Future Economic History of the U.S. Department of Energy's Major Nuclear Weapon Site Regions: National Government Policy Options for Contributing to Regional Economic Stability

by

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Abstract

This paper integrates observations and findings from our regional economic analyses of the DOE's major nuclear weapons sites. Two key questions addressed are:

1. *Would the areas surrounding the sites have been better off with the DOE sites or without them? In other words, what do theory, history and likely future tell us about the economic health of these DOE-site-centered regions?*

Four policy-relevant observations are made:

1.1 From an economic perspective, the DOE has two broad species of site-regions. One is rural and heavily dependent on DOE funding, and the second is metropolitan and is not dependent on the DOE.

1.2 The rural-dependent regions have experienced roller coaster fluctuations in jobs, income, and other economic measures in response to changes in DOE programs, but these fluctuations vary markedly in their impact on sub-areas within rural regions because of different physical and demographic attributes.

1.3 It costs more to support economic growth in rural and dependent regions than in metropolitan ones because the rural regions have "leaky" economies, that is, they lack forward and backward economic linkages that would keep money in their regions and multiply its impact, and with regard to sophisticated new technological applications, other major DOE sites can draw away resources from the host regions, especially during the design and pilot-testing stages.

1.4 Without any major changes in DOE spending patterns, the rural and dependent site-regions are expected to fall further behind their metropolitan counterparts in employment and income growth because of the continuing national trend toward the growth of major metropolitan areas.

2. *What can be done by the national government to help these site-regions establish more sustainable and less volatile economies?*

The following suggestions are offered:

2.1. Assistance should be based on regional economic need, not on regional capacity to multiply national investments in the region.

2.2. The most dependent regions have expressed strong feelings about the type of economic benefits they desire and their voices need to be heard. If the national government has a choice of how to invest funds, the highest benefits will come from education, recreation and other so-called "soft" investments rather than from high technology. Whatever the investment, the national government must recognize that regional economic benefit to cost ratios will be less in rural and dependent regions than in metropolitan ones.

2.3. Off-site programs for the regions should be administered by a group of national, state and local organizations. The DOE should be part of this consortium, but not the core of it.

Introduction

For more than half a century, the design, manufacture, and testing of nuclear weapons has been a major public policy issue for the United States. The strategic implications of nuclear weapons, the morality of targeting and using them, and the cost of maintaining nuclear weapons and cleaning up their legacy have been debated in innumerable forums (Anderson, Bischak, Oden 1991, Brice et al., 1994, Crump 1989, Gertcher, Weida 1990, Markusen et al., 1991, Melman 1974, Oden and Markusen 1995, Office of the Assistant Secretary of Defense 1991, Schwartz 1995). We will not add to the strategic and ethical arguments about nuclear weapons in this paper. Rather, we concentrate on the regional economic legacy of facilities where the U.S. Department of Energy (DOE) has left a major environmental legacy. The paper represents a synopsis of more than a half decade of research that has produced more than a dozen articles on this subject. The paper does not describe the details of the economic modeling, nor does it review all the interviews and surveys that were conducted. Instead, drawing from the above body of studies, it focuses on key policy-related issues and options that would help the most economically distressed regions to achieve smart decline with less pain and ultimately a more stable economy. We do this by answering two questions that have been at the heart of every conversation we have had with residents of these regions:

1. Would the areas surrounding the sites have been better off with the DOE sites or without them? In other words, what do theory, history and likely future tell us about the economic health of these DOE-site-centered regions?
2. What can be done by the national government to help these site-regions establish more sustainable and less volatile economies?

Better off or not : What can we learn from regional economic theory, history, and economic simulations?

Four policy-relevant observations are the focus of this section:

1.1 From an economic perspective, the DOE has two broad species of site-regions. One is rural and heavily dependent on DOE funding, and the second is metropolitan and is not dependent on the DOE.

1.2 The rural-dependent regions have experienced roller coaster fluctuations in jobs, income, and other economic measures in response to changes in DOE programs, but these fluctuations vary markedly in their impact on sub-areas within rural regions because of different physical and demographic attributes.

1.3 It costs more to support economic growth in rural and dependent regions than in metropolitan ones because the rural regions have "leaky" economies, that is, they lack forward and backward economic linkages that would keep money in their regions and multiply its impact, and with regard to sophisticated new technological applications, other major DOE sites can draw away resources from the host regions, especially during the design and pilot-testing stages.

1.4 Without any major changes in DOE spending patterns, the rural and dependent site-regions are expected to fall further behind their metropolitan counterparts in employment and income growth because of the continuing national trend toward the growth of major metropolitan areas.

What Theory Predicts

Regional economic and land use theories predict differences in the economic impacts of defense-related industries because of variations in urbanization, local market size, and socioeconomic status of surrounding areas, state and local government involvement, and site conditions. In rural areas new commercial and residential land uses tend to cluster on the most developable land adjacent to already developed areas (Bar-El 1987, Bergman, Maier, Todtling 1991, Miller, Cote 1987, Nourse 1968, Kaiser, Godschalk, Chapin 1995). This should especially be the case with DOE sites because the DOE has historically paid much higher salaries than normal regional wage scales (Suffolk County Planning Commission 1995, Bebbington 1990). The economic power of employees at large DOE sites draws water and sewer service, good schools, retailing, and other urban services toward the places where they reside.

Infrastructure, plant and equipment, degree of contamination, and other site attributes also influence the magnitude and direction of intra-regional impacts. If one direction has been stigmatized by contamination, either actual or perceived, whereas another direction has new highways or recreation facilities, secondary impacts will cluster around the more desirable location (Kaiser, Godschalk, Chapin 1995, Greenberg, Schneider 1996).

State and local government influences the initial propensity to cluster development. If a DOE facility located to take advantage of a natural feature, such as river water, the local and state governments containing that facility can help spread intra-regional benefits across the river by agreeing to build bridges, roads, and other infrastructure. They can also limit the spread of economic impacts by refusing to do so (Gittell 1992).

In some relatively poor rural regions, the presence of a new major federal facility, such

as a DOE weapons site, may draw local investment toward the site where workers live and away from the remainder of the region. For example, the big box chain store that wants to locate in a region with a large DOE site will be drawn toward the facility because of an increased density of highly paid workers. In turn, these new retail firms are likely to hurt smaller existing businesses elsewhere in the region by taking their customers, and steering investment funds toward the developing zone near the site. Their host communities suffer as existing businesses fail, and their tax revenues decrease.

All of this means that in rural areas some places within a few miles of a major DOE site may receive an enormous economic impact, while other areas may not be impacted at all or may lose investment. The disadvantage is that these dollars also create economic dependency. As illustrated below, this is what has happened near the SRS, INEEL, Hanford, Portsmouth, Paducah and other rural DOE sites.

In contrast to rural regions, services, product production, and labor are already prevalent in metropolitan areas. Relatively self-contained economically, much of the needed labor and product needs can be met from within the region's borders or can be attracted. Because the economic base of metropolitan regions is large and more diverse, the tax base is less impacted by national government facility contractions and expansions. Overall, major metropolitan areas are more able to convert DOE dollars to new local jobs than their rural counterparts. When they give birth to a new business, that business is likely to remain in the region. Rural areas, by comparison, have relatively "leaky" economies. They lack the economic linkages and new businesses that are incubated in these regions typically leave for a larger region (Lewis 2001). Indeed, the metropolitan-rural gap in ability to create local economic benefits should be much

bigger for high-technology projects, which require highly specialized workers and products that are much more likely to be available in metropolitan than in rural areas.

What History Shows

With over 100 installations and a budget of about $16 billion for much of the 1990s, the national impact of U.S. Department of Energy's (DOE) facilities is eclipsed by the DoD's $300+ billion budget and thousands of sites. But the local impacts of DOE sites are extremely important to the surrounding regions (Blush and Heitman 1995, Browning 1995, Gerber 1992, Lancaster 1984, Mavrides 1995, Schwartz 1995, Noah 1994). Some assert that DOE sites, like their DoD counterparts, have helped poor rural economies grow into urban centers with much better schools, transportation, health care and other services than otherwise would have been the case. Others counter that the defense industry, including the DOE, has diverted trillions of dollars away from health care, non-defense science, education, and other national priorities into technologies that create relatively few high paying and sustainable jobs, created economic dependency, and left an unparalleled economic stigma effect that has already cost tens of billions to address.

A deficit in both sides of the argument is case studies and economic analyses that look in detail at specific site regions and the set of DOE site-regions as a whole. Recognizing this limitation, we have conducted economic simulation studies and numerous interviews to determine the historical impact of DOE spending on places adjacent to DOE's major facilities (Table 1). For context, Table 1 shows the 13 major site-regions. Those in California, Illinois, and Washington, D.C. have gross regional products (GRP) exceeding $100 billion dollars. Their economies are more than ten times larger than the site regions surrounding Hanford, SRS, Oak

Ridge and Pantex. Table 1 also provides a crude measure of economic dependency in the form of the ratio of the DOE site budget and the regional GRP. Hanford, INEEL, and SRS are dependent on the EM budget and Oak Ridge and Los Alamos/Sandia on the DOE budget as a whole. The dependency suggested in this table is underestimated because the regions include not only the counties adjacent to the sites but other counties that are part of the larger economic region. In some local jurisdictions over half of the population works for DOE or provides services to people who do.

The studies found that the answer to the first question (are we better off) depends entirely on when the observation is being made and from what geographical vantage point. The best way of illustrating this is with examples. The first of these compared the impact of changes in DOE spending patterns on surrounding regions (Greenberg et al., 2002). Using an interregional economic simulation model, a comparative analysis was made of the economic impacts of shifting $4 billion from DOE's defense programs to EM, then visa versa, and transferring $4 billion to the science and energy research budget, half from the defense activities budget and half from the environmental management budge. A fourth simulation cut $4 billion in the DOE budget, with the money used for a reduction in taxes. These shifts and cuts only slightly exaggerate observed changes in DOE budget priorities in the previous decade. Depending upon the missions of the DOE sites, economic recessions or booms occurred in the small and dependent regions when funds equivalent of one-fourth of the DOE budget are shifted among the major programs and/or when the DOE program as a whole is substantially cut. As expected from the literature, the DOE-centered metropolitan regions in Colorado, Ohio, Nevada and Washington, D.C. are buffered by their economic size and large economic multiplier capacity.

Five site-regions were vulnerable to wide economic swings. The Hanford and Savannah River site-regions were the most impacted because of their relatively small market size, dependence on DOE environmental management funds, and a lesser ability to turn investments into new jobs. The INEEL region is small and dependent, but has a small subarea centered around Pocatello which has the potential for substantial expansion during the next decade. Oak Ridge has a demonstrated ability to obtain funding from all three DOE branches and create jobs and income with these investments. On the other hand, it is the site most vulnerable to a policy aimed at dramatically cutting the DOE. It will suffer if there is a major reduction of the DOE budget. Lastly, Los Alamos and Sandia are part of a rapidly growing region of the U.S. But, both are markedly dependent on the continuation of DOE's defense funding.

Table 1 about here

The difficulty that rural regions have in multiplying the dollars spent by the DOE is illustrated by estimations of the economic impacts of investing environmental management (EM) dollars. The region centered around the Oak Ridge site is more populated and urbanized than is the one surrounding Hanford. An investment in environmental management at Oak Ridge generated 40% more jobs than in more rural Washington. In turn, the multiplier at Brookhaven, Argonne, and other DOE sites located in major metropolitan regions is even larger than Oak Ridge (Frisch et al., 1998, Suffolk County Planning Commission 1995).

In the worst case, rural economies may be temporarily hurt by new on-site projects. For example, we simulated the economic impact of using technologies to manage the salt wastes in SRS's high level waste tanks (Greenberg, Lewis, Frisch 2001). These simulations showed that project expenditures did not proportionately convert into new jobs and income in the host

regions. The small tank technology was estimated to cost 16 percent more than the grout technology in design, start-up and building costs, but would produce 25 percent more jobs; small tank would cost 9 percent less than ion exchange, but produce almost as many jobs; and it was estimated to cost 26 percent less than caustic-based technologies, but would only produce 14 percent less jobs for the host region. The explanation is that the DOE sites tend to operate as an economic system, and in the case of the ion exchange and caustic technologies other DOE sites would likely do the design and pilot-testing. Looking at the project from a parochial SRS perspective, small tank technology would have been the best choice for the economy of the SRS region because a good deal of the up-front work had already been done in the host SRS region and so economic leakage of dollars would be reduced if that technology was chosen.

Also, for the smaller DOE regions, it is critical to know the source of the DOE funding. For example, in the above salt waste case, funds could come from the total EM national budget, but the dollars could be paid from the SRS EM budget, in other words, a zero-sum SRS budget. If the total cost of the ion exchange and caustic-based technologies were subtracted from a fixed SRS site EM budget, then the region would actually lose jobs, gross regional product and income during the years when a great deal of money was spend on out-of-region purchases. During those years, the site would be deferring other EM activities which rely more on local workers and products. Overall, at the regional scale, what appear to be intuitively obvious expectations about economic impacts of DOE projects must be questioned.

As predicted above, within the rural and dependent regions, the local impacts of the changes in DOE priorities can be markedly different. For example, we compared the change in employment, population and income in four counties surrounding the Savannah River (SRS)

nuclear weapons site: Aiken, Barnwell, Columbia, and Richmond (Greenberg et al., 1998, 1999).

We utilized a set of methods that first selects a group of counties (controls) that were similar to SRS counties (cases) before the facility was constructed, and then constructs a counterfactual history for the cases based on the performance of the controls. That is, the control counties, nearly all of which are from the same region, identify how the SRS region might have developed had it not been chosen as the site for the weapons facility. The difference between the actual growth of the region and the counterfactual growth, based on the controls, is considered the impact.

The Savannah River site was acquired in early 1951, and the federal government invested over a billion dollars during the first three years (Bebbington 1990). Tens of thousands of construction workers came to build the facilities. As expected from theory, the biggest impact was in Aiken and Barnwell (SC), the two counties hosting the site. The method suggests an effect of over 29,000 people. Since the population of the two counties only grew 27,000 people during 1950-1959, the two counties would have lost population without SRS, according to the simulation.

The importance of SRS during the 1950s and 1960s was further underscored by the total manufacturing earnings data. In 1959, in the four-county region, the impact proportion for manufacturing earnings was +36.3 percent. These results were consistent with numerous reports that DuPont's workers were paid much higher wages than the regional norm, particularly for manufacturing or construction (Bebbington 1990). In other words, the DOE sites brought not only jobs and people, but also higher incomes to these regions.

Thereafter, history shows a strong association between DOE expenditures in these

regions and the economic health of the region as a whole. The 1970s were a period when the region's employment, population, and income suffered a relative decline compared to the counterfactual set of 80 counties. By the late 1980s and into the 1990s, the indicators became positive when the DOE began to spend a great deal on national security and then began to engage in large EM projects.

However, combining the four counties into a single region obscured important differences. For example, Aiken and Richmond (GA) begin the 1970s with employment growth rates less than almost all of their controls. But by 1980, they were heading in opposite directions. Aiken changed from a 3 percent negative employment impact in 1970 to a positive effect of over 30 percent by 1990, a faster growth rate than any of its controls. The construction industry clearly led the trend, which is a direct parallel of construction projects at the SRS. Impacts of over 20 percent were observed for wholesaling, retailing, FIRE (finance, real estate, insurance), and other services by 1985. Aiken's population effect also jumped after 1980 and by 1990 exceeded 10 percent, a trend also followed by its personal income data. In short, the job, income, and population growth impacts in Aiken during the Cold War were pronounced.

Richmond, in strong contrast, began the early 1970s with a negative employment effect of -15 percent and gradually slipped to almost -30 percent by 1993. Local data show that Augusta, the central city of Richmond County, experienced declines in population and employment similar to many American central cities during the 1980s and 1990s. Throughout the study period, Richmond County also lagged behind most of its counterfactual counties in population, employment, and income growth.

Columbia (GA) was a third type of county. By 1979, Columbia County was experiencing

more rapid increases than nearly all of its counterfactual counties in employment, population, and income. Local sources suggest that Columbia benefitted from suburbanization from Richmond County and by the disproportionate choice of Columbia County as the place to live by SRS upper management (Lowrie and Greenberg 1997). Aiken, Richmond, and Columbia, in short, are markedly different places, which influences how changes in DOE budgets impacts their economy.

The up and down cycles can severely strain the more dependent sub-areas of these regions. Lowrie et al [1999a] interviewed 26 local treasurers, comptrollers, and chief financial officers in towns and counties near seven major facilities (Oak Ridge, Savannah River, Hanford, Sandia, Los Alamos, Idaho National Engineering and Environmental Laboratory (INEEL), Rocky Flats). Fluctuating site budgets caused serious fiscal strains on local governments. Many had invested money into public schools, water and sewer lines and systems, and other infrastructure during the period of growth only later struggle to pay them off as the DOE sites downsized. Most noted that they were not sure they had sufficient economic capacity to deal with their stranded capital investments, declining property values, and unsold properties. Further, they questioned their attractiveness to new businesses that might help to diversify their economies.

So have the regions surrounding the major DOE sites been better off with the sites than without it? In the case of the major metropolitan regions, the impact of the AEC and DOE facilities has been negligible from the regional perspective, although some areas within each region would feel the impact. The answer to the question for SRS, Hanford, Paducah, INEEL and other more rural and dependent areas is that it depends upon the time and place: during

some periods and in some sub-areas of these region the answer is yes, the region was better off; and in others the answer is no.

Overall, from the perspective of the rural and dependent regions, it is plausible that the same energy, labor, abundant water, and other location factors that brought the AEC and DOE Atomic Energy Commission to the banks of the Savannah and Columbia Rivers and to other sites during the Cold War could have brought another industry that would have jump-started these regions, without leaving a legacy of contamination. But our analyses suggest that the alternative history for the area surrounding nearly all of these rural sites was fewer jobs and people, and lower incomes. Particularly during the 1980s, when American corporations began the merging and downsizing that eliminated hundreds of thousands of jobs, the Cold War economy of the most economically dependent counties that were receiving EM funds experienced a bonanza of stable jobs and an increase in wages.

What Do Likely Near Term Trends Tell Us?

Our simulation models include estimates of the future economies of DOE-centered regions. The results are not subtle. Beginning with the present, among the 13 DOE-site regions that receive about 90 percent of the EM budget, Savannah River, Hanford, and INEEL, the three most dependent regions ranked last in per capita income. Even allowing for differences in cost-of- living does not eliminate the gap (Table 1).

Assuming no major boom and bust cycles, the gap between these three and the regions hosting Argonne (Chicago), Rocky Flats (Denver), Nevada Test Site (Las Vegas), and others will increase. Hanford, for example, is forecasted to have annual employment and gross regional

product growth rates of 0.60 and 1.83 percent through the year 2025. The numbers for the SRS region are 0.53 and 2.29 percent. In comparison, the annual comparative employment growth rates for the Rocky Flats (Denver), Lawrence Livermore (San Francisco, San Jose, Oakland), and Argonne (Chicago) ranged from 0.84 to 0.89, and for GRP they ranged from 2.35 to 2.87. For context, the estimates for the nation as a whole were 0.80 for employment and 2.47 for gross regional product.

Of course, no one can comfortably predict economic health of a region more than two decades into the future. But, in fact, these estimates are a product of econometric simulations of the past, in essence, demonstrating that these rural dependent regions have not been able to compete with most larger metropolitan regions and are unlikely to do so in the near future if the past 30 years is a prognosticator of the next 20+. In short, the rural and dependent regions as a whole are likely to fall further behind their metropolitan counterparts.

What Can the National Government Do?

This section offers three suggestions that would guide any investments:

2.1. Assistance should be based on regional economic need, not on regional capacity to multiply national investments in the region.

2.2. The most dependent regions have expressed strong feelings about the type of economic benefits they desire and their voices need to be heard. If the national government has a choice of how to invest funds, the highest benefits will come from education, recreation and other so-called "soft" investments rather than from high technology. Whatever the investment, the national government must recognize that regional economic benefit to

cost ratios will be less in rural and dependent regions than in metropolitan ones.

2.3. Off-site programs for the regions should be administered by a group of national, state and local organizations. The DOE should be part of this consortium, but not the core of it.

Who Needs Aid the Most

Every region can point to lost jobs, reduced incomes, environmental stigma of some kind, and other social and economic problems as a result of DOE facilities and cyclical funding patterns. Yet, Hanford, INEEL, and Hanford stand out as site-regions that have the biggest economic obstacles to overcome. Some of the areas around Oak Ridge, Pantex, Paducah and Portsmouth, to a lesser extent, deserve serious consideration for aid based on need.

Yet DOE's off-site aid policy has been based on economic utilitarianism, that is, the merits of individual proposals rather than on need (GAO 1999). GAO noted that the Rocky Flats site region received one-third more aid than the Hanford region despite the fact that the Hanford-centered region has about twice the unemployment rate and nearly twice the job loss of the Rocky Flats site. GAO added that Rocky Flats would not have been eligible for any aid if the DOE had applied the criteria used by the Department of Commerce's Economic Development Administration (EDA). Our research suggests a reconsideration of the DOE aid policy is in order.

Aid can make a major difference for these regions. We conducted an economic simulation of the different worker separation policies. We named the three different policies as follows: the "painful response" (no severance packages), the "current response" (the current average of DOE separation packages), and the "supportive response" (more lucrative severance

and continued medical coverage). Congress, at the urging of the Clinton Administration, the DOE, and the DOE communities passed the Nuclear Workers Compensation legislation (part of the Defense Authorization Act FY 2001), enhancing the capacity of the DOE to give more lucrative worker separation packages. This bill would substantially raise the worker separation packages and increase the continued medical coverage for affected workers. Based on this new policy, we increased the current average DOE severance package by 4 times ($62,112), the continued medical coverage by 8 times ($6440), and the retraining money by 10 times ($15,180). The time distribution of spending for worker retraining funds was designed to stimulate investment in college or technical school (2-4 years), and thus was spread out over three years.

The analysis is split on two regional axes, 1) rural DOE regions such as that which surrounds the Savannah River Site (SRS), which is a relatively poor region measured by income and job growth versus 2) more metropolitan locations such as Rocky Flats which is in the Denver MSA. The results are striking. In the simulations, using DOE data, the rural regions were estimated to lose 12,100 DOE jobs and the metropolitan regions 11,100 DOE jobs. A no aid policy is estimated to lead to 25,000 lost jobs in the rural regions. Current severance practices reduces the job loss in the rural regions from 25,000 to 20,000, and the enhanced package reduces it to only 3,100 jobs. A more fine-grained analysis of the data suggests that the stabilization of consumer spending power—in part as a result of the increased severance payments and the retraining money—is one of the most significant causal factors explaining the positive benefits. In brief, the results of our research indicate that the recent legislation that enhances the worker separation packages for nuclear defense workers will indeed help the workers and their DOE rural dependent communities cope with the negative impacts of DOE

restructuring. From the national perspective, the "supportive response" provides the least disruption from the baseline, indicating that national government action can smooth out the transition in the rural dependent regions.

The impact on the metropolitan regions of the job cuts and severance packages is negligible from the regional perspective. Hence, the evidence for a similar level of support to the metropolitan regions is less compelling, although the workers themselves would need assistance. But the metropolitan regions as a whole are more able to cope with downsizing.

Form of Aid and Impact of the Investments

Using interviews with key stakeholders, reviews of newspaper coverage, and surveys, it is clear that the three most distressed regions care as much about the DOE's economic impact in their regions as they do about health and environmental impacts, and they have strong opinions about the form any assistance should take. The Savannah site-region appears to be the most eager to host defense initiatives as well as continue a major EM program (U.S. DOE-SR 2000, Mayer and Greenberg 2000, Lowrie and Greenberg 1997, Lowrie et al. 2000, Williams et al. 1999). Hanford has pressed for rapid cleanup of the site but no new defense missions (U.S. DOE-RL 1999, Mayer and Greenberg 2000, Lowrie et al., 1999b, 2000). INEEL's stakeholders appear to want a prominent role in DOE technology development and continuing site remediation (Mayer and Greenberg 2000, U.S. DOE-ID 1995). In essence, the region perceives the site as a place where high technology research is done, not as a place where nuclear weapons and cleanup are the center of activity.

The national government may not be able to respond to all regional preferences because

of national security and cost. Off-site economic assistance packages may be deemed inappropriate for the DOE and, in fact, confusing the primary EM mission at some sites (Russell 1997). Whatever the final policy decision, it is imperative that the national government realize that it will cost more to accomplish the same regional economic benefit in the rural dependent regions than in the metropolitan ones, and the leakage from high technology projects is more than for soft economic investments. To reiterate this point, we point to two studies. In one, we examined the potential economic impacts of off-site investments. Providing money to local school systems is a good way of creating jobs and local income because a great deal of the money is spent on teachers, paper, pads, and other products that can be purchased locally. The regional economic impact of spending a million dollars on the educational system of the SRS-centered region in South Carolina was 42.5 jobs and $1.4 million in personal income (Frisch et al., 2000). Yet the same million dollars is estimated to produce 50 jobs and $2.2 million in personal income in the Atlanta metropolitan region, the nearest large metropolitan region. For almost every investment the regional economic benefit to cost ratio will be less in a rural dependent region than in a metropolitan region.

The difference is even greater for soft versus high technology investments than it is among regions, in most instances. For example, we estimated the job impacts of investing in the educational systems, recreation, environmental management, and a proposed tritium particle accelerator. In the SRS South Carolina site-region, jobs created per million invested for these four activities were 45.4, 44, 17, and 14.4, respectively. Investing in high technology has a huge initial impact, but as these numbers show, there are more economically effective ways of stimulating local economies. Furthermore, as noted previously, our work shows that the rural

DOE regions are less likely to capture the benefits of spin-off firms from technology investments because they leave the region (Lewis 2001). This, we feel, will also be the case for efforts to develop environmentally-based industries at DOE sites. An investigation of DOE economic incubator sites shows that the incubators often do produce innovations, but the technology is then lured to a major metropolitan region for final development, marketing, and production. In other words, the economic leakage from major DOE site-regions will continue to be a problem.

Administering Smart Decline and Building Regional Economic Stability

The DOE as a whole and the EM program, more specifically, are not focused on economic redevelopment, although they implicitly have taken on that function because of the huge increment of federal dollars they have poured into the sites. Added to the long history of secrecy, the surrounding regions often view the DOE as Goliath and themselves as David without a slingshot (Lowrie and Greenberg 2001). HUD, EDA, with participation from EPA, DOT, and their state and local progeny are the appropriate organizations to lead an effort to lead regional strategic planning efforts for the rural and dependent regions that will focus on rebuilding and diversifying these economies. The metropolitan regions will not need this level of assistance.

The DOE should participate in the regional strategic planning efforts in two important ways. First, the Department and its contractors must try to more effectively communicate and better still to integrate their on-site activities with the local governments' off-site plans and activities. Will the DOE permit more recreation and other activities? Will it attempt to preserve as much of the Hanford, SRS, INEEL and other sites for a new twenty-first century nuclear or

other security missions? If it chooses a continued nuclear as well as cleanup mission, the DOE will doubtless want to restrict some on-site non-nuclear options and maintain more site workers. The DOE may not have final answers to these and other questions. Yet it can be more open about on-site activities so that local governments will be informed and can react in constructive ways rather than feeling blind-sided and reacting with cynicism and anger.

There remains the reality that the regions face some difficult choices. A current set of articles from the Tri-City Herald (Hanford site) capture the beauty and the beast of being near a DOE site (Isaacs 2002a,b,c,d, Staff 2002, Trumbo 2002). The region is primed for a huge economic impact resulting from the construction of a vitrification facility. But some sources quoted in the local news stories are not fooled by the upswing. Today's new investment will become a stranded investment unless there is a plan for smart decline. Our interviews with key stakeholders in the economic development process suggest that concern that these investments will seduce the regions into inaction, believing that as in the past, the DOE will continue to provide investment even if they are cyclical in nature.

The magnitude of the economic vulnerability of the three most rural and dependent sites is hard to ignore. Former Secretary O'Leary and successors have acknowledged the moral imperative to clean up these sites (Office of Environmental Management, 1995a,b). While it may not have an equally strong ethical imperative to support these economies, we question why the federal government should be less supportive of these regions than it has been of closed military sites and other contaminated sites across the U.S. The DOE's worker and transition programs have provided much less support than given to Department of Defense (DOD) facilities that have been closed.

We would also suggest that the DOE program is not even equivalent to what has been devised for brownfield sites, which are contaminated former factories and commercial facilities in cities and industrial suburbs. For example, EPA has selected brownfield showcase communities which receive coordinated assistance from more than 15 federal agencies. In collaboration with local and state officials, these agencies seek to promote economic redevelopment, community revitalization, and environmental protection. The EPA-led brownfields initiatives have generated investments of several hundreds of millions of dollars in grants and loans for economic redevelopment. If the federal government is going to continue to substantially downsize these DOE facilities, equity suggests that these regions should at least receive similar treatment. We suggest a more reasonable policy for the U.S. Congress toward DOE site-regions would be similar to the approach followed for closing DOD sites, and for the brownfield showcase communities. It would provide funding for planning, organize federal assistance in a way that facilitates action, and provide access to federal funding perhaps assigning the responsibility for economic development to the Department of Housing and Urban Development or EDA.

It would be prudent for the national government to consider a strategic planning program for economic and land use planning and direct aid for economic redevelopment for places that contain heavily contaminated sites, located in relatively poor and rural regions without a history of strong state and local government economic and land use planning. Even as some of them grow as a result of DOE EM programs, these regions need to be preparing themselves for the time when the program has been reduced in scope and the region begins to suffer from a slowdown of real estate transactions, reduced real estate prices, closed restaurants and other

retail establishments. The key is to build cooperative planning that will lead to the most effective use of resources that may be plentiful during the boom so that the region is able to downsize with as little pain as possible later. In other words, the national government can help lead the way toward smart decline and toward economic stability in these regions.

Interface with Current DOE Economic Cost Issues

The body of research we have summarized connects with a key DOE economic policy and planning issue. Beginning with former Assistant Secretary Al Alm's "accelerated cleanup" concept, upper level DOE administration increasingly feels the growing pressure of spending over $6 billion a year and not showing much risk reduction despite these expenditures (Top-to-Bottom 2002). The DOE has begun a major effort to estimate the life cycle costs of its remediation, management, and long-term stewardship programs. Our economic simulation tools can take estimates that are forthcoming from those efforts and use them to estimate the regional economic impacts over at least the next three decades for 26 regions, including each of the 13 where the DOE spends 90 percent of its EM funds.

However, estimating the life cycle costs of DOE's EM programs is a daunting challenge because there are so many uncertainties, including the choice of technologies; performance of technologies; value and source of funds to pay for DOE programs over a period of century or more; occupational, off-site and ecological risks; on-site management of missions; and off-site developments that influence on-site activities. We plan to work with the DOE to develop a probabilistic model for estimating the life cycle costs of plausible options from among the myriad of possible options. Outcomes of those estimates can be used in our regional economic

simulation models.

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Table 1. Site Regions and Basic Information

Name of region	States (number of counties)	Metropolitan statistical areas	Per capita income, $ (1000's) 2001	Gross regional product, 2000 billions of $1992	Six year average, 1996-2001, billions$ Total	EM	2000 DOE site budget/ regional GRP from DOE EM, x 100
Savannah River	Georgia, South Carolina (11)	Augusta-Aiken MSA	17.9	16.34	1.29	1.10	6.5
Hanford	Washington (7)	Richland-Yakima-Kennewick-Pasco MSA	17.3	15.34	1.35	1.12	6.8
Oak Ridge	Tennessee (10)	Knoxville MSA	19.8	20.73	1.34	0.38	1.4
INEEL	Idaho (7)	Pocatello MSA	17.0	5.55	0. 69	0.51	9.4
Rocky Flats	Colorado (9)	Denver CMSA	22.8	81.33	0.78	0.56	0.73
Los Alamos & Sandia	New Mexico (7)	Santa Fe MSA Albuquerque MSA	20.0	27.08	2.44	0.37	1.2
Nevada Test Site	Nevada, Arizona (4)	Las Vegas MSA	18.7	35.96	0.55	0.31	0.86
Fernald, Mound, Portsmouth	Kentucky, Indiana, Ohio (23)	Cincinnati, Hamilton CMSA Dayton MSA	20.9	95.25	0.45	0.35	0.36
Pantex	Texas (5)	Amarillo MSA	20.4	7.19	0.25	0.02	0.17
DOE Headquarters	D.C., Maryland, Virginia, West Virginia (26, including cities)	Washington, D.C PMSA	24.1	168.25	1.63	0.41	0.31
Lawrence Livermore & Sandia (CA)	California (11)	San Francisco-San Jose-Oakland CMSA	23.7	275.24	1.51	0.10	0.03

Argonne	Illinois, Indiana, Wisconsin (13)	Chicago-Gary-Kenosha CMSA	22.4	290.97	0.96	0.03	0.01
Pittsburgh & Morgantown	Pennsylvania, West Virginia (9)	Pittsburgh MSA	22.2	71.69	0.60	0.07	0.06
Total U.S.	-------	----------	20.5		15614	5811	—