that intangible assets can be valued accurately, that the net worth of many large conglomerate firms includes large amounts of intangible net worth because they have grown by acquisition, and that intangible net worth can be assessed in association with other financial indicators such a strong bond ratings. Another stakeholder stressed that the intangible asset consisting of intellectual property may include patents and regulatory licenses and approvals, and therefore can be both liquid and valuable. Stakeholders also stated that intangible assets were not inherently more likely than tangible assets to lose value quickly.

Stakeholders did not express concerns when the topic of eliminating the escrow account as a financial assurance mechanism was raised. One stakeholder with an escrow account stated that it did not foresee any difficulties in shifting to an alternative mechanism. Some stakeholders requested that the NRC allow as wide a possible range of options for financial mechanisms, to provide flexibility for licensees.

Stakeholders at the January 2007 workshop generally did not oppose the codification of existing NRC guidance regarding the development and contents of the DFP. Stakeholders, with few exceptions, agreed that planning for decommissioning and decommissioning cost estimates should be based on the costs of having an independent contractor perform the work, and that cost estimates should be based on unrestricted release criteria. Stakeholders did request that NRC provide a more detailed discussion and analysis of any proposed new reporting requirements for reactors that have submitted a certificate of permanent cessation of operations.

Staff Assessments

NRC staff reviews decommissioning cost estimates and financial assurance mechanisms submitted by licensees to provide decommissioning financial assurance. The NRC has addressed financial assurance issues in a revision to the current guidance on decommissioning in NUREG-1757, Volume 3, Appendix A.

NRC has performed several lessons-learned studies addressing various aspects of decommissioning and financial assurance. A September 2003 program evaluation of the NRC's decommissioning program for materials licensees provided an overall evaluation of program effectiveness and a roadmap of ongoing and future improvements (Reference 18). Subsequent initiatives included an Integrated Decommissioning Improvement Plan for fiscal years 2004 to 2007 (Reference 19) and an analysis of implementation issues impacting the decommissioning of sites under the License Termination Rule (10 CFR 20 subpart E).

(Reference 20) The latter, in NRC Regulatory Issues Summary 2004-08, results of the License Termination Rule Analysis, described staff experience with sites licensed before the financial assurance regulations were issued in 1988, as well as subsequent staff experience, and identified several specific risks that could cause shortfalls in decommissioning funding. These included underestimation of decommissioning costs caused by a restricted release assumption; operational events that caused increased costs; unavailability of funds due to bankruptcy; inadequate financial disclosure; corporate reorganizations that make funds difficult to reach; and investment losses of funds set aside for decommissioning. Several of the staff recommendations to address these issues are reflected in the final rule amendments.

On the bankruptcy issue, NRC staff reviewed a variety of sources to determine whether recent changes to the Bankruptcy Code, financial accounting practices, trends in the business cycle, or other factors might be making the bankruptcy of firms with financial structures similar to NRC's licensees more likely, or were causing bankruptcies to occur more quickly after firms get into financial trouble. Such factors could reduce the effectiveness of the financial tests for parent company and self-guarantees. (References 21 - 30) These sources included the record of a recent bankruptcy by an NRC legacy site materials licensee, data on business bankruptcy trends from 1980 to 2005, data on firm failure rates by net worth categories, studies of bankruptcy topics published in the financial literature, and reports of decisions in bankruptcy cases addressing such topics as the regulatory exception to the automatic stay provision of the Bankruptcy Code and the availability of decommissioning funds through the administrative costs provision of the Bankruptcy Code. Staff examined data for a sample of bankrupt firms to assess the degree to which a firm's possession of tangible versus intangible assets affected its potential for entering bankruptcy and/or how it fared in bankruptcy. Staff also obtained assessments of the effectiveness of recent Sarbanes-Oxley legislation in curbing accounting abuses that could threaten the solvency of firms. Several of the financial assurance requirements in this final rule are intended to strengthen the parent guarantee and self-guarantee against bankruptcy risks. They include the requirement that firms supplying a parent guarantee or a self guarantee must set up a standby trust at the inception of the guarantee, that firms seeking to use a parent guarantee or self-guarantee must obtain an independent public auditor's evaluation of the firm's off-balance sheet transactions and provide an opinion on whether those transactions could materially adversely affect the company's ability to pay for decommissioning costs, and that guarantors must demonstrate to the NRC that they pass the financial test within 90 days following the close of each fiscal year. A clause added to the guarantee instrument requires the guarantor to immediately notify the NRC of the occurrence of events signifying financial distress and allow the NRC, in cases of financial distress by the guarantor company, to declare the financial assurance guaranteed by the guarantor to be immediately due and payable to the standby trust. In addition, elimination of the escrow account and line of credit as acceptable financial assurance mechanisms was based on an assessment of their relative risk in bankruptcy.

On the issue of financial test criteria, staff reviewed the technical analysis performed by the EPA in support of the financial tests for parent guarantee and self guarantee that were also eventually adopted by the NRC (Reference 31), and discussed with EPA staff the EPA's subsequent experience with and evaluations of the financial tests. In addition, staff reviewed the analysis of potential self-guarantee tests for non-profit colleges, universities, hospitals, and business firms that do not issue bonds. (Reference 32) This final rule requires bonds used in the parent company and self-guarantee financial tests to be uninsured, uncollateralized, and unencumbered. This requirement is based on the analysis in NUREG/CR-6514 and makes the bond rating in the parent company and self-guarantees compatible with the requirements for

non-profit colleges, universities, and hospitals. The staff's analysis also led to the amendment in the rule to require that the guarantor's tangible net worth be at least $21 million to pass one of the criteria for the financial tests in Appendices A, C, and D of Part 30, an increase based on inflation from the current requirement to have tangible net worth of at least $10 million.

On the issue of including intangible assets in the net worth calculation, NRC staff evaluated the information received from stakeholders during the January 2007 public meeting. Staff also reviewed recent Statements of Financial Accounting Standards issued by the Financial Accounting Standards Board, including Statement No. 141 on business combinations and the determination of the value of goodwill and other acquired assets, and Statement No. 142 on the measurement of internally developed intangible assets. Articles from the accounting literature discussing the process by which intangible assets are valued, and potential problems and ambiguities, were also reviewed. Staff also reviewed a small sample of quarterly reports (Form 10-Q) filed by NRC licensees with the Securities and Exchange Commission to determine whether goodwill was reported separately from other intangible assets. This analysis provides the basis for the amendment in the final rule that, for the financial test requirements, tangible net worth must be calculated to exclude the net book value of the nuclear facility and site and any intangible assets, and net worth must be calculated to exclude the net book value and goodwill of the nuclear facility and site.

Staff reviewed the bond rating components of the parent company and self guarantee financial tests, using studies of the default rates of corporate bond issuers published by Moody's Investors Service and Standard & Poor's. In particular, staff reviewed data on the default rates for different categories of bond ratings, the length of time that elapsed from the last rating until default for defaulting firms, and the rating path of defaulters. (References 33 - 34) Staff also examined through a review of the corporate ratings criteria of the ratings firms how intangible assets affect ratings. The information obtained supports the amendment in the final rule to continue to rely on bond ratings as significant components of the parent company and self guarantee financial tests and to clarify the status of adjustments (+ or - as issued by Standard & Poor's, or 1, 2, or 3 as issued by Moody's) to the ratings.

The requirement of establishing a security interest in collateral for the amount guaranteed in the parent guarantee and self guarantee financial assurance mechanisms is evaluated under Alternative 3 in this Regulatory Analysis. Collateral is not included in the final rule, or in the analysis of Alternative 2 in this Regulatory Analysis. NRC staff assessed the cost and implementation information received from stakeholders during the January 2007 public meeting. Discussions with a small number of firm financial officers, bankers, and attorneys tended to support the arguments made by stakeholders that a collateral requirement would be difficult to administer and subject to risks that other creditors could gain access to the same collateral. (Reference 35) Upon completion of the Regulatory Analysis for the proposed rule, NRC staff rejected the option to require a security interest of collateral for the guaranteed amounts.

Risk Assessments

NRC staff performed a broad range of technical analyses of issues affecting the financial tests for parent company and self guarantees; bond ratings, accounting standards pertaining to intangible assets, bankruptcy, business reorganizations, investment of funds, collateral, and insurance. The purpose of these analyses was to better risk inform the staff's recommendations on particular regulatory proposals.

In January 2006 the staff reviewed a study evaluating topics that could pose risks that funds would not be available when needed for decommissioning materials licensees. (Reference 21) The issues included an evaluation of whether explicit NRC approval of decommissioning cost estimates submitted by licensees would be likely to increase the accuracy of such estimates. The study outlined the current practices of other federal agencies to review cost estimates, and assessed the potential benefits and drawbacks of cost estimate approvals. These topics were given additional attention by the staff during 2006 and 2007.

Regulations Before this Final Rule

The following two sections describe the regulatory framework prior to this final rule and how that framework is revised by the final rule. The final rule amendments are in two sections. Section 2.2.1 includes the amendments that require licensees to provide accurate information in decommissioning cost estimates. Section 2.2.2 includes the amendments that require licensees to provide adequate decommissioning financial assurance at the start of decommissioning activities.

2.2.1. Detailed Reporting

Since establishment of financial assurance requirements for decommissioning in 1988, the staff has reviewed approximately two hundred decommissioning cost estimates. In addition, staff recently reviewed decommissioning cost estimates prepared as part of license applications for two proposed uranium enrichment facilities. In the course of these reviews, NRC staff have identified certain issues that frequently arise in the preparation of decommissioning cost estimates, including failures to provide an adequate level of detail, missing or inadequate contingency factors, reliance on first-party rather than independent third-party costs as the basis of the estimate, and delays in revising the decommissioning cost estimates when the facility conditions change. NRC staff also identified situations in which licensees were not adequately familiar with guidance provided in NUREG-1757 (Reference 41) concerning the contents of decommissioning cost estimates and how such estimates should be organized to provide the most effective presentation of the decommissioning activities to be performed and their expected costs. The following amendments in the final rule have the objective of providing the NRC with an accurate decommissioning cost estimate (DCE). They are discussed individually below.

Changes to §§ 30.35(e), 40.36(d), Criterion 9(b) to Appendix A to Part 40, and 70.25(e)(1)]

Before this final rule, the regulations required that each DFP must contain a cost estimate for decommissioning, including the means for adjusting the cost estimate periodically over the life of the facility. Although detailed guidance on the DCE is contained in NUREG-1757, Volume 3, licensees are not required to follow the guidance. The final rule specifies that the DCE must be “detailed,” that it be based on the cost of an independent contractor to perform all decommissioning activities, that it specify the volume of soils and ground water containing residual radioactivity that will require remediation to meet the criteria for license termination, that it contain an “adequate” contingency factor, and that it identify and justify the key assumptions contained in the DCE. In addition, the final rule specifies that a DCE for Part 30, Part 40 (except for licensees subject to Appendix A to Part 40), and Part 70 licensees must be based on the cost of meeting the § 20.1402 criteria for unrestricted use, unless the licensee can demonstrate its ability to meet the provisions of § 20.1403 (restricted release).

Changes to §50.82(a)(4)(i) and (a)(8)(v), (vi) and (vii)

Before the final rule, the regulations required that a power reactor licensee submit a post-shutdown decommissioning activities report (PSDAR) that includes a description of the planned decommissioning activities, along with a schedule for their accomplishment, and an estimate of expected costs. The contents of the cost estimate were not specified, nor do the requirements for the cost estimate refer to the costs of managing irradiated fuel, which can be considerable and which can be incurred for a considerable time (including a period after other decommission-ing activities have been completed). The final rule amendment to 10 CFR 50.82(a)(4)(i) make clear that the cost estimate in the PSDAR must include estimates for decommissioning the facility and for managing irradiated fuel. The amendments to 10 CFR 50.82(a)(8)(v), (vi) and (vii) require annual reporting in a financial assurance status report of current amounts spent and estimated to be spent to complete decommissioning, balance of funds available for decommissioning, funds accumulated for managing irradiated fuel, and the projected cost to manage irradiated fuel until title is transferred to the Secretary of Energy.

2.2.2. Tighter Controls

The following amendments have the common objective to provide greater certainty to the NRC that adequate financial assurance will be available at the start of decommissioning activities. They are discussed individually below.

Changes to §§ 30.35(c)(6), 40.36(c)(5) and 70.25(c)(5)

Before the final rule, the regulations allowed licensees authorized to possess relatively small quantities of radioactive materials meeting limits specified in 10 CFR 30.35(d) to submit a certification that they have financial assurance, rather than having to prepare a detailed DCE. Licensees authorized to possess radioactive materials in higher amounts must submit a DFP, which includes a site-specific DCE. The amendments require licensees, including those that would otherwise qualify to use the certification, to submit a DCE if survey results detect significant residual radioactivity in soils or ground water (i.e., detected levels that would, if left uncorrected, prevent the site from meeting the criteria for unrestricted use). Remediating subsurface contamination can be very expensive. However, licensees that have licensed possession limits below the amounts that trigger the DFP requirement had no requirement before this final rule to increase the amount of financial assurance to cover subsurface remediation costs. This final rule provides the regulatory basis to require such licensees to cover the full cost of decommissioning, not just the prescribed amount covered by a certification.

Changes to §§ 30.35(f), 40.36(e), 70.25(f), 72.30(e)

Before this final rule, the regulations allowed the use of an escrow account as a financial assurance mechanism. An escrow account may be less preferable than a trust for assurance that funds will be available when needed for decommissioning. The EPA concluded that a trust was more protective of funds because, under trust law, the title to property in a trust is transferred to the trustee, while in an escrow account, title to the property remains with the grantor. (46 FR 2802, 2827) Thus, property in an escrow is more likely to be subject to a creditor's claim than property held in trust. In addition, the law of trusts places obligations on the trustee to act in the interest of the beneficiary. In contrast, an escrow agent is responsible

only for what is specified in the escrow agreement. The EPA concluded that it would be extremely difficult to draft an escrow agreement that adequately specifies all the actions that an escrow agent would need to take in all situations to assure the instrument served its intended purpose. Therefore, the final rule eliminates the escrow as a method to provide financial assurance. About 25 licensees with escrow accounts are affected by this change.

Before this final rule, the regulations allowed lines of credit to be used as financial assurance mechanisms, but no licensee to date used this method to provide financial assurance for decommissioning. Maintaining the option to use a line of credit incurs costs to maintain regulatory guidance and conduct training. Although the cost is small, it appears no benefit is realized from retaining this option in the regulations. Therefore, the NRC has eliminated this option in this final rule.

Changes to §§ 30.35(i), 40.36(h), 70.25(i), and 72.30(g)

Before this final rule, the regulations allowed funds set aside for decommissioning to be placed in accounts that are subject to market fluctuations with no requirement of licensees to monitor the fund balance and replace in a timely manner shortfalls that occur when market prices decline. This final rule requires the licensee to monitor the fund balance and specifies the time period for a licensee to make up a shortfall in decommissioning funding. A decline of 25 percent was selected as the make up trigger point because the cost estimate includes a 25 percent contingency. Requiring timely replacement of market losses will increase the likelihood that funds will be available for decommissioning when needed. This amendment was made as one of many separate assurances that funds will be available for decommissioning.

Change to §§ 20.1403(c) and 20.1404(a)(5)

Before this final rule, the regulations allowed licensees to use several financial assurance mechanisms to provide decommissioning financial assurance for restricted site release, but specified no financial assurance options for licensees planning to decommission under 10 CFR 20.1404 alternate release criteria. A trust fund as a financial assurance mechanism is better suited to the long-term nature of the financial requirement because it can exist for long periods of time without need for renewal. The trust exists independently of the former licensee, and can continue to serve the purposes of control and maintenance even if the former licensee ceases to exist. The trustee has a fiduciary duty to serve the beneficiaries of the trust. The funds placed in the trust become property of the trust, and generally cannot be reached by creditors of the former licensee. The final rule amendments require licensees to place adequate funds into a trust for the purpose of long-term control and maintenance, and would sureties, insurance, other guarantee methods, and other forms of prepayment for restricted site release cases. Government entities continue to be permitted to use a statement of intent or to assume custody and ownership of a site. The final rule requires a trust be used as the decommissioning financial assurance mechanism in cases involving 10 CFR 20.1404 site releases. Very few licensees are expected to apply for site releases under the 20.1403 or 20.1404 criteria, and all such licensees are required to use a trust as the financial assurance mechanism. None of the current licensees are affected by this change. This amendment was made as one of many separate assurances that funds will be available for decommissioning.

Changes to §§ 30.34(b), 40.46, 70.36, and 72.50(b)(3)

Before this final rule, the regulations did not specify required information of the transferee as part of the request for license transfer. The final rule codifies NRC regulatory guidance to require the existing licensee to provide information on the proposed transferee's technical and financial qualifications, and to provide financial assurance for decommissioning as a condition for approval of the transfer. The information and financial assurance are necessary to evaluate the adequacy of the proposed transferee. Placing these provisions in regulations, rather than continuing to rely on regulatory guidance, will improve regulatory efficiency by improving the quality of license transfer requests. None of the licensees are affected by this change. This amendment was made as one of many separate assurances that funds will be available for decommissioning.

Changes to §§ 30.35(f), 40.36(e), 70.25(f), and 72.30(e)

Before this final rule, the regulations specified only limited information that must be in the financial assurance instrument. Financial instruments submitted to the NRC do not always contain adequate identifying information regarding the licensee, the issuer, and, if applicable, the trustee. The final rule requires that the name and contact information for each party is included in the instrument, along with the license and docket numbers of the facility for which it provides financial assurance. Licensees are required to submit a revised instrument within 30 days of a change in the information on the current instrument. Many licensees will need to add information to their current instrument, but this information should be readily available and the cost to do so will be very small. This amendment was made as one of many separate assurances that funds will be available for decommissioning.

Changes to Parent Guarantee and Self Guarantee Methods [Appendices A, C, D, and E to 10 CFR Part 30]

Before this final rule, the regulations specified a minimum tangible net worth requirement of $10 million, which was first adopted by the EPA in 1981 and adopted by the NRC in 1998 (53 FR 24046). This amount for minimum tangible net worth has not been changed to account for inflation. Therefore, to provide for inflation, the amended amount is $21 million. Research by staff indicates that none of the licensees who currently use the parent guarantee or self guarantee will fail to demonstrate minimum tangible net worth of $21 million.

Before this final rule, the regulations in Appendices A and C to 10 CFR Part 30 did not specify that the rated bond must be uninsured, uncollateralized, and unencumbered to adequately reflect a bond rating agency's evaluation of the financial stability of the bond issuer. The final rule will add the requirement that the bond rating used to pass the financial test must be uninsured, uncollateralized, and unencumbered. Research by staff indicates that none of the licensees who currently use the parent guarantee or self guarantee is expected to be affected by this change.

This final rule clarifies that qualifiers at the low end of the bond ratings, for example "-" and "3", meet the regulatory standard for bond rating. The final rule also requires an annual verification of the bond rating. None of the licensees who use the parent guarantee or self guarantee will be affected by this change.

Before this final rule, the regulations did not require the independent certified public accountant's special report to examine off-balance sheet transactions. Since these transactions have the potential to materially affect the guarantor's ability to fund

decommissioning obligations, the final rule requires the auditor to include an opinion of off-balance sheet transactions. Research by staff indicates that none of the licensees who currently use the parent guarantee or self guarantee is expected to be affected by this change.

Before this final rule, the regulations required the licensee to repeat passage of the financial test each year, but did not explicitly state that the licensee must annually submit documentation to the NRC to verify its passage of the test. The final rule requires annual submittal of documentation that the guarantor passed the financial test. All of the licensees who use the parent guarantee or self guarantee will be affected by this change, but at a very low additional cost.

Before this final rule, the regulations did not require the guarantor to set up a standby trust to hold funds for decommissioning in the event the NRC requires the guarantor to provide such prepaid funding for decommissioning. The final rule requires the guarantor to set up a standby trust, and provides the Commission the right to change the trustee, and specifies that an acceptable trust is one that meets the regulatory requirements of the Commission. About 50 percent of the existing licensees who use the parent guarantee or self guarantee (or about 25 licensees) will be affected by this change.

Before this final rule, the regulations did not specify the guarantor's obligation to fund decommissioning work to terminate the license. The final rule clarifies that the guarantor's obligation is not capped at the guaranteed amount, but includes costs in excess of the guaranteed amount if additional funds are required to complete decommissioning and termination of the license. Staff has assumed that no licensees who currently use the parent guarantee or self guarantee will have to pay more for decommissioning than the guaranteed amount.

Before this final rule, the regulations did not require the parent company comply with Commission orders. The final rule includes an agreement by the parent company making itself subject to NRC payment orders. The requirement is necessary because the parent company may not itself be an NRC licensee.

Before this final rule, the regulations did not provide for the possibility that the guarantor may be in financial distress at the time it is required to provide alternate financial assurance. In order to provide a money claim on the assets of the guarantor that would cover the cost of decommissioning at the time of a division of assets, the final rule authorizes the Commission to make the amount guaranteed immediately due and payable to the standby trust.

3. IDENTIFICATION OF ALTERNATIVE APPROACHES

The NRC considered three alternatives for the final rule:

Alternative 1: No-Action

This alternative provides a baseline to assess the other two alternatives (Reference 36). Under the No-Action alternative, the Commission would make no changes to current regulations. It assumes there will be one additional legacy site from currently operating facilities licensed by the NRC and four additional legacy sites from currently operating facilities licensed by Agreement States. The basis for this assumption is in Section 3.1 of this document.

Alternative 2: Decommissioning planning

This alternative would amend the regulations as described in Section 1.1 and 1.2 of this document to improve licensees' decommissioning planning. This is the preferred alternative.

Alternative 3: Decommissioning planning and collateral

This alternative would include all of the changes in Alternative 2, and it would add a requirement for a security interest in collateral to support the decommissioning assurance pledged in the parent guarantee and self guarantee financial assurance mechanisms.

3.1 Alternative 1: The No-Action Alternative

The No-Action alternative is to maintain the status quo. Under the No-Action alternative, the Commission would make no changes to the current regulations in 10 CFR Part 20 or to the regulations in 10 CFR Parts 30, 40, 50, 70, and 72 relating to decommissioning planning and decommissioning financial assurance. No costs would be incurred for the implementation of new regulations but society would incur costs due to additional legacy sites for the reasons discussed in Section 1.2. NRC staff reviewed the technical basis information in Section 2 and assessed the likelihood of additional legacy sites among different types of licensees. Five of the current 8 legacy sites are classified within program code 11700 in the NRC License Tracking System. This program code represents facilities licensed for rare earth extraction operations. This could include uranium, thorium or other rare earth elements.

NRC staff assumed under Alternative 1 that a single NRC licensed rare earth extraction facility will become a legacy site. Based on an approximate 4 to 1 relationship in the number of Agreement State licenses to NRC licenses, we assumed that 4 Agreement State licensed rare earth extraction facilities also will become legacy sites, for a total of 5 additional legacy sites.

The 5 additional legacy sites will require control and surveillance beginning in year 1 of the analysis. In year 15 of the analysis, the decommissioning for these sites is funded by Congressional appropriations (for a Federal agency) and State appropriations (for an Agreement State agency) and each site terminates its license that year consistent with unrestricted use criteria. The analysis for Alternative 1 also calculates collective dose from inhalation and ingestion of uranium contaminated soils at the legacy sites using methodology and assumptions in Appendix N of NUREG-1757, Volume 2 (Reference 37). The methodology would presumably be used by the licensee to determinate whether remediation of the contaminated soils should be undertaken to meet the ALARA requirement of decommissioning.

Section 4.1.2 describes the specific assumptions and Appendix A shows the input and line item results for Alternative 1.

3.2 Alternative 2: Monitoring with Financial Assurance Changes

Alternative 2, the preferred approach, implements the regulatory amendments described in Section 1.1.

Section 4.1.3 describes the specific assumptions and Appendix B shows the input and line item results for Alternative 2. The analysis assumes that licensees implement the final rule amendments beginning in year 1. The amendments affect different numbers of licensees. For example, 240 licensees are assumed to be affected by the amendment to 10 CFR 30.35(f) to report on a one-time basis additional information in the financial assurance mechanism, whereas only 1 licensee is assumed to be affected by 10 CFR 30.35(h)(3) to notify NRC of shortfalls in decommissioning funding and the plan to replenish the funds. These line item assumptions are made for licensees affected by the amendments in 10 CFR Parts 20, 30, 40, 50, 70 and 72, and shown in Appendix B.

Alternative 2 also assumes costs for licensees at the 5 sites that were modeled under Alternative 1 as legacy sites. These costs are to identify residual radioactivity in their subsurface environment, and implement appropriate leak detection, inspection and ground-water monitoring procedures to minimize the introduction of residual radioactivity into their site area. The assumption in Alternative 2 is that the licensees do this in year 1, and in year 2 these licensees have a choice of increasing financial assurance to remediate at a later time or remediate the subsurface residual radioactivity in year 2 to a level that would allow license termination under unrestricted use criteria. Because for uranium contamination it is a lower cost to remediate sooner rather than later, all 5 of the licensees are assumed to remediate in year 2. In the last year of the analysis, these licensees are still implementing the leak detection and monitoring program, and their sites are ready for license termination consistent with unrestricted use. There is no collective dose in Alternative 2.

3.3 Alternative 3: Monitoring with Financial Assurance Changes, and Collateral

Alternative 3 adds a collateral requirement to the assumptions of Alternative 2. The collateral requirement would establish a security interest equal to the amount of the guarantee for each licensee that uses a parent company guarantee or a self guarantee as a decommissioning financial assurance mechanism. The analysis assumes two-thirds of licensees with a Guarantee would apply collateral and the other one-third would switch to an alternate financial assurance mechanism. The analysis assumes 43 NRC licensees and 172 Agreement State licensees use Guarantees. These assumptions are consistent with information in the NRC License Tracking System and from information gathered from Agreement State via Information Request FSME-06-111, dated December 13, 2006. The total value of Guarantees represents a very large financial commitment for decommissioning, thus the collateral alternative is expensive.

Section 4.1.4 describes the specific assumptions and Appendix C shows the input and line item results for Alternative 3.

4. ANALYSIS OF VALUES AND IMPACTS

This section examines the values (benefits) and impacts (costs) expected to result from NRC's final rule. The benefits and costs are analyzed for implementation of the rule under Alternatives 1, 2 and 3.

The affected attributes for the rule are listed below with reference to their significance. Section 4.1 describes the methodology for calculating benefits and costs associated with each attribute. The analysis is done over a fifteen-year time period.

The results are presented in Section 5, in constant 2007 dollars. The results are presented for the one-time costs and the annual operating expense to implement the rule. The total cost of the rule over the 15-year implementation period is estimated using 7 percent and 3 percent real discount rates. Under the preferred approach, Alternative 2, the estimated total costs are $110 million and $77 million, discounted at 3 percent and 7 percent, respectively. Alternative 2 is about 40 percent lower cost than Alternative 1 and is substantially lower cost than Alternative 3.

The characteristics in the public and private sectors that will be affected by the rule are listed below. These are called "attributes," using the list of potential attributes provided by NRC in Chapter 5 of its Regulatory Analysis Technical Evaluation Handbook (Reference 38).

1. ***Public Health (Accident)***. NRC anticipates a slight benefit from ensuring that residual radioactivity is identified at operating facilities and that sufficient decommissioning funding is provided consistent with unrestricted use. No costs are anticipated for this attribute.

2. ***Occupational Health (Accident)***. NRC anticipates a slight benefit due to timely identification of residual radioactivity. No costs are anticipated for this attribute.

3. ***Occupational Health (Routine)***. NRC anticipates a benefit due to timely identification of residual radioactivity. Costs are identified for this attribute but only for Alternative 1 where additional legacy sites are assumed and a cost of collective dose is estimated due to exposure to soil contamination over the 15-year analysis period.

4. ***Onsite Property***. A slight benefit is anticipated to onsite property due to a reduction in the incidence of ground-water contamination within the site boundary before decommissioning is completed. No costs are anticipated for this attribute.

5. ***Industry Implementation***. Industry would incur one-time costs, both capital and labor, to read and implement the rule. Alternative 3 includes the implementation costs in Alternative 2, and the additional costs associated with the collateral requirement for the guarantees.

6. ***Industry Operation***. Industry would incur an increase in annual labor-related operating expense to implement the rule. Some licensees also will be required to pay annual fees for standby trusts that they are not currently incurring, and costs of financial assurance instruments including opportunity costs of collateral.

7. ***NRC Implementation***. NRC will incur one-time costs to implement the final rule following publication in the *Federal Register*. NRC will also need to revise guidance

documentation during this implementation time period, and will process financial assurance license applications and amendments during the initial period of implementation. NRC will incur one-time costs to review additional decommissioning cost estimates and financial assurance mechanisms.

8. ***NRC Operation***. NRC will incur an increase in annual operating expense due to staff time to review license amendments and applications, identify State requirements concerning renewal of financial statements and periodically re-filing financing statements; review amended decommissioning cost estimates, reviewing results of monitoring; and under Alternative 3 monitor security interests by conducting searches of State records to obtain information concerning collateral. NRC may achieve benefits from elimination of legacy sites and the associated necessity of monitoring such sites and engaging in enforcement activities and legal actions to obtain funds for decommissioning.

9. ***Other Government***. The rule will impose one-time and recurring costs to Agreement State governments of the same type as the costs incurred by NRC and proportionate to the number of materials licensees affected. These costs are estimated in the analysis.

10. ***Improvements in Knowledge***. Benefits are anticipated for NRC as a result of the rulemaking. NRC will gain valuable information about residual radioactivity at its licensed sites and about the adequacy of decommissioning financial assurance to terminate those licenses consistent with unrestricted release criteria.

11. ***Regulatory Efficiency***. The final rule will result in a small benefit due to elimination of existing regulatory authority to use the escrow account and the line of credit as approved financial assurance instruments, which will reduce the need for monitoring and potential enforcement and legal actions to obtain funds. A small benefit also will result from increased clarity and detail in decommissioning cost estimates, which will reduce the need for Requests for Additional Information and review by NRC staff, and result in greater accuracy in the decommissioning cost estimates.

12. ***Environmental Considerations***. NRC anticipates a slight benefit due to more timely and accurate identification of residual radioactivity that could result in contamination of soil and ground water. Reference 39, the Environmental Assessment for this final rule, contains more information. No costs are anticipated for this attribute.

13. ***Other Considerations***. Public confidence in NRC may be affected positively by the rule. The public may have more confidence in NRC's program for protection of human health and safety, and the environment, as a result of the perception that decommissioning requirements have been strengthened and future legacy sites are more likely to be averted.

The following attributes are not expected to be affected:

1. ***General Public***. No impacts are anticipated for the general public.

2. ***Public Health (Routine)***. No impacts are anticipated for this attribute.

3. ***Offsite Property***. No impacts are anticipated for this attribute.

4. ***Safeguards and Security Considerations***. No impacts are anticipated.

4.1 Analytical Methodology

This section describes the process used to evaluate values and impacts associated with the affected attributes discussed above for the alternate methods to implement the final rule. The values (benefits) include any desirable changes in affected attributes. The impacts (costs) include any undesirable changes in affected attributes, such as increased costs for different segments of industry to conduct their business in accordance with new regulations. These attributes have quantifiable values and impacts due to implementing the rule:

– Occupational Health (Routine), for Alternative 1 where there are legacy sites
– Industry Implementation
– Industry Operation
– NRC Implementation
– NRC Operation
– Agreement State Implementation
– Agreement State Operation

NRC collected the input assumptions using data and information obtained from the following sources: Cost estimating manuals and other sources of data on costs of planning and implementing subsurface monitoring; information provided by State Secretary of State offices and other sources on costs and procedures for electronic filing of financing statements for collateral; NRC Workgroups and NRC Staff experience; Reports and documents (e.g., OMB burden statements); and independent research. An Agreement State representative participated in the NRC workgroup meetings. The number of affected entities for this rule was estimated using NRC information on existing licensees, NRC staff best professional judgment, and consultation with Agreement States.

4.1.1 General Assumptions

The general input assumptions for the analysis are discussed below.

- NRC wage rate: $110/hour. This is NRC's incremental labor rate, which includes only the variable costs associated with implementation and operation costs of the rule.

- Industry wage rate for licensee management and for legal support: $120/hour. This represents a blended rate for executive level and financial and administrative personnel and for both internal and external counsel.

- Industry wage rate for licensee clerical staff: $60/hour.

- Annual fees for financial assurance mechanisms (trust, surety bond, letter of credit): 5 percent of face value of mechanism

- Annual fees for standby trust (funded with de minimus amount): $800/year

- The time period for the analysis is 15 years. This is representative of the amount of time after a legacy site has recognized its inability to fully decommission its site and for State or

Federal government to provide resources for site remediation and license termination consistent with unrestricted use. This time period varies based on site-specific characteristics, but 15 years is a reasonable estimate for the legacy sites in this analysis.

- There are estimates of one-time implementation costs made in the first year of the analysis. There are estimates of recurring annual operating expense to support implementation of the rule. The values for annual operating expense are identical for each of the 15 years in the analysis. The annuity formula used to discount the annual expense values is on page B.3 of NUREG/BR-0184 (Reference 38).

4.1.2 Specific Assumptions for Alternative 1

Under the No-Action alternative (Alternative 1), NRC would make no changes to existing regulations. No financial costs would be incurred associated with regulatory amendments, but there would be 5 additional legacy sites – 1 NRC licensee and 4 Agreement State licensees. Detailed assumptions are in Appendix A. The specific assumptions for Alternative 1 are:

- The 5 legacy sites are assumed to be rare metal extraction facilities with uranium as a subsurface contaminant. The ore processing facility described in NUREG-0586 (Reference 40) was chosen as a representative site for this analysis. The facility pumps waste sludge to a settling pond about 100 meters from the facility. At this type of facility, residual radioactivity is primarily in the process and tailings areas and there is no significant contamination elsewhere. The main decommissioning task for these legacy sites involves the disposition of the residual radioactivity from the tailings pile and pond. The DECON decommissioning strategy was selected for this analysis. DECON requires the immediate removal and disposal of all residual radioactivity in excess of levels which would permit release of the facility for unrestricted use.

- Uranium as a contaminant penetrates into soil at a rate of about 1 inch per year, so the depth of subsurface contamination at the end of the analysis period is 15 inches. We are making this assumption to simplify the calculation in the analysis. There are other situations of submerged pipes, which usually start at a depth of about 5 feet below the surface, or the bottom of ponds that are deeper below the surface, which occur more frequently than uranium as a surface soil contaminant.

- The decommissioning cost for each legacy site is $55 million (2007$), which occurs in year 15 of the analysis. This decommissioning cost is based on the $32.69 million (1986$) DECON decommissioning cost estimate from NUREG-0586 (page 14-12) for this type of facility. The primary assumption was that 90 million pounds of radioactive sludge were transported 500 miles by truck to a low-level waste burial site. The sludge is removed from an area within the site boundary that is 200 square meters, 0.6 meters deep, with an average concentration of 200 pCi/gm due to uranium soil contamination.

- Each legacy site occupies 20 acres and there is a one time capital cost of $245,000 for surveillance and control of the site perimeter, with annual maintenance cost of $31,000.

- For each legacy site, the licensee identifies significant residual radioactivity in year 1 and shuts down operations because there is insufficient decommissioning financial assurance to terminate the license consistent with unrestricted use criteria. The licensee incurs in year 1 one-time implementation costs to install site surveillance and security for institutional

control. The licensee also begins to incur the first of 15 annual costs for stabilization and control of the site. With inadequate financial assurance for site decommissioning, government funding is used to decommission each site for unrestricted use. For the NRC site, the cost for decommissioning is an NRC operation cost. For the Agreement State sites, the cost for decommissioning is an Agreement State operation cost.

- For each legacy site, there is a potential for radiological exposure due to soil contamination. The averted dose methodology in NUREG-1757 Appendix N is applied to indicate the present worth (2007$) of the collective dose due to remediation of the soil. If the remediation is not performed it is considered a cost in Alternative 1. The critical group is workers at the site. With a relatively small contaminated area at low concentration levels, the Occupational Health (Routine) exposure is estimated to be about 0.6 person-rem over the 15 year analysis period.

4.1.3 Specific Assumptions for Alternative 2

Under Alternative 2, NRC amends 10 CFR 20.1406 and 20.1501 and makes changes to financial assurance requirements in 10 CFR Parts 30, 40, 50, 70 and 72 as described in Sections 1.1 and 1.2. There are no additional legacy sites in this alternative. Detailed assumptions are in Appendix B. The specific assumptions for Alternative 2 are:

- The same 5 facilities modeled in Alternative 1 as legacy sites are assumed in Alternative 2 to be operating facilities for the full 15-year period.

- The licensees of these 5 facilities identify significant residual radioactivity in year 1 and choose to remediate the contamination in year 2. The remediation is done to allow decommissioning and license termination in year 15 consistent with unrestricted use. This assumption is conservative in the calculation of benefits that would occur because it does not include estimates for other facilities (in addition to the 5 facilities) where, as a result of the rule, the occurrence of leaks is identified on an early basis and corrective actions are made to limit the spread of the source term, in particular before there is subsurface contamination.

- The remediation cost for each operating facility is $1.2 million (2007$), which occurs in year 2 of the analysis. This remediation cost is based on the $963,000 (1997$) cost estimate from NUREG-1496, Volume 3 (page C.2-45) for this type of facility with direct disposal of soil at a cost of $350 per-ft^3 (1997$). The 1997$ were escalated to 2007$ using indices of the Gross Domestic Product Implicit Price Deflator (118.041/95.054). For this type of facility to achieve a reduction in residual radioactivity dose rate of between 15 and 25 mrem/year, NUREG-1496 estimated approximately 75 cubic meter of soil volume would be removed.

- The decommissioning cost for each operating facility is $18 million (2007$), which is about one-third the cost to decommission a legacy site under Alternative 1. The assumption here is that uranium penetrates the soil at a rate of 1 inch per year for a total depth of only 1 inch in Alternative 2 and a total depth of about 15 inches in Alternative 1. For both Alternatives, the DECON decommissioning in year 15 is done using a bulldozer to remove contaminated soil. The sensitivity of bulldozer soil clearance depth is assumed to be in increments of 6 inches, so under Alternative 2 with uranium contamination only 1 inch deep only one pass of the bulldozer is required to remove the soil whereas three times that amount were removed under the Alternative 1 legacy site with 15 years of uranium seepage into the soil.

- The licensees of these facilities conduct surveys starting in year 1 using an appropriate monitoring program pursuant to the amendments to 10 CFR 20.1501 and 20.1406. For inspection and leak detection activities at each facility, the one-time and annual operating costs are $8,800 and $4,500 respectively. For ground-water monitoring activities at each facility, the one-time and annual operating costs are $46,000 and $5,000 respectively.

- The decommissioning planning and financial assurance amendments in this final rule will affect certain licensees based on the specific section of regulation. For example, we assume 10 licensees are affected annually by the change in 10 CFR 30.35(e)(2) to assess whether specific incidents, such as spills or leaks, will affect the decommissioning cost estimate, whereas no licensees are assumed to be affected annually by the change in 10 CFR 30.35(h)(3) to notify NRC of shortfalls in decommissioning funding and their plan to replenish the funds. These line item assumptions are made for each of the amendments in 10 CFR Parts 20, 30, 40, 50, 70 and 72 and are shown in Appendix B.

- Amendments in this rule reduce the number of approved financial assurance mechanisms and require certain licensees to use a Decommissioning Funding Plan instead of a certified amount for decommissioning financial assurance. Elimination of the escrow account affects the following number of NRC licensees: 14 in Part 30, 3 in Part 40, and 2 in Part 70. The change to require a licensee with significant subsurface residual radioactivity to shift from a certified amount to an approved Decommissioning Funding Plan is estimated to affect 1 licensee each year under Parts 30, 40, and 70. Another change requires licensees who use a parent guarantee or a self guarantee as a decommissioning financial assurance mechanism to establish a standby trust; this affects the following number of licensees: 30 in Part 30, 6 in Part 40, 6 in Part 70, and 1 in Part 72. The number of Agreement State licensees affected by the regulations is assumed to be four times the NRC licensees for Parts 30 and 40.

- A one-time implementation cost is assumed for 500 NRC licensees and 1,000 Agreement State licensees who have an obligation to maintain decommissioning financial assurance and who have liquid processes at their facility that could cause significant subsurface residual radioactivity at the site. An estimate is made of 90 minutes for each of the 1,500 licensees to read the final rule changes to 10 CFR Part 20 and the survey and monitoring guidance released with the final rule.

- The reporting requirements in 10 CFR 72.30(b), (c) and (d) apply to ISFSI General and Site-Specific licensees. An estimated 20 licensees per year assess the occurrence of four specific events at their site pursuant to new 10 CFR 72.30(c).

- Power reactor licensees with a reactor in decommissioning status will have increased reporting requirements under changes to 10 CFR 50.82 for an estimated 3 licensees per year.

- Fuel cycle facilities licensed under Part 70 will have increased reporting requirements under changes to 10 CFR 70.25 and 70.36.

- Licensees with a facility licensed under Part 72 will have increased monitoring of funds under changes to 10 CFR 72.30.

4.1.4 Specific Assumptions for Alternative 3

All of the specific assumptions in Alternative 2 apply to Alternative 3. In addition, Alternative 3 would add a new requirement of licensees who use a parent guarantee or a self guarantee to provide a security interest in collateral in support of the guarantees. This would provide additional assurance that decommissioning funds will be available when needed. There would be no additional legacy sites in Alternative 3. Detailed assumptions are in Appendix C. The specific assumptions for Alternative 3 not mentioned previously are:

- The number of NRC and Agreement State licensees with a parent guarantee or a self guarantee, and the total guaranteed amount, is shown below:

	NRC licensees	NRC $ Amount	A/S Licensees	A/S $ Amount
Part 30 and 50	30	120 million	120	110 million
Part 40	6	220 million	24	90 million
Part 70	6	200 million	0	
Part 72	1	40 million	0	

- Of the licensees with Guarantees, two-thirds are assumed to use collateral as a security interest and one-third are assumed to choose a less-expensive alternative by switching to a different financial assurance mechanism. For those who use collateral, the average cost of collateral among the licensees is 2.5 percent of the guaranteed amount. For those who switch to a different mechanism, the average cost is 3 percent of the guaranteed amount.

- There are small one-time costs to establish standby trusts and to switch financial assurance mechanisms.

- The number of hours required for NRC and Agreement States to implement and maintain the more complex regulations requiring a security interest in collateral would be 20 percent higher than the effort to implement and maintain the regulations under Alternative 2.

5. RESULTS

This section presents results of values and impacts that are expected to be derived from the final rule. The results are shown for each affected Part in Title 10 of the Code of Federal Regulations and by the following seven attributes:

- Occupational Health (Routine) for Alternative 1 where there are legacy sites
- Industry Implementation
- Industry Operation
- NRC Implementation
- NRC Operation
- Other Government Implementation (Agreement States)
- Other Government Operation (Agreement States)

The rule is expected to provide values in other attributes, such as Improvements in Knowledge, Regulatory Efficiency, Environmental Considerations, and Public Confidence, but these values are not quantified because they are expected to be small and there is no verifiable input available at this time to support input assumptions. The costs are presented in constant 2007 dollars, for both implementation and annual operating expenses. The impact of the final rule over a 15 year analysis period is estimated using 3 percent and 7 percent real discount rates to show an overall effect in terms of 2007 dollars. Alternative 1, the No-Action Alternative, provides a baseline against which the other two alternatives are assessed.

5.1 Summary of Results

Table 5-1 presents the net impact of the rule for each of the three alternatives, at 3 percent and 7 percent real discount rates, including all benefits and costs over the 15-year analysis period. Because the rule is intended to avoid the occurrence of legacy sites, the net impact of Alternative 1, the No-Action Alternative, is estimated to include the existence of 5 legacy sites that would not occur under Alternatives 2 or 3.

Table 5-1: Net Impact of Alternatives 1, 2, and 3

Regulatory Alternative	15-year total at 3% discount rate ($ 000)	15-year total 7% discount rate ($ 000)
1. No Action	179,593	102,315
2. Monitoring and Financial Assurance	109,609	77,292
3. Monitoring, Financial Assurance plus Security Interest in Collateral for Parent and Self-Guarantees	369,938	276,827

The input and line item results for the No-Action Alternative 1 are shown in Appendix A. The major contributing costs under Alternative 1 are due to:

- The costs shown in Table 5-1 are for a total of 5 legacy sites over a 15 year period.
- The total one-time cost for each of the Part 40 licensees with a legacy site is $245,000.
- The annual operating cost for surveillance and site stabilization and control at each legacy site is $31,000 which is equal to $370,000 present value 2007$ over the 15 year analysis period at 3 percent discount rate.
- The decommissioning cost for each legacy site in year 15 is about $35 million (2007$) at 3 percent discount rate. The decommissioned area is about 200 square meters by a depth of about 0.6 meter. The depth is about 18 inches equal to 3 passes of a bulldozer. About 90 million pounds of radioactive sludge is disposed in the DECON decommissioning of each site. The decommissioning cost is paid by State or Federal government.
- The collective dose over the 15 year analysis period is about 1 person-rem for each site for a total of 5 person-rem. The cost associated with collective dose for all 5 sites over the 15 year period is about $6,000 (2007$) at 3 percent discount rate.

The input and line item results for Alternative 2 are shown in Appendix B. The major contributing costs under Alternative 2 are due to:

- The same 5 sites modeled under Alternative 1 operate over the 15 year analysis period and implement leak detection and ground-water monitoring, starting in year 1. The total cost per facility over the 15 year period is about $54,000 and $60,000 for leak detection and ground-water monitoring, respectively.
- The remediation cost for each facility in year 2 is about $1.2 million (2007$). The remediation area (i.e., 200 square meters) was conservatively estimated as the same depth (i.e., 18 inches) as the decommissioned area for Alternative 1. The total amount of remediated soil is 75 cubic-meters.
- The decommissioning cost for each facility in year 15 is about $12 million (2007$) at 3 percent discount rate. This decommissioning cost is paid by the licensee. The decommissioned area is about 200 square meters at a depth of about 6 inches. A total amount of about 30 million pounds of radioactive sludge is disposed in DECON decommissioning.
- The implementation of the final rules by industry, NRC and the Agreement States represent a total of about $44 million (2007$) over the 15 year period, at 3 percent discount rate. NRC licensee costs are about $6 million, and NRC costs are about $3 million. Agreement State licensee costs are about $23 million, and Agreement State costs are about $12 million. The implementation of the rules by industry represents about 26 percent of the total for Alternative 2. Virtually all of the industry costs are due to amendments in 10 CFR Parts 20 and 30.

The input and line item results for Alternative 3 are shown in Appendix C. The major contributing costs under Alternative 3 are due to:

- Using the 3 percent discount rate, the extra $257 million for Alternative 3 compared to Alternative 2 is due to implementing the requirement of collateral as a security interest for Guarantees. With an estimated $840 million in Guarantees for both NRC and Agreement States licensees, and among the approximate 200 licensees who use Guarantees, about $170 million is due to the cost of collateral and $90 million is due to licensees using an

alternative financial assurance mechanism. Alternative 3 is not considered a viable alternative compared to Alternative 2.

Table 5-2 provides the estimated costs, by attribute, over the 15-year analysis period. The Industry Operation costs represent about 80 percent of total costs under Alternative 2, and are mostly due to decommissioning and remediation costs which are $59 million and $6 million respectively (see Table B-1). At the 3 percent discount rate for Alternative 2, about $94 million of the total $109 million is for implementation of the rule by industry, due to one-time implementation and multi-year operating costs, and $15 million of the total is for implementation of the rule by NRC and Agreement States. Note the total values match Table 5-1.

Table 5-2: Estimated Values and Impacts by Attribute

Attribute	Alternative 2 15-Year Total Cost ($ 000)		Alternative 3 15-Year Total Cost ($ 000)	
	3% Discount	7% Discount	3% Discount	7% Discount
Industry Implementation	7,254	7,254	8,089	8,089
Industry Operation	87,115	54,799	343,561	250,451
NRC Implementation	144	144	172	172
NRC Operation	2,978	2,978	3,574	3,574
Other Government Implementation	204	204	245	245
Other Government Operation	11,913	11,913	14,296	14,296
Total	109,609	77,292	369,938	276,827

Implementation costs shown above represent one-time costs that would be incurred by affected licensees, NRC and Agreement States to implement changes to regulations in Alternatives 2 and 3.

Operation costs shown above represent the additional annual operating expense projected to be incurred by affected licensee, NRC and Agreement States over 15 years to meet the requirements in the rule.

Table 5-3 presents estimated values and impacts, by affected 10 CFR Part, for the Industry Implementation and Industry Operation costs shown in Table 5-2.

Table 5-3: Estimated Costs by 10 CFR Part for Industry Implementation and Operation

	Alternative 2				Alternative 3		
	One-time ($ 000)	Annual 3% ($ 000)	Annual 7% ($ 000)		One-time ($ 000)	Annual 3% ($ 000)	Annual 7% ($ 000)
Part 20 NRC – final rule	97.2	2,200.4	1,678.8		-	-	-
Part 20 A/S—final rule	208.8	8,801.6	6,715.1		-	-	-
Part 20 total	306.0	11,002.0	8,393.9		306.0	11,002.0	8,393.9
Part 30 NRC – prop rule	134.7	3,064.0	2,337.6		-	-	-
Part 30 NRC – collateral	0	0	0		134.0	16,076.4	12,265.3
Part 30 NRC total	134.7	3,064.0	2,337.6		268.7	19,140.4	14,603.0
Part 30 A/S total	539.0	12,256.0	9,350.5		1,075.0	76,561.6	58,411.8
Part 30 total	673.7	15,320.0	11,688.2		1,343.7	95,702.0	73,014.8
Part 40 NRC – decom	0	11,767.5	6,644.8		-	-	-
Part 40 NRC – remedtn	1,165.0	0	0		-	-	-
Part 40 NRC – coll dose	0	0	0		-	-	-
Part 40 NRC – GWM	54.8	113.4	86.5		-	-	-
Part 40 NRC – final rule	30.6	168.8	128.8		-	-	-
Part 40 NRC – collateral	0	0	0		26.8	20,023.9	15,277.0
Part 40 NRC total	1,250.5	12,049.7	6,860.2		1,277.3	32,073.6	22,137.2
Part 40 A/S total	5,002.0	48,198.7	27,440.6		5,109.2	128,294.3	88,548.7
Part 40 total	6,252.4	60,248.4	34,300.8		6,386.4	160,367.9	110,685.8
Part 50 NRC – final rule	0	143.3	109.3		0	143.3	109.3
Part 70 NRC – final rule	21.8	163.1	124.4		-	-	-
Part 70 NRC – collateral	0	0	0		26.8	63,958.7	48,796.6
Part 70 NRC total	21.8	163.1	124.4		48.6	64,121.8	48,921.0
Part 72 NRC – final rule	0	238.8	182.2		-	-	-
Part 72 NRC – collateral	0	0	0		4.5	11,985.7	9,144.3
Part 72 NRC total	0	238.8	182.2		4.5	12,224.4	9,326.5
Total NRC and A/S	7,253.9	87,115.4	54,798.7		8,089.2	343,561.4	250,451.2

Note: the " - " symbol in the table above indicates the same value as in Alternative 2.

The values in Table 5-3 represent estimates of NRC and Agreement State licensee costs for activities related decommissioning (decom), remediation (remedtn), collective dose (coll dose) leak detection and ground-water monitoring (GWM), implementation of the final rule (final rule), and the collateral requirements analyzed in Alternative 3. Note the total NRC and A/S values match Industry Implementation and Industry Operation values in Table 5-2.

6. PRE-RULE ANALYSIS VALUES AND IMPACTS

This section addresses the values and impacts of the Industry Ground Water Protection Initiative (GPI). The voluntary GPI "identifies actions to improve utilities' management and response to instances where the inadvertent release of radioactive substances may result in low but detectible levels of plant-related materials in subsurface soils and water" (Reference 14; August 31, 2007). The GPI applies to operating power reactors licensed under 10 CFR Part 50. This section identifies the manner in which the voluntary GPI will provide an effective and efficient resolution of subsurface radioactivity detection and monitoring issues at power reactors. It also identifies NRC inspection criteria to inspect compliance by industry to assure performance of the commitments made in the voluntary GPI.

Voluntary Initiative by Licensees of Power Reactors

The purpose of the GPI, as described in the Reference 14 document dated August 2007, is to "help licensees to: (1) improve management of situations involving inadvertent radiological releases that get into ground water, and (2) improve communication with external stakeholders to enhance trust and confidence on the part of local communities, States, the NRC, and the public in the nuclear industry's commitment to a high standard of public radiation safety and protection of the environment." The GPI only applies to licensed radioactive materials that are or were generated as a result of plant operations.

The GPI identifies licensee actions to implement a ground water protection program. Each of the actions has objectives and acceptance criteria to demonstrate that the objectives have been met. The GPI is a written document maintained by the power reactor licensee, specifying the frequency at which and/or conditions under which each program element is to be performed to ensure that the licensee's understanding of the site, the potential for leaks or spills to occur, or for equipment to degrade over time accurately reflect actual conditions at the site. The three program areas and action for each program area are:

- Ground Water Protection Program, with an action to "improve management of situations involving inadvertent radiological releases that get into ground water."

- Communication, with an action to "improve communication with external stakeholders to enhance trust and confidence on the part of local communities, States, the NRC, and the public in the nuclear industry's commitment to a high standard of public radiation safety and protection of the environment."

- Program Oversight, with an action to "perform program oversight to ensure effective implementation of the GPI program."

Reference 14 documents licensee commitments in the GPI. The commitments have not been controversial among industry or among the public. The commitments are expected to be performed in a manner similar to other routine operating procedures performed to support power reactor operations and are expected to continue throughout the term of the reactor operating license.

NRC Inspection Criteria

The NRC will begin to inspect in 2008 the activities performed by power reactor licensees compared to their public commitments in the GPI. NRC Temporary Instruction 2515/173 (ADAMS ML072950622) will be used by inspectors to assess if licensees have completed the voluntary industry Groundwater Protection Initiative. The Temporary Instruction includes inspection of licensees' Annual Reporting whereby the power reactor licensees will have documented onsite groundwater sample results for each calendar year in the Annual Radiological Environmental Operating Report (AREOR) or the Annual Radiological Effluent Release Report (ARERR), as part of their annual Environmental Reports. This information is publicly available in ADAMS.

NRC staff has concluded that the monitoring and survey processes and related reports prepared at power reactor sites, or budgeted for implementation before the effective date of a final rule for Decommissioning Planning, likely would contain sufficient information to satisfy the amendments to 10 CFR 20.1406(c) and 20.1501. NRC is not requiring licensees to submit reports but the information must be available for review. It is not expected that power reactor licensees will need to install new capital or modify operating procedures to satisfy the amendments to 10 CFR 20.1406(c) and 20.1501. If NRC publishes a Decommissioning Planning final rule, it may be necessary for licensees at a time after the effective date of the final rule to install additional monitoring equipment under some circumstances. This could occur, for example, if significant residual radioactivity in the subsurface is detected at a site (i.e., it is determined to be a quantity that would later require remediation during decommissioning to meet the unrestricted use criteria of 10 CFR 20.1402). The need for additional monitoring equipment would be determined on a case-by-case basis by either licensee activities or after NRC inspection activities. NRC's schedule is to publish a final rule no earlier than October 2008. The NRC staff conclusion noted above is supported by the following conditions:

- Power reactor licensees have already invested or have budgeted funds for the fixed costs to achieve the GPI actions and objectives;

- The GPI has been undertaken by licensees to increase public confidence and is unlikely to be eliminated in the future because of the detrimental impact on public confidence that would cause; and

- The GPI is well-defined and will have been in place for several months after the effective date of a final rule.

6.1 Pre-Rule Results

NRC is not aware of cost data representing the GPI actions and objectives at nuclear power reactors.

Appendix D provides the assumptions for estimates of the one-time and recurring annual operating cost to support leak detection, ground water monitoring and communications undertaken by power reactor licensees in the voluntary GPI. A conservative assumption is used that each power plant site, after consideration of hydrology and geology studies, installs 10 ground water monitoring wells. The assumed one-time capital cost is $900,000 for each nuclear power plant site. Assuming 65 sites represent the 104 operating power reactors, the total for one-time capital costs is $58.5 million. The annual operating cost to implement the GPI is estimated at $60,000 (2007$) per nuclear power plant site. Assuming 65 sites, the total for all power reactor sites is approximately $3.9 million annually (2007$). Over a 15 year period, this annual recurring cost for 65 sites is equal to $46.6 million and $35.5 million at 3 percent and 7 percent discount rates, respectively.

The total GPI cost over a 15 year period, including both one-time and annual operating costs, for the operating power reactors is equal to $105 million and $94 million, at 3 percent and 7 percent discount rates, respectively. This total cost represents the expenditures that would be associated with implementation of the GPI, under the conservative assumption that ground water monitoring wells are needed at each site and in the absence of any existing ground water monitoring, analysis, and reporting capability by power reactor licensees. However, existing regulatory requirements in 10 CFR § 50.34a [Design objectives for equipment to control releases of radioactive material in effluents–nuclear power reactors], and § 50.36a [Technical specifications on effluents from nuclear power reactors], and 10 CFR Part 50, Appendix I [Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion “As Low As Is Reasonably Achievable” for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents] as well as the existing requirements in 10 CFR § 20.1501 have caused power reactor licensees to implement Radiological Environmental Monitoring Programs (REMP). The REMP at power reactor sites are now being supplemented when necessary with actions associated with the GPI. The Action Plan guidance document for the GPI specifies that companies will not necessarily be required to drill more monitoring wells, modify plant systems, structures, or components, and that the scope of any needed enhancements will vary from site to site, depending on the extent and quality of current programs for detecting and preventing leaks and the efficacy of the current site program for monitoring ground water.

This analysis assumes that the costs incurred by power reactor licensees to implement the GPI are equivalent to the estimate provided in Appendix D and that no additional costs will be incurred beyond those already expended under the GPI to implement the final rule requirements, as of the effective date of the final rule.

The results shown in Section 5 provide no credit for the GPI because the activities by licensees were undertaken before development of the rule. The estimate shown in Appendix D is the cost that would be included if the licensees were given full credit for the voluntary GPI.

7. BACKFIT ANALYSIS

The NRC has determined that the NRC's rules on backfitting, 10 CFR 50.109, 70.76, 72.62, and 76.76, do not require the preparation of a backfit analysis. A backfit is the modification of equipment or procedures required to operate a facility resulting from new or amended NRC regulations, or the imposition of a regulatory staff position interpreting the Commission rules that is either new or different from a previously applicable staff position.

The new or amended regulations in this final rule either clarify existing requirements, or require the collection and reporting of information using existing equipment and procedures. The changes to requirements are not regulatory actions to which the backfit rule applies. The new and amended NRC regulations in this final rule are summarized below.

The rule amends 10 CFR 20.1406 and 20.1501. Section 20.1406, "Minimization of contamination," is amended by adding a new subsection (c) to read as follows:

> (c) Licensees shall, to the extent practical, conduct operations to minimize the introduction of residual radioactivity into the site, including the subsurface, in accordance with existing radiation protection requirements in Subpart B and radiological criteria for license termination in Subpart E of this part.

This is not a backfit because it clarifies licensee requirements under two existing regulations applicable to licensed operations. To comply with the current ALARA dose requirements in 10 CFR 20.1101(b) and 10 CFR 20.1402 (within existing subparts B and E, respectively), licensees must have operating procedures to minimize the introduction of residual radioactivity into their site, including the subsurface. Otherwise, licensees may lack information to provide a basis to demonstrate that they have achieved, during the life cycle of the facility which includes the decommissioning phase, public and occupational exposures that are ALARA. Licensees should already have these procedures in place as part of their radiation protection program, and the amended 20.1406(c) clarifies this requirement.

The staff continued position of the revision to 10 CFR 20.1406 as an extension of the policy articulated by the Commission in 1997, when the LTR was established. In the SOC accompanying the LTR, in response to a public comment that the requirements of then-proposed 10 CFR 20.1406 should apply to all licensees, rather than only to applicants for new licenses, the Commission stated:

> "Applicants and existing licensees, including those making license renewals, are already required by 10 CFR part 20 to have radiation protection programs aimed towards reducing exposure and minimizing waste. In particular, Sec. 20.1101(a) requires development and implementation of a radiation protection plan commensurate with the scope and extent of licensed activities and sufficient to ensure compliance with the provisions of 10 CFR part 20. Section 20.1101(b) requires licensees to use, to the extent practicable, procedures and engineered controls to achieve public doses that are ALARA. In addition, lessons learned and documented in reports such as NUREG-1444 have focused attention on the need to minimize and control waste generation during operations as part of development of the required radiation protection plans. Furthermore, the financial assurance requirements issued in the January 27, 1988 (53 FR 24018), rule on planning for decommissioning require licensees to provide adequate funding for decommissioning. These funding requirements create great

incentive to minimize contamination and the amount of funds set aside and expended on cleanup." (62 FR 39082).

The current § 20.1101(a) requires each licensee to implement a radiation protection program to ensure compliance with the regulations in 10 CFR Part 20. The current § 20.1101(b) requires each licensee to use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. These operating procedures and controls need to include methods to minimize the introduction of residual radioactivity into the site, including the subsurface, to achieve doses that are ALARA. Otherwise, licensees may lack information to provide a basis to demonstrate that they have achieved, during the life cycle of the facility including decommissioning, public and occupational exposures that are ALARA. The concept of reducing residual radioactivity to ALARA as part of the decommissioning criteria has been a position of the NRC since at least 1994 (NUREG-1501, page iii).

Section 20.1501, "General" (part of Subpart F, "Surveys and Monitoring"), has been amended by revising subsection (a), and inserting a new subsection (b), to read as follows:

(a) Each licensee shall make or cause to be made, surveys of areas, including the subsurface, that--
(1) May be necessary for the licensee to comply with the regulations in this part; and
(2) Are reasonable under the circumstances to evaluate --
(i) The magnitude and extent of radiation levels; and
(ii) Concentrations or quantities of residual radioactivity; and
(iii) The potential radiological hazards of the radiation levels and residual radioactivity detected.
(b) Records from surveys describing the location and amount of subsurface residual radioactivity identified at the site must be kept with records important for decommissioning.

The amended 10 CFR 20.1501(a) replaces the undefined term "radioactive material" with "residual radioactivity," a term already defined in 10 CFR Part 20. As defined in existing 10 CFR 20.1003, residual radioactivity includes subsurface contamination within its scope, and the word "subsurface" is being added to 10 CFR 20.1501(a). This regulation (10 CFR 20.1501(a)(2)(iii)) already requires the evaluation of potential radiological hazards. Thus, as amended, 10 CFR 20.1501(a) makes clear that subsurface residual radioactivity is a potential radiological hazard, and that the radiological surveys required by this section must address subsurface residual radioactivity. This clarification of existing requirements does not require the preparation of a backfit analysis.

As set forth above, a new subsection (b) to 10 CFR 20.1501 requires that survey records describing the location and amount of subsurface residual radioactivity identified at a licensed site be kept with records important for decommissioning. Regulatory changes imposing information collection and reporting requirements do not constitute regulatory actions to which the backfit rule applies. Additionally, NRC licensees are already required to keep records important for decommissioning. See, e.g., 10 CFR 50.75(g), 70.25(g), and 72.30(d). Moreover, the new 10 CFR 20.1501(b) is not intended to require recordkeeping of any and all amounts of subsurface residual radioactivity, but only amounts that are significant to achieve effective decommissioning planning and ALARA dose requirements. For operating facilities, significant residual radioactivity is a quantity of radioactive material that would later require

remediation during decommissioning to meet the unrestricted use criteria of 10 CFR 20.1402. Significant residual radioactivity in subsurface media, such as soil, is a component of waste because it must be removed and disposed of to meet unrestricted use criteria.

The Commission established a broad framework when § 20.1501 was added to the regulations in 1991, when 10 CFR Part 20 was substantially revised. (56 FR 23360) In the Statements of Consideration for that final rule, in a response to a comment about the lack of specificity in monitoring requirements, the Commission stated as follows:

> "Many portions of Part 20 are not very specific and detailed because Part 20 contains the NRC's general radiation protection requirements and applies to all classes of licensees, including large power reactors, universities, and medical institutions as well as small radionuclide and sealed source users. Because of this breadth of application, the requirements in Part 20 cannot be very detailed and for any one type of facility. However, the requirements in Part 20 are designed to provide the framework for all licensees and to establish provisions that the NRC considers to be fundamental to basic radiation protection."(56 FR 23376)

Within that broad framework, licensee requirements have included the need to provide basic radiation protection in the form of surveys during facility operations if there is reason to believe (e.g., based on records of past spills) that there is contamination or a radiological hazard at the licensed facility and site. These surveys have been done primarily to comply with occupational and public dose limits resulting from effluent releases. Such releases are subject to the requirements stated in 10 CFR 20.1301, 20.1302, and 50.36a, and the reporting requirements in §§ 40.65, 50.36a(2), and 70.59. The amended § 20.1501(a) requires that surveys also be performed if there is a reason to believe that subsurface contamination is present which constitutes a potential radiological hazard. Subsurface contamination, which is not obvious or evident, also is a risk for creation of a legacy site if contaminant characteristics are not addressed early when the facility is operating.

Additionally, adherence to the § 20.1501(a) survey requirements may be a necessary part of effectively planning for decommissioning, as well as to comply with dose limits resulting from effluent release. It is important to distinguish between effluent release dose limits (10 CFR 20.1301 and 20.1302) and decommissioning criteria dose limits. While the two sets of dose limits share the pathways used to calculate doses to a person (i.e., exposure from radioactive material that may be in the air, water, food crops, meat, and fish), the exposure is based on a different location. The effluent limits apply to a person outside the facility's site boundary. But for the decommissioning criteria, the maximum dose is expected to be to a person occupying the area that was decommissioned, which may include areas that were formerly inside the facility's restricted area. Another contrast between the two sets of dose limits is that the person's dose is calculated differently in each case. For effluent releases, the dose is calculated for the maximally exposed person. But the decommissioning dose is calculated for the average person of the critical group. Due to these differences, the effluent release dose is not directly comparable to the decommissioning dose. Compliance with the effluent release dose requirements does not necessarily mean that remediation will be unnecessary to achieve the decommissioning criteria. Thus, the dose limits in NRC regulations concerning effluent release to unrestricted areas (10 CFR Parts 20, 30, 40, 50, and 70) are not applicable in determining whether significant residual radioactivity exists at a site.

As indicated above, facilities to which the backfit rule applies (i.e., power reactors, fuel cycle facilities, and the gaseous diffusion plants) currently have monitoring systems to collect effluent release data from designated areas. A licensee is prohibited by 10 CFR 20.1301 from releasing radioactive materials to an unrestricted area in concentrations that exceed the limits specified in 10 CFR Part 20 or that exceed limits otherwise authorized in an NRC license. Power reactors are subject to effluent release regulations in § 50.36a that require each reactor's technical specifications to cite the ALARA release levels of radioactive materials to unrestricted areas during normal operations in addition to requiring compliance with § 20.1301. Section 50.36a was added to the regulations in 1996, when the decommissioning regulations for nuclear power reactors were revised. (61 FR 39299) The numerical guidance in Appendix I to 10 CFR Part 50 was amended in the same final rule (61 FR 39303) to include reference to the § 50.36a technical specification effluent release ALARA requirements to be applicable during operations as well as during decommissioning activities. Fuel cycle facilities have reporting requirements of effluent release pursuant to §§ 40.65 and 70.59. Although not required, except in cases of a drinking water or irrigation source, these facilities also have designated onsite monitoring areas generally in the shallow ground water table. Each of the two gaseous diffusion plants, certified under 10 CFR part 76, has an extensive ground water monitoring program managed by DOE. USEC provides copies to the NRC of each gaseous diffusion plant annual radionuclide emissions report. NRC staff concludes that the monitoring systems at power reactors, fuel cycle facilities and gaseous diffusion plants likely would generate sufficient information to meet the objectives of the amendments to 10 CFR 20.1501(a) and (b) set forth above, by the effective date of this final rule. NRC anticipates no additional survey requirements for licensees with independent spent fuel storage installations (ISFSI) because these facilities do not have credible source terms to create subsurface contamination.

The final rule also revises decommissioning planning and financial assurance requirements in 10 CFR Parts 30, 40, 50, 70, and 72. These revisions do not entail modifying any equipment or procedures required to operate the types of NRC-licensed facilities governed by 10 CFR Parts 50, 70, or 72. The changes concern administrative matters which are outside the scope of protection afforded by the NRC's backfitting rules (10 CFR 50.109, 70.76, and 72.62). Therefore, preparation of a backfit analysis is not required for the revisions to the decommissioning planning and financial assurance requirements.

Accordingly, the final rule's provisions do not constitute a backfit and do not require the preparation of a backfit analysis. This regulatory analysis identifies the benefits and costs of the final rule, discusses the voluntary GPI, and evaluates other options for addressing the identified issues. As such, this regulatory analysis constitutes a "disciplined approach" for evaluating the merits of the final rule and is consistent with the intent of the backfit rule.

8. DECISION RATIONALE AND IMPLEMENTATION

The assessment of costs and benefits discussed previously leads the NRC to the conclusion that the final rule, if implemented, would improve licensees' decommissioning planning and reduce the likelihood that a currently operating licensed facility will become a legacy site. In the past, a significant contributing factor of a site becoming a legacy site was the lack of knowledge by the licensee regarding the presence of significant onsite subsurface contamination while the facility was in an operating status. Together, the set of amendments in §§ 20.1406(c) and 20.1501, and the set of financial assurance amendments in 10 CFR Parts 20, 30, 40, 50, 70, and 72, will create greater confidence that the licensee has accurate information from which to base its decommissioning cost estimate, has reported additional details necessary for NRC staff review of the cost estimate, and that the financial assurance will be available when needed, even if the licensee enters bankruptcy.

Three alternatives were evaluated in this Regulatory Analysis. Alternative 1 would maintain the regulations as currently written. NRC anticipates under this alternative that an additional 1 legacy site would occur over the next 15 years under NRC jurisdiction, and an additional 4 legacy sites would occur in the Agreement States. The estimated cost associated with Alternative 1 is higher than the preferred Alternative 2.

Alternative 2 will make the amendments in §§ 20.1406 and 20.1501, and the set of financial assurance amendments in 10 CFR Parts 20, 30, 40, 50, 70, and 72, as discussed in Sections 1.1 and 1.2. There will be no additional legacy sites in Alternative 2. The amendments in Alternative 2 will increase licensee reporting and recordkeeping requirements, and the time and resources expended by NRC and Agreement States, compared to current regulations. Alternative 2 will increase the certainty that NRC will obtain licensees' decommissioning financial assurance funds even if the licensee enters bankruptcy.

Alternative 3 would provide a higher level of certainty, compared to Alternative 2, of obtaining licensees' decommissioning funds by requiring licensees who use the parent guarantee or self guarantee financial assurance options to provide a security interest in collateral for the amount guaranteed. The security interest in collateral is much higher cost compared to Alternative 2, and does not provide an equivalent increase in the certainty of obtaining decommissioning funds compared to Alternative 2.

For the reasons discussed in the previous paragraphs, Alternative 2 is superior to Alternative 1 and Alternative 3.

The final rule is planned for publication in the *Federal Register* in late 2008.

9. REFERENCES

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Appendix A: Input and Line Item Results for Alternative 1

Table A-1: One-time capital costs and annual costs for assumed legacy sites

At 3% discount

Alternative 1 (No Action) at 3%

	Number of Legacy Sites	One-time Capital and O&M Costs (per site)	Annual Cost (per site)	Govt funded decom cost (per site 2007$)	Total one-time cost (2007$)	Total annual costs (2007$)	Total decom cost in year 15 (2007$)	Total Costs (2007$)
Part 40: NRC Source Material Facilities								
Rare Metal Extraction Facility	1							
Stabilization and Control		$245,000	$31,000		$245,000	$370,076		$615,076
Decommissioning				$55,000,000			$35,302,407	$35,302,407
Inspection/leak detection		$0	$0					
Groundwater monitoring		$0	$0					
						Total federal funded decom cost		$35,917,483

	Stabilization and control costs	Decommissioning costs	Sum
Total NRC =	$615,076	$35,302,407	$35,917,483
Total Agreement States =	$2,460,304	$141,209,628	$143,669,932
	$3,075,380	$176,512,036	$179,587,415

At 7% discount

Alternative 1 (No Action) at 7%

	Number of Legacy Sites	One-time Capital and O&M Costs (per site)	Annual Cost (per site)	Govt funded decom cost (per site 2007$)	Total one-time cost (2007$)	Total annual costs (2007$)	Total decom cost in year 15 (2007$)	Total Costs (2007$)
Part 40: NRC Source Material Facilities								
Rare Metal Extraction Facility	1							
Stabilization and Control		$245,000	$31,000		$245,000	$282,345		$527,345
Decommissioning				$55,000,000			$19,934,531	$19,934,531
Inspection/leak detection		$0	$0					
Groundwater monitoring		$0	$0					
						Total federal funded decom cost		$20,461,876

	Stab and control costs	Decommissioning costs	Sum
Total NRC =	$527,345	$19,934,531	$20,461,876
Total Agreement States =	$2,109,381	$79,738,124	$81,847,506
	$2,636,727	$99,672,655	$102,309,382

Table A-2: Cost assumptions for legacy site one-time capital and annual costs

Alternative 1 Cost Estimate: Onsite Stabilization and Long Term Control (2007$)

	20-acre site Part 40
Capital Costs - Site Prep	
Mobilization	10,000
Construction surveys	20,000
Sediment and erosion control	10,000
Capital Costs - Construction	
Radiological and air monitoring	10,000
Installation of wells	33,000
Sediment and erosion controls	10,000
Security fencing (6' H, 6 ga, AL)	130,000
Capital Costs - Site Prep & Con	223,000
Capital Costs - Adm and Eng	22,000
Capital Costs - Total	245,000
Annual Surv and Monitoring Cost	
Radiation surveys	2,000
Site security/maintenance	12,000
NRC oversight fees	10,000
License renewal and inspection	4,000
Trustee fees and expenses	3,000
Annual Costs - Total	31,000

Notes:

Installation of wells: assume 6 wells on each site at a cost of $5,500 per well.

Security fencing: 20 acres = approx. 860,000 sq.ft; assume sq. perimeter = 1300 feet of fence each side with fence cost at $25 per linear foot.

Rare Metal Extraction Facility Site Parameters

Site boundary – 20 square acres (860,000 square feet)
Contaminated area – 200 square meters (2,152 square feet)
Contaminated soil volume – 200 square meters at 0.6 meters depth, equal to approximately 90 million pounds of sludge (3,500 pounds sludge/cubic meter).

Table A-3: Uranium movement through soil methodology and assumptions

Methodology

We used the following relationship to estimate the vertical movement of uranium through soil:

$$V = \frac{(P \times F / n)}{R}$$

where:	*V*	=	Vertical velocity of uranium in soil (cm/yr)
	P	=	Annual precipitation (cm/yr)
	F	=	Fraction of rainfall that infiltrates into the soil
	n	=	Total porosity of soil (unitless)
	R	=	Retardation Factor for uranium (unitless)

The retardation factor is calculated from the partition coefficient for uranium, and the bulk density and porosity of the soil as follows:

$$R = 1 + \frac{Kd \times \rho}{n}$$

where:	*Kd*	=	partition coefficient for uranium in soil (ml/g)
	ρ	=	bulk density of soil (g/ml)

Assumptions

The values for annual precipitation, infiltration fraction, uranium partition coefficient, soil porosity, and bulk density are as listed below:

PARAMETER	VALUE	JUSTIFICATION
Annual Precipitation	178 cm/yr	Assumed a wet region of the US (70 in/yr)
Infiltration Fraction	0.3	See discussion below
Uranium Partition Coefficient	15 ml/g	Default value in NUREG/CR-5512
Soil Bulk Density	1.6 g/ml	Default value in NUREG/CR-5512
Total porosity	0.3	Default value in NUREG/CR-5512

The analysis estimates the uranium movement in the top several inches of soil. Because of the large uncertainties involved in estimating uranium movement, the parameters were chosen to estimate a reasonable upper bound on the vertical movement in soil. As such we used an annual rainfall for a very wet area of the continental United States and a low value for uranium partitioning in soil. The analysis also assumes that 30% of the annual rainfall percolates into the soil. We based this assumption on the data provided in tables 6.42 and 6.43 of NUREG/CR-5512 Vol. 3 that give an estimated infiltration rate of 12-14% for loam. This range was assumed low because it pertains to the fraction that makes it below the root zone, and a higher fraction would make it into the first few inches of soil. When using these parameter values, we calculated the maximum vertical movement of uranium to be 2.2 cm/yr or slightly less than 1 inch per year.

References

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Table A-4: Collective dose methodology and assumptions for legacy sites

Methodology

The equation for the present worth of future collective averted dose from NUREG 1757, Volume 2, Appendix N [page N-5] is:

$$PW(AD_{collective}) = P_D * A * 0.025 * F * \frac{Conc}{DCGL_w} * \frac{1 - e^{-(r+\lambda)*N}}{r+\lambda}$$

where P_D = population density for the critical group scenario (people/m^2)
A = area being evaluated (square meters, m^2)
F = effectiveness (fraction of the residual radioactivity removed by the remediation action)
Conc = average concentration of residual radioactivity in the area being evaluated (in units of activity per unit volume for soils)
$DCGL_W$ = derived concentration guideline equivalent to the average concentration of residual radioactivity that would give a dose of 0.25 mSv/y (25 mrem/y) to the average member of the critical group (in the same units as *"Conc"*)
r = monetary discount rate (annual)
λ = radiological decay constant for the radionuclide (annual)
N = number of years over which the collective dose will be calculated

Assumptions

The equation above is based on Uranium contamination in soil for this Regulatory Analysis. The time period for the analysis is 15 years (N).

PARAMETER	VALUE	JUSTIFICATION
Population density	0.0004 p/m^2	Land value, p. N-10, NUREG 1757, V. 2
Area	200 m^2	Assumption for this analysis
Effectiveness	1.0	Assumption for this analysis
Conc (of U-234 and U-238)	200 pCi/g	Assumption for this analysis
DCGL (of U-234 and U-238)	14.1 pCi/g	Page B-3, NUREG 1757, V. 1
Monetary discount rate	3% and 7%	Page N-10, NUREG 1757, V. 2
Radiological decay constant		
U-234	2.8 E-06	Calculation
U-238	9.8 E-10	Calculation
Number of years	15	Assumption for this analysis

When using these parameter values, we calculated the collective averted dose to be 0.6 person-rem (rounded) at 3 percent discount rate. For the 5 legacy sites, the total averted dose is 3 person-rem. At $2000 per person-rem, the present worth of future collective averted dose is $6,000.

Appendix B: Input and Line Item Results for Alternative 2

Table B-1: Cost assumptions for ground water monitoring, inspection and leak detection, remediation and decommissioning

At 3% discount

Alternative 2 - preferred alternative - at 3%

	Number of Legacy Sites	One-time Capital and O&M Costs (per site)	Annual Cost (per site)	Ind funded decom cost (per site 2007$)	Total one-time cost (2007$)	Total annual costs (2007$)	Total decom cost in year 15 (2007$)	Total Costs (2007$)
Part 40: NRC Source Material Facilities								
Rare Metal Extraction Facility	1							
Stabilization and Control		$0	$0					
Decommissioning				$18,333,333			$11,767,469	$11,767,469
Remediation (year 2)		$1,200,000			$1,165,049			$1,165,049
Inspection/leak detection		$8,800	$4,500		$8,800	$53,721		$53,721
Groundwater monitoring		$46,000	$5,000		$46,000	$59,690		$59,690
						Total federal funded decom cost		$13,045,928

	Remediation, inspection, leak and gw monitoring costs	Decommissioning costs	Sum
Total NRC =	$1,278,459	$11,767,469	$13,045,928
Total Agreement States =	$5,113,836	$47,069,876	$52,183,712
	$6,392,295	$58,837,345	$65,229,640

At 7% discount

Alternative 2 - preferred alternative - at 7%

	Number of Legacy Sites	One-time Capital and O&M Costs (per site)	Annual Cost (per site)	Ind funded decom cost (per site 2007$)	Total one-time cost (2007$)	Total annual costs (2007$)	Total decom cost in year 15 (2007$)	Total Costs (2007$)
Part 40: NRC Source Material Facilities								
Rare Metal Extraction Facility	1							
Stabilization and Control		$0	$0					
Decommissioning				$18,333,333			$6,644,844	$6,644,844
Remediation (year 2)		$1,200,000			$1,165,049			$1,165,049
Inspection/leak detection		$8,800	$4,500		$8,800	$40,986		$40,986
Groundwater monitoring		$46,000	$5,000		$46,000	$45,540		$45,540
						Total federal funded decom cost		$7,896,417

	Remediation, inspection, leak and gw monitoring costs	Decommissioning costs	Sum
Total NRC =	$1,251,574	$6,644,844	$7,896,417
Total Agreement States =	$5,006,295	$26,579,375	$31,585,670
	$6,257,869	$33,224,218	$39,482,087

Table B-2: Alternative 2 Assumptions for 10 CFR Part 20

NRC Licensees

10 C.F.R.	Description	NRC Licensee	Hours	Wage Rate ($/hr)	Cost/Licensee (incl. clerical)	Total Cost	Annual Cost	Total 15 Yr 3% NPV	Total 15 Yr 7% NPV
Part 20									
20.1403(c)(1)	Requires use of trust for FA for restricted release site, and one percent real rate of return assumption for initial balance.	3	20	120	$2,400	$7,200	one-time	-	-
20.1403(c)(2)	Eliminates surety, insurance, or other guarantee as FA for restricted release site.	0	20	120	$2,400	$0	one-time	-	-
20.1404(a)(5)	Requires licensees who use alternate use criteria to provide sufficient financial assurance to enable a third party to perform work.	0	8	120	$960	$0	one-time	-	-
20.1406(c) and 20.1501	Estimated one-time expense for licensees with finanical assurance and liquid processes to understand changes to Part 20 and draft revised Regulatory Guide 4.21.	500	1.5	120	$180	$90,000	one-time	-	-
20.1406(c)	Requires licensees, to the extent practical, to conduct operations to minimize the introduction of residual radioactivity into the site, including the subsurface.	16	80	120	$9,600	$153,600	$153,600	$1,833,667	$1,398,976
20.1501(a)	Requires licensees to perform surveys of areas, including the subsurface, that may be necessary to demonstrate compliance with regulations or to evaluate potential radiological hazards.	8	32	120	$3,840	$30,720	$30,720	$366,733	$279,795
20.1501(b)	Requires licensees to retain records from surveys of subsurface residual radioactivity with records important for decommissioning.	8	0	120	$0	$0	$0	$0	$0
							SUBTOTAL	$2,200,400	$1,678,771
							+ one-time costs	$97,200	$97,200
							TOTAL	$2,297,600	$1,775,971

Notes:

1. An estimated 16 source and byproduct material licensees would need to perform additional activities regarding identification and minimization of residual radioactivity within the site boundary [20.1406(c)].

2. An estimated 8 licensees will need to perform additional surveys that may be necessary to demonstrate compliance with regulations. The assumption is that the surveys are done quarterly and each require 8 hours labor [20.1501(a)].

3. The 8 licensees who perform additional surveys retain the survey records in records important for decommissioning, as they would have done under existing regulations [20.1501(b)].

Table B-3: Alternative 2 Assumptions for 10 CFR Part 30

NRC Licensees

10 C.F.R.	Description	NRC Licensee	Hours	Wage Rate ($/hr)	Cost/Licensee (incl. clerical)	Total Cost	Annual Cost	Total 15 Yr 3% NPV	Total 15 Yr 7% NPV
Part 30									
30.34(b)(2)	Requires application for transfer of license to include additional information about financial assurance.	3	0.5	120	$60	$180	$180	2,149	$1,639
30.35(c)(6)	If residual radioactivity exceeds 10 CFR 20.1402 unrestricted use criteria, prepare DFP and switch out of certification.	1	40	120	$4,800	$4,800	$1,600	$19,101	$14,573
	If residual radioactivity exceeds 10 CFR 20.1402 unrestricted use criteria, amend DFP.	2	16	120	$1,920	$3,840	$1,280	$15,281	$11,658
	If residual radioactivity does not exceed 10 CFR 20.1402 unrestricted use criteria, continue with certification or DFP.	0	0	120	$0	$0	$0	$0	$0
30.35(e)(1)	Requires DCE to be submitted for review and approval.	Licensees already comply				No Cost	-	-	-
30.35(e)(1)(i)(A)	Requires DCE to cover cost of decommissioning by an independent third party contractor.	Licensees already comply				No Cost	-	-	-
30.35(e)(1)(i)(B)	Requires DCE to cover cost of meeting criteria for unrestricted release unless demonstrate ability to meet restricted release criteria.	2	160	120	$19,200	$38,400	$12,800	$152,806	$116,581
30.35(e)(1)(i)(C)	Requires DCE to provide the volume of subsurface material containing residual radioactivity that will require remediation.	10	16	120	$1,920	$19,200	$6,400	$76,403	$58,291
30.35(e)(1)(i)(D)	Requires DCE to include adequate contingency.	Licensees already comply				No Cost	-	-	-
30.35(e)(1)(ii)	Requires DCE to explain and justify key assumptions.	Previously covered				No Cost	-	-	-
30.35(e)(2)	Requires assessment of whether occurrence of specified events requires revision of DCE.	10	16	120	$1,920	$19,200	$6,400	$76,403	$58,291
30.35(f)	Requires financial assurance mechanisms to include specified information; licensee cost to amend/review.	40	2	120	$240	$9,600	one-time	-	-
30.35(f)(1)	Requires prepayment FA to be in form of trust with trust and trustee acceptable to Commission; cost to obtain trust fund.	10	4	120	$1,520	$15,200	one-time	-	-
30.35(f)(2)	Eliminates line of credit.	0				$0	one-time	-	-
30.35(f)(3)	Requires external sinking fund to be in form of trust, eliminates other options and restricts combination of options.	0				$0	one-time	-	-
30.35(h)(1)&(2)	Requires licensees to monitor funds on quarterly basis and replenish funds.	5	4	120	$480	$2,400	$2,400	$28,651	$21,859
30.35(h)(3)	Requires licensees to notify NRC that it has replenished funding and provide new balance.	0	4	120	$720	$0	$0	$0	$0
							SUBTOTAL	$370,792	$282,892
							+ one-time costs	$24,800	$24,800
							TOTAL	$395,592	$307,692

Notes: 1. An estimated 2 licensees per year revise their decommissioning cost estimate (DCE) to represent the cost of meeting unrestricted use criteria [30.35(e)(1)(i)(B)].

2. An estimated 10 licensees per year consider volume of contaminated soil in the DCE [30.35(a)(1)(i)(C)].

Table B-4: Alternative 2 Assumptions for 10 CFR Part 30, Appendices

NRC Licensees

10 C.F.R.	Description	NRC Licensee	Hours	Wage Rate ($ per hour)	Cost per licensee (incl. clerical)	Total Cost	Annual Cost	Total 15 Year 3% NPV	Total 15 Year 7% NPV
Appendix A to Part 30									
II.A	Revises financial test to require total net worth to exclude net book value of the nuclear facility or site and net worth to exclude net book value and goodwill of nuclear facility and site.	23	24	120	$2,940	$67,620	$67,620	$807,243	$615,877
II.A.1.(ii)	Revises financial test to require net working capital and total net worth at least 6 times decommissioning funds being assured instead of 6 times DCE or cert.	23	0						
II.A.1.(iii)	Revises financial test to require $19 million in tangible net worth.	23			No Cost	No Cost	one-time	-	-
II.A.2.(i)	Revises financial test to specify bond ratings include adjustments of + or -.	Current licensees already comply			No Cost	No Cost	one-time	-	-
II.A.2.(iii)	Revises financial test to require $19 million in tangible net worth.	23			No Cost	No Cost	one-time	-	-
II.B	Require CPA to evaluate off-balance sheet transactions and provide opinion. CPA to verify bond rating meets terms of financial test.	23	24	120	$2,940	$67,620	$67,620	$807,243	$615,877
II.C.1	Requires parent company to provide annual documentation of continuing eligibility to use parent company guarantee.	23	4	120	$540	$12,420	$12,420	$148,269	$113,120
III.B	Require parent to provide funds immediately if regulatory prerequisites met	0	0						
III.C	Adds requirements for period financial must remain in effect	23	0						
	Requires standby trust to be created.	23	4	120	$1,520	$34,960	one-time	-	-
III.D	Requires standby trust to be revised to reflect a change in grantor or trustee.	3	2	120	$240	$720	$720	$8,595	$6,558
III.E	Adds requirement for joint and several liability of licensee and guarantor	23	8	120	$960	$22,080	$22,080	$263,590	$201,103
III.F	Adds provision that guarantee agrees to be subject to commission orders.	One time cost for current licensees for E, F, G, and H covered together under E							
III.G	Adds agreement that commission may declare assurance immediately due.	23	0						
III.H	Adds requirement that guarantor will notify NRC of bankruptcy action.	23	0						
Appendix C to Part 30									
II.A	Revises financial test to require tanglible net worth to exclude net book value of the nuclear facility and site, and any intangible assets, and net worth to be calculated to exclude the net book value and goodwill of the nuclear facility and siteebleotal	11	16	120	$2,960	$32,560	one-time	-	-
II.A.1	Revises financial test to require $19 million in tangible net worth.	11	0			No Cost	one-time	-	-
II.B.(2)	Requires CPA to evaluate off-balance sheet transactions and provide opinion	11	24	120	$2,940	$32,340	$32,340	$386,073	$294,550
II.B.(3)	Provide annual documentation of FT passage	11	8	120	$1,020	$11,220	$11,220	$133,944	$102,191
III.E	Notice to NRC if bond rating drops below required level	1	1						
III.F	Licensee will provide funds immediately if regulatory prerequisites met	0							
III.G	Requires standby trust to be created.	11	4	120	$540	$5,940	one-time		
III.H	NRC can require immediate payment in case of bankruptcy	0							
III.I	Licensee will notify NRC immediately in case of bankruptcy	0							

Table B-5: Alternative 2 Assumptions for 10 CFR Part 30, Appendices (continued)

NRC Licensees

Appendix D to Part 30									
II.A.(1)	Revises FT to require tangible net worth to exclude net book value of the nuclear facility and site and any intangible assets.	1			No Cost	No Cost	one-time	-	-
II.B.(1)	CPA evaluataes off-balance sheet transactions and provides opinion.	1	24	120	$2,940	$2,940	$2,940	$35,098	$26,777
II.B.(2)	Licensee provides annual documentation to NRC of continued eligibility to self-guarantee	1	4	120	$540	$540	$540	$6,446	$4,918
II.D	Guarantee includes commitment to provide funds immediately if regulatory prerequisites met	1	4	120	$1,520	$1,520	one-time	-	-
II.E	Requires standby trust to be created.	1	4	120	$1,520	$1,520	one-time		
II.F	Adds agreement that commission may declare assurance immediately due.	0							
II.G	Adds requirement that licensee will notify NRC of bankruptcy action	0							
Appendix E to Part 30									
II.A.(1)	Revises financial test to specify bond ratings include adjustments of + or -.	Current licensees already comply			No Cost	No Cost	one-time	-	-
II.B.(1)	Revises financial test to specify bond ratings include adjustments of + or -.	Current licensees already comply			No Cost	No Cost	one-time	-	-
II.C.(1)	Requires CPA to evaluate off-balance sheet transactions and provide opinion	11	4	120	540	$5,940	5940	$70,911	$54,101
II.C.(2)	Requires licensee to provide annual documentation of continued eligibility to use guarantee	11	1	120	180	$1,980	1980	$23,637	$18,034
III.D	Agreement to provide funds immediately if regulatory prerequisites met	11	4	120	$1,520	$16,720	one-time	-	-
III.E	Agreement to notify NRC within 20 days if bond ratings drop below required level	1	1	120	180	$180	180	$2,149	$1,639
III.F	Requires standby trust to be created.	11	4	120	$1,520	$16,720	one-time		
III.G	Adds agreement that Commission may declare assurance immediately due	0							
III.H	Adds requirement that guarantor will notify NRC of bankruptcy action.	0							
							SUBTOTAL	$2,693,198	$2,054,745
							+ one-time costs	$109,940	$109,940
							TOTAL	$2,803,138	$2,164,685

Table B-6: Alternative 2 Assumptions for 10 CFR Part 40

NRC Licensees

	Description	NRC Licensee	Hours	Wage Rate ($/hr)	Cost/Licensee (incl. clerical)	Total Cost	Annual Cost	Total 15 Yr 3% NPV	Total 15 Yr 7% NPV
Part 40									
40.36(c)(5)	If residual radioactivity exceeds 10 CFR 20.1402 unrestricted use criteria, prepare DFP and switch out of certification.	1	40	120	$4,800	$4,800	$1,600	$19,101	$14,573
	If residual radioactivity exceeds 10 CFR 20.1402 unrestricted use criteria, amend DFP.	2	16	120	$1,920	$3,840	$1,280	$15,281	$11,658
	If residual radioactivity does not exceed 10 CFR 20.1402 unrestricted use criteria, continue with certification or DFP.	0	0	120	$0	$0	$0	$0	$0
40.36(d)(1)(i)(A)	Requires DCE to cover cost of decommissioning by an independent third party contractor.	Licensees already comply				No Cost	-	-	-
40.36(d)(1)(i)(B)	Requires DCE to cover cost of meeting criteria for unrestricted release unless demonstrate ability to meet restricted release criteria.	0	160	120	$19,200	$0	$0	$0	$0
40.36(d)(1)(i)(C)	Requires DCE to include estimate of volume of onsite subsurface material containing residual radioactivity.	5	16	120	$1,920	$9,600	$3,200	$38,201	$29,145
40.36(d)(1)(i)(D)	Requires DCE to include adequate contingency factor.	Licensees already comply				No Cost	-	-	-
40.36(d)(1)(ii)	Requires DCE to explain and justify key assumptions	Previously covered				No Cost	-	-	-
40.36(d)(2)	Requires assessment of whether occurrence of specified events requires revision of DCE	5	16	120	$1,920	$9,600	$3,200	$38,201	$29,145
40.36(e)	Requires financial assurance mechanisms to include specified information; licensee cost to amend/review mech	20	2	120	$240	$4,800	one-time	-	-
40.36(e)(1)	Requires prepayment FA to be in form of trust with trust and trustee acceptable to Commission; cost to obtain trust fund	17	4	120	$1,520	$25,840	one-time	-	-
40.36(e)(2)	Eliminates line of credit	0				$0	one-time	-	-
40.36(e)(3)	Requires external sinking fund to be in form of trust, eliminates other options and restricts combination of options.	0				$0	one-time	-	-
40.36(f)(1)&(2)	Requires licensees to monitor funds on quarterly basis and replenish funds.	5	4	120	$480	$2,400	-	-	-
40.36(f)(3)	Requires licensees to notify NRC that it has replenished funding and provide new fund balance	0	4	120	$720	$0	$0	$0	$0
40.46(b)(1)	Requires application for transfer of license to include specified information	1	0.5	120	$60	$60	$60	$716	$546
40.46(b)(2)	Requires application for transfer of license to include FA for decommissioning	1	40	120	$4,800	$4,800	$4,800	$57,302	$43,718
							SUBTOTAL	$168,802	$128,786
							+ one-time costs	$30,640	$30,640
							TOTAL	$199,442	$159,426

Table B-7: Alternative 2 Assumptions for 10 CFR Part 50

NRC Licensees

	Description	NRC Licensee	Hours	Wage Rate ($/hr)	Cost/Licensee (incl. clerical)	Total Cost	Annual Cost	Total 15 Yr 3% NPV	Total 15 Yr 7% NPV
Part 50									
50.75(e)(1)(iii)(A)	Eliminates use of line of credit for decommissioning FA.	0	2	120	$240	$0	-	-	-
50.82(a)(4)(i)	Submit PSDAR to NRC with specified information.	3	0	120	$0	$0	-	-	-
50.82(a)(4)(i)(A)	Report actual cost of decommissioning the reactor facility.	3	0	120		$0	-	-	-
50.82(a)(4)(i)(B)	Report on spent fuel management plan funding.	10	4	120	$480	$4,800	$2,400	$28,651	$21,859
50.82(a)(8)(v)	Submit annual financial assurance status reports to NRC.	10	8	120	$960	$9,600	$4,800	$57,302	$43,718
50.82(a)(8)(vi)	Submit additional finanical assurance to cover estimated cost of decommissioning.	0	2	120	$240	$0	-	-	-
50.82(a)(8)(vii)	Submit annual report of status of managing irradiated fuel.	10	8	120	$960	$9,600	$4,800	$57,302	$43,718
							SUBTOTAL	$143,255	$109,295
							+ one-time costs	$0	$0
							TOTAL	$143,255	$109,295

Notes: 1. An estimated 10 licensees per year, with power reactors in decommissioning, submit financial assurance status report [50.82(a)(8)(v)] and irradiated fuel management report [50.82(a)(8)(vii)].

Table B-8: Alternative 2 Assumptions for 10 CFR Part 70

NRC Licensees

	Description	NRC Licensee	Hours	Wage Rate ($/hr)	Cost/Licensee (incl. clerical)	Total Cost	Annual Cost	Total 15 Yr 3% NPV	Total 15 Yr 7% NPV
Part 70									
70.25(c)(5)	If residual radioactivity exceeds 10 CFR 20.1402 unrestricted use criteria, prepare DFP and switch out of certification.	1	40	120	$4,800	$4,800	$1,600	$19,101	$14,573
	If residual radioactivity exceeds 10 CFR 20.1402 unrestricted use criteria, amend DFP.	2	16	120	$1,920	$3,840	$1,280	$15,281	$11,658
	If residual radioactivity does not exceed 10 CFR 20.1402 unrestricted use criteria, continue with certification or DFP.	0	0			$0	-	-	-
70.25(e)(1)(i)(A)	Requires DCE to cover cost of decommissioning by an independent third party contractor.	Licensees already comply				No Cost	-	-	-
70.25(e)(1)(i)(B)	Requires DCE to cover cost of meeting criteria for unrestricted release unless demonstrate ability to meet restricted release criteria.	0	160	120	$19,200	$0	$0	$0	$0
70.25(e)(1)(i)(C)	Requires DCE to include estimate of volume of onsite subsurface material containing residual radioactivity	4	16	120	$1,920	$7,680	$2,560	$30,561	$23,316
70.25(e)(1)(i)(D)	Requires DCE to include adequate contingency factor.	licensees already comply				No Cost	-	-	-
70.25(e)(1)(ii)	Requires DCE to explain and justify key assumptions	Previously covered				No Cost	-	-	-
70.25(e)(2)	Requires assessment of whether occurrence of specified events requires revision of DCE	4	16	120	$1,920	$7,680	$2,560	$30,561	$23,316
70.25(f)	Requires financial assurance mechanisms to include specified information; licensee cost to amend/review	40	2	120	$240	$9,600	one-time	-	-
70.25(f)(1)	Requires prepayment FA to be in form of trust with trust and trustee acceptable to Commission; cost to obtain trust fund	8	4	120	$1,520	$12,160	one-time	-	-
70.25(f)(2)	Eliminates line of credit	0				$0	one-time	-	-
70.25(g)(3)	Requires external sinking fund to be in form of trust, eliminates other options and restricts combinations of options	0				$0			
70.25(h)(1)&(2)	Requires licensees to monitor funds on quarterly basis and replenish funds.	5	4	120	$480	$2,400	$800	$9,550	$7,286
70.25(h)(3)	Requires licensees to notify NRC of shortfalls in funding and actions to replenish funding.	0	4			$0	-	-	-
70.36(a)(2)(i)	Requires application for transfer of license to include specified information	1	0.5	120	$60	$60	$60	$716	$546
70.36(a)(2)(ii)	Requires application for transfer of license to include FA for decommissioning	1	40	120	$4,800	$4,800	$4,800	$57,302	$43,718
							SUBTOTAL	$163,072	$124,414
							+ one-time costs	$21,760	$21,760
							TOTAL	$184,832	$146,174

Notes: 1. An estimated 4 licensees per year consider volume of contaminated soil in the DCE [70.25(e)(1)(i)(C)].

Table B-9: Alternative 2 Assumptions for 10 CFR Part 72

NRC Licensees

	Description	NRC Licensee	Hours	Wage Rate ($/hr)	Cost/Licensee (incl. clerical)	Total Cost	Annual Cost	Total 15 Yr 3% NPV	Total 15 Yr 7% NPV
Part 72									
72.30(b)(2)(i)	Requires DCE to cover cost of decommissioning by an independent third party contractor.	Licensees already comply				No Cost	-	-	-
72.30(b)(2)(ii)	Requires DCE to include adequate contingency factor.	Licensees already comply				No Cost	-	-	-
72.30(b)(2)(iii)	Requires DCE to cover cost of meeting criteria for unrestricted release unless demonstrate ability to meet restricted release criteria.	0				$0	-	-	-
72.30(b)(3)	Requires DCE to explain and justify key assumptions.	Covered previously				No Cost	-	-	-
72.30(b)(5)	Requires DCE to include estimate of volume of onsite subsurface material containing residual radioactivity that will require remediation.	0	40	120	$4,800	$0	$0	$0	$0
72.30(c)	Requires assessment of whether occurrence of four specified events requires revision	20	16	120	$1,920	$38,400	$12,800	$152,806	$116,581
72.30(d)	If residual radioactivity exceeds 10 CFR 20.1402 unrestricted use criteria, revise DFP within one year of surveys.	0	16	120	$1,920	$0	$0	$0	$0
72.30(e)	Requires financial assurance mechanisms to include specified information.	0	2	120	$240	$0	one-time	-	-
72.30(e)(1)	Requires prepayment FA to be in form of trust with trust and trustee acceptable to Commission.	0				$0	one-time	-	-
72.30(e)(2)	Eliminates line of credit	0				$0	one-time	-	-
72.30(g)	Requires licensees to monitor funds on quarterly basis, replenish funds and notify NRC of funding shortfalls.	15	4	120	$480	$7,200	$7,200	$85,953	$65,577
72.50(b)(3)	Requires application for transfer of license to include specified info	0				$0	-	-	-
72.80	Requires records to be forwarded to NRC and transferred to new licensee if licensed activities are transferred.	0				$0	-	-	-
							SUBTOTAL	$238,759	$182,158
							+ one-time costs	$0	$0
							TOTAL	$238,759	$182,158

Notes:
1. An estimated 15 site-specific ISFSI licensees per year monitor financial assurance funds on a quarterly basis [72.30(g)].
2. An estimated 20 ISFSI licensees per year comply with 72.30(c).

Appendix C: Input and Line Item Results for Alternative 3

Table C-1: Detailed Assumptions and Results for Collateral Requirement In Alternative 3

Input	Value
All Parts	
% Use Collateral	67%
% Use Alternative Mechanism	33%
Collateral Cost (average)	2.5%
One-Half of Collateral Users	0%
One-Half of Collateral Users	5%
Alternative Mechanism Cost	3.0%
FT Test Submission	$4,000
Years	15
Total One-Time Cost: Alternative Mechanism	$5,000
Total One-Time Cost: Collateral	$4,200
Part 30	
NRC Licensees	30
Agreement States	120
Financial Assurance (total)	$230,000,000
Amount of FA (Appendix A)	*$110,000,000*
Amount of FA (Appendix C)	*$90,000,000*
Amount of FA (Appendix E)	*$30,000,000*
Part 40	
NRC Licensees	6
Agreement States	24
Financial Assurance (total)	$310,000,000
Amount of FA (Appendix A)	*$180,000,000*
Amount of FA (Appendix C)	*$130,000,000*
Part 70	
NRC Licensees	6
Agreement States	0
Financial Assurance (total)	$200,010,000
Amount of FA (Appendix A)	*$150,000,000*
Amount of FA (Appendix C)	*$40,000,000*
Amount of FA (Appendix D)	*$10,000,000*
Amount of FA (Appendix E)	*$10,000*
Part 72	
NRC Licensees	1
Agreement States	0
Financial Assurance (total)	$40,000,000
Amount of FA (Appendix C)	*$40,000,000*

	Amount Per Licensee	Cost Per Licensee	Total Annual Cost for all NRC and AS licensees	Total 15 Year 3% NPV	Total 15 Year 7% NPV
Part 30					
Alternative Mechanism	$511,111	$15,333	$2,300,000	$27,457,251	$20,948,202
Collateral	$1,022,222	$29,556	$4,433,333	$52,924,846	$40,378,419
Part 40					
Alternative Mechanism	$3,444,444	$103,333	$3,100,000	$37,007,599	$28,234,533
Collateral	$6,888,889	$176,222	$5,286,667	$63,111,883	$48,150,505
Part 70					
Alternative Mechanism	$11,111,667	$333,350	$2,000,100	$23,877,064	$18,216,739
Collateral	$22,223,333	$559,583	$3,357,500	$40,081,617	$30,579,821
Part 72					
Alternative Mechanism	-	-	-	-	-
Collateral	$40,000,000	$1,004,000	$1,004,000	$11,985,687	$9,144,346
			SUBTOTAL: Alt. Mech.	$88,341,913	$67,399,474
			+ one-time costs	$311,667	$311,667
			SUBTOTAL: Collateral	$168,104,033	$128,253,091
			+ one-time costs	$523,600	$523,600
			TOTAL: Alt. Mech. and Collateral	$257,281,213	$196,487,832

Alternative 3 assumes all of the monitoring and changes to financial assurance considered in Alternative 2, and in addition Alternative 3 assumes a security interest in collateral to support the decommissioning assurance pledged in the parent guarantee and self guarantee.

This appendix describes the method and presents input and line item results to estimate total costs to NRC licensees if a collateral requirement was placed on the amount guaranteed using a parent guarantee or a self guarantee financial assurance mechanism for decommissioning. Estimates are provided of the number of licensees that would be affected and the costs that they or their parent companies would incur.

The analysis is based on contacts with financial administrators of companies and bankers, and assumes the following:

- Status of potential collateral. Under Alternative 3 of the rule, the NRC would require that the collateral offered by licensees be liquid and that it not be encumbered by more senior security interests (i.e., that it not already have been pledged as security to someone else).

However, it is likely that numerous firms will already have pledged as collateral the liquid assets that would be most desirable as collateral to the NRC, in particular, the accounts receivable of the companies. Accounts receivable are frequently pledged as collateral for short-term revolving lines of credit used by companies for their operating funds. Banks taking accounts receivable as collateral for revolving lines of credit generally take the full amount of accounts receivable, in part because they consider accounting and recordkeeping for only a portion of the receivables to be too difficult to administer and in part to avoid conflicts with other creditors. This analysis assumes that those licensees choosing to use collateral will be able to identify collateral that is acceptable to the NRC and that is not subject to a security interest that would be senior to the interest granted the NRC. The estimated annual cost of the collateral is estimated as 5% of the face value of the collateral supplied.

- Collateral requirements for alternative financial mechanisms. This analysis assumes that one-third of the licensees will be able to secure alternate mechanisms without being required to supply additional collateral, and therefore will choose not to continue to use a parent guarantee or self-guarantee. Instead, they will shift to an alternate financial mechanism.

- Cost of alternative mechanisms. Fees for a letter of credit issued to an existing customer of a financial institution can range from 2 to 5 percent of the face value, but are likely to be in the range of 2 to 3 percent. This analysis assumes that the annual fees for the alternative mechanisms will be 3% of their face value.

- Alternative uses of capital. A firm with free capital available for collateral would consider alternative uses for the capital, and would attempt to find alternative investments that would bring a return in the 10 to 15 percent range. At a minimum, funds invested in overnight or short-term accounts could bring a return of at least 5 percent. Thus, firms would be reluctant to commit capital for use as collateral unless no alternative opportunities for investment were available. However, the cost of an alternate financial mechanism if it must be supported by collateral (i.e., the cost of the fees plus the cost of the collateral) would be greater than the cost of collateral alone. This analysis therefore assumes that two-thirds of all licensees currently using a parent company guarantee or self-guarantee will continue to use those mechanisms and supply collateral. The analysis further assumes that half will have a competing alternative use for the collateral and therefore will allocate a cost to it, and the other half will have no alternative use that requires them to allocate a cost to the collateral.

Based on these factors, approximately two-thirds of the licensees now using guarantees are expected to continue using them and to supply collateral under the new requirement. The other firms (one-third) now using guarantees are expected to shift to another financial assurance mechanism. In both cases, substantial additional costs compared to the current rule will be incurred. Table C-1 provides estimates of the costs associated with these two alternative approaches by licensees to complying with proposed new requirements.

Appendix D: Input Assumptions for Power Reactor Pre-Rule Analysis

This appendix provides the input assumptions to estimate the costs of the voluntary GPI at a nuclear power plant. This is an estimate of the licensee costs associated with implementation of the rule requirements under 10 CFR 20.1406(c) and 20.1501, in the absence of any existing ground water monitoring, analysis, and reporting in place at the time the rule becomes effective. NRC staff is aware that power reactor licensees will not necessarily be required to drill more monitoring wells than were in place before the GPI, and that the monitoring and operating procedures used at each site will be highly site-specific. A cost estimate is required for this Regulatory Analysis. NRC staff has used its industry experience and engineering judgement in arriving at the input assumptions shown below.

As discussed in Section 6, each power reactor licensee has committed to put in place for the GPI a set of site specific actions with objectives and acceptance criteria to demonstrate that the objectives have been met. A conservative assumption is made in Table D-1 that 10 ground water monitoring wells are installed at each nuclear plant site. The costs shown in Table D-1 are not expected to be additional costs incurred by power reactor licensees, but rather are the estimated one-time and annual recurring expenditures to support the GPI.

Table D-1
Capital and Annual Recurring O&M Costs to Support the GPI at a Two-Unit Site

Capital (2007$)		
1. Define Objectives and Develop Conceptual Site Model		
a. Collect and evaluate site information		
b. Perform site-characterization studies		
	Subtotal	$150,000
2. Hydro-Geologic Site Characterization		
a. Conceptual subsurface investigation		
b. Detailed site characterization		
c. Define drilling method and well types		
d. Define monitoring zones		
e. Define well construction, locations and materials		
	Subtotal	$100,000
3. Install Ground Water Monitoring System		
a. Install sample wells (10, 150 ft deep, 2"-4" diameter)		
b. Field test and document well performance		
c. Analyze sample data to confirm/adjust site model		
d. Install additional wells (10, 150 ft deep, 2"-4" in diameter)		
	Subtotal	$600,000
4. Reporting		
a. Establish and implement new reporting requirements		
	Subtotal	$ 50,000
	Total Capital	$900,000
Recurring O&M (2007$)		
1. Annual O&M to support GPI		$ 60,000

Total capital (2007$) for 65 nuclear power plant sites is $58.5 million. The present value of 65 sites with annual O&M for GPI of $60,000 per site is $46 million and $35.5 million at 3 percent and 7 percent discount rates, respectively. The total GPI, over a 15 year period, is $105 million and $94 million at 3 percent and 7 percent discount rates, respectively.