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A Strategic analysis of the Rocky Flats cleanup

Patrick McCann

University of Nevada Las Vegas

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A STRATEGIC ANALYSIS OF THE ROCKY FLATS CLEANUP

A Thesis submitted in partial satisfaction
of the requirement for the degree of
Bachelor of Arts
in

Environmental Studies
UNIVERSITY OF NEVADA
Las Vegas

by
Patrick McCann

Fall 1998

Thesis Advisor: Dr. Delbert Barth
Professor Emeritus
Department of Environmental Studies
Greenspun College of Urban Affairs

ABSTRACT

A Strategic Analysis of the Rocky Flats Cleanup

by
Patrick D. McCann

The Rocky Flats Environmental Technology Site is located in Golden, Colorado. It is situated on 384 acres in a 6,550-acre natural preserve. Rocky Flats ended its original mission in 1989, after raids on the site by both the FBI and the EPA for illegal dumping and other environmental violations. Since then the site has been scheduled for cleanup. This thesis will provide background information on the site and on the company hired to perform the cleanup. It also provides an evaluation of some key policies regarding the cleanup procedures. Since the end of the cold war, the production of nuclear weapons has ceased. The proposed cost of cleaning up such sites is dramatically higher than for similar sites not involved in the nuclear industry. This cost differential leads us to the inevitable conclusion that since such sites already exist, we must maintain efficient means of cleanup. Because a major factor in the cost is the speed or amount of time it takes to cleanup a site. So there is a need for streamlining the proposed cleanup of this site and others like it. To keep cost as low as possible.

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INTRODUCTION

The possible need for nuclear waste cleanup can be traced back to the 1940's with the first use of the atomic bomb. One can trace the regulation of nuclear material all the way back to 1942 with the establishment of the Manhattan Engineer District (MED). "The MED spearheaded the development and manufacture of the first atomic weapons during World War II" (DOE, 1998 c). Soon after this happened, Congress passed the Atomic Energy Act, which changed the MED into the Atomic Energy Commission (AEC). The AEC had cognizance over all atomic and nuclear policies, developments, and future developments. It was in 1977 that the Department of Energy (DOE) was created. "The DOE is responsible for developing and administering national energy programs and policies" (DOE, 1998 c). The Department of Energy took over all operations of the former MED and AEC. This meant that the DOE also took responsibility for all the nuclear weapons plants and their potential for cleanup.

Located in Golden, Colorado, the Rocky Flats Environmental Technology Site is situated on 384 acres amid a 6,550-acre natural preserve (buffer zone). The AEC chose the site because Rocky Flats possesses a dry, moderate climate and is isolated enough not to require the displacement of many people although the site, did have a supporting population in the vicinity. The site also had "attractive environs" that would compensate skilled personnel conducting hazardous work at the plant (DOE, 1998 d).

The plant was opened in 1952. Its first mission was to produce plutonium and other metal components for nuclear weapons. The components that the plant was going to produce were plutonium triggers, which contain fissile plutonium fuel for nuclear weapons; it was also going to fabricate plutonium pits (DOE, 1998 d). It is these main

two production items that have caused the pollution problems that we see and must face today.

Rocky Flats did the foundry and machine shop work needed to manufacture and assemble the pits into finished products and then shipped them to the DOE Pantex Facility near Amarillo, Texas, for final assembly. In addition, Rocky Flats performed plutonium recovery and waste management activities (DOE, 1998 d).

Rocky Flats performed these operations from 1952 until 1989.

The Rocky Flats Plant was organized according to a pattern established by the MED and inherited by the AEC. The operations of Rocky Flats changed hands a few times during the life of the Plant. When Rocky Flats first opened, it was the AEC that decided who was to run the plant. Even though this was one of the first plants of its kind, there was some precedent the AEC decided to follow. “The first commissioners, reluctant to significantly alter existing administrative structures and viewing 'decentralization and contractor operation as good practices in public administration,' decided to retain the government-owned, contractor-operated policy for new and operating facilities” (DOE, 1998 a). So the AEC selected Dow Chemical Company to be the prime contractor for Rocky Flats. The Dow Chemical Company stayed in control for the first twenty-three years. Due to the political atmosphere of the time, there was not a large need for increased numbers of nuclear weapons during those years. The Dow Chemical Company assigned a general manager, who had responsibility for the overall operations of the facility (DOE, 1998 a).

In 1951 construction of four buildings for the Rocky Flats site was underway. The main building of concern was building 771 (see map). All plutonium manufacturing and recovery operations were housed in the C Plant (Building 771) after it became

operational in 1953 (DOE, 1998 b). Other buildings were built for operations, but 771 was the principal building for plutonium manufacture. The administration knew that waste management would be crucial to the success of Rocky Flats. “The goal of waste operations at Rocky Flats historically has been to reduce the volume of waste material as much as possible and then convert it into a form acceptable for transfer to offsite burial grounds (DOE, 1998 b). From the opening of Rocky Flats until the late 1960s, production was at a reasonably constant rate. Because of political changes and a change in military spending, in the early 1970s the production of Rocky Flats increased. This led to more buildings and more pollution. The plant was unable to permanently dispose of the new wastes and started storing toxic wastes on the site.

In 1975 the political atmosphere changed in the United States. The threat of the Cold War had taken over, and more money was being spent for military operations. At this time the administration changed from Dow Chemical Company to Rockwell International Corporation. This took place in 1975. “ In response to Cold War policies, facility and work force expansion reached record levels in the 1980s. Under the company’s management, the work force grew to almost 6,000 in an effort to meet the demands of the Reagan Administration’s defense policies (DOE, 1998 a). It was this expansion, together with a lack of attention to safety, that lead to the eventual raid by the FBI and the closing of the Plant in November of 1989.

Rocky Flats ended its original mission in 1989. There were several factors that lead to the shutting down of the plant. Two historic fires at the plant had significant impact on the site and its production. A fire occurred in Building 771 on September 11,

1957 and another, more serious fire occurred in 1969. This second fire was a plutonium fire that occurred in a glovebox line in building 776, spreading to building 777. Buildings 776 and 777 had gone into service in 1958, following the first fire, to handle the increased need for plutonium machining and handling resulting from weapon design changes (DOE, 1998 b). It was these two fires that lead to the allegations of contamination having reached the drinking water supply and of possible safety violations of air emissions.

On June 6, 1989, the Federal Bureau of Investigation raided the Rocky Flats Plant as part of its investigation of allegations of mismanagement, negligence, and criminal practices. Rockwell International, the plant operator at the time, eventually pled guilty to ten counts, including violations of the Clean Water Act, and agreed to pay a fine of 18.5 million dollars (DOE, 1998 d). This act shut down production at the Rocky Flats Plant. The name of the plant was then changed from the Rocky Flats Plant to the Rocky Flats Environmental Technology Site. “In September 1989, the Rocky Flats Plant was placed on the national priorities list of the Environmental Protection Agency's Superfund hazardous waste sites. The plant ceased operations in November 1989 and began its transformation to a cleanup site in February 1992” (DOE, 1998 d). Thus the mission of the plant was changed. It is no longer used for production of nuclear weapons.

Currently the plant’s mission has expanded to include plutonium reclamation, environmental remediation, and waste management. As part of an aggressive environmental restoration program, 178 sites at RFP are being investigated and characterized. The effort involves installation of around 750 wells to monitor ground water quality (Wesphal, 1998). Currently Rocky Flats stores the largest quantity of

radioactive and hazardous wastes in Colorado. According to DOE figures, Rocky Flats is the repository of about 14 tons of plutonium. Rocky Flats contains the second largest stockpile of plutonium in the country (CDPHE, 1998).

By inheriting the Rocky Flats Plant in 1977, the Department of Energy is now responsible for its cleanup. From 1992 until 1995 the DOE put the cleanup of the site up for bid by private contractors. Over these three years there were various companies that were evaluated to see if they could perform the cleanup in the time frame that the Department required. Kaiser-Hill, L.L.C. of Golden, Co was awarded the integrating management contract for the Rocky Flats Environmental Technology Site in April 1995 and assumed operations of the 6,500 acre site July 1, 1995 (Kaiser-Hill, 1996 a). Kaiser-Hill Company, L.L.C., is performing the job of preparing a Site Treatment Plan. In carrying out this plan, they are required to submit progress reports to both the DOE and a citizens action committee.

SUPERFUND SITE

Once Rocky Flats Plant was closed down, the EPA focused on putting it on the Superfund list. In 1989, EPA, Department of Energy (DOE), the FBI, and the DOE Inspector General investigated Rocky Flats for violations of environmental statutes. All plutonium operations were suspended at that time. There was not to be any new production of any kind coming out of the plant. In 1992, the plant's mission changed from defense production to environmental restoration, waste management and economic conversion. This action reduced the staff as well as the potential earnings of the area.

Starting in February 1993, USDOE received approval to restart building 707 for stabilization of plutonium residues. Site contaminants have spilled onto the ground and into water drainages. The USDOE identified over 2,000 waste streams that the production processes generated at the site. Other major environmental concerns at the site encompass 178 identified disposal areas resulting from past waste management practices, including a series of irrigation fields, two on-site landfills, leaking drum storage areas, and several disposal trenches. USDOE has recently identified another 79 areas of concern that will be incorporated into investigations administered through the clean up agreement. (EPA, 1996).

The potential for possible harm to people is also great at this site. Currently over 2 million people live within 50 miles of Rocky Flats, and over 300,000 live within 10 miles (EPA, 1996). Rocky Flats Environmental Technology site was placed on the National Priorities List (NPL) on October 4th, 1989. In placing this site on the NPL the DOE has made a list as to what needs to be cleaned up at Rocky Flats to get it off the NPL. That is why the DOE has contracted with Kaiser-Hill to do what needs to be done so the site can be remediated.

In the Record of Decision prepared by the EPA on the Rocky Flats site, they list the current threats and contaminants, starting with the groundwater contaminants. Groundwater contains various volatile organic compounds (VOCs), radionuclides and heavy metals. Shallow groundwater in the southern section of the site (Hillside area) and the eastern section of the site (903 Pad, East Trenches and Mound areas) are contaminated with high levels of VOCs. These then go into the soil and surface water. Soil and surface water are also contaminated with plutonium, uranium, and americium.

Air is a potential pollution pathway for migration of radioactive plutonium, uranium and americium. Finally, people could be exposed to chemicals on site by touching, inhaling or ingesting contaminants in soil, air, groundwater and surface water (EPA, 1996). Next the EPA gives a site by site specific breakdown of the problems in the Record of Decision.

The site is beginning to address the total problem in multiple stages: several long-term remedial phases are focusing on addressing contamination, including the hillside 881 STET area; the 903 pads, east trenches, and mound areas; off-site releases; solar ponds; Woman Creek, and Walnut Creek; present landfill; original process waste lines; 700 Area; other outside closures; and the west spray field (EPA, 1996). Next, in the Record of Decision there is a list of what the DOE has accomplished at each site, before they contracted it out to Kaiser-Hill. It then becomes Kaiser-Hill's responsibility to finish the rest of the cleanup. The following information was taken from the Superfund site on the EPA home page. The information was last updated October 1996. All of the actions started or completed by 1992 have been done by the DOE, and after 1992 by the Kaiser-Hill team. On the Hillside 881 area, as an interim remedy, the USDOE constructed and began operating a French drain system to collect contaminated groundwater in this area in 1992. A final remedy will be needed for complete cleanup of the area. In the 903 pad, trenches, and mound area, in the fall of 1995, USDOE excavated soils from Ryan's Pit and thermally treated them to decontaminate the VOC contamination. USDOE prepared a modified plan that addresses the plutonium issue and put it out for public comment. From the resulting information, Kaiser-Hill must formulate a cleanup plan. The off-site releases have affected areas immediately east of the plant boundary. These areas contain two reservoirs used as drinking water supplies for approximately 250,000 people, and a third

reservoir used for irrigation of recreational lands as well as for agricultural. The investigation for the off-site areas is expected to be completed in late 1996. The EPA expects the investigation to indicate that no action will be necessary to protect human health and the environment in the off-site areas. In 1987, the USDOE removed 20,000 cubic yards of sludge from the solar ponds; however, they still act as a source of groundwater contamination. An interim cleanup action was selected in 1992, which includes the construction of storage tanks and a water distillation unit to de-water/de-sludge the pond. These actions were completed in 1993. The final decision on how to cleanup the ponds will fall on Kaiser-Hill, so for now the USDOE will continue to operate a collection system to gather and treat the groundwater from the ponds. The Woman Creek area encompasses the stream, two ponds on the stream, and a number of disposal sites within the basin, including an abandoned landfill, disposal trenches, and former waste storage areas. The drainage basin receives surface water flows and groundwater seepage from contaminated and active industrial areas of the site, which potentially could affect downstream surface water supplies. An investigation work plan has been developed and approved. Fieldwork began in late 1992, and the first phase of the investigation has been completed. The Walnut Creek area encompasses the stream; numerous ponds; disposal areas, including an active landfill, disposal trenches, and surface impoundment's; and former waste storage areas. The drainage basin also receives surface water and some groundwater seepage from contaminated and active industrial areas of the site. Also a work plan for an investigation was submitted and approved. Finally, the area consists of an underground network of old process waste lines that were used to pipe wastes to the surface impoundment's or discharge points. A preliminary

work plan for an investigation of these poorly mapped lines was submitted and has been approved.

KAISER-HILL, L.L.C.

Kaiser-Hill has taken over the project, and taken over the responsibility for cleaning up the area and getting Rocky Flats off the National Priority List. They have come out with a preliminary project description of what they are going to do. Let's look first at a brief overview of what will be presented and then at their detailed report. Kaiser-Hill believes that the project should be executed in three phases.

Phase I is the key closure and reduction phase and could be accomplished by 2005 for less than \$7 billion. Phase II is a shipment and further closure phase where all mixed transuranic (MTRU) waste including plutonium would be shipped off-site and the two interim storage facilities demolished. This is anticipated to end between 2005 and 2017 for about \$1.5 billion. Phase III would include any additional cleanup that was desired at the time (RFETS, 1998).

Phase I, which is predicted to end in 2005 (depending on funding), will include the activities discussed below. The first activity is the Plutonium Stabilization, Consolidation and Storage activity. In order to complete this activity, Kaiser-Hill must: 1) Construct a new, interim plutonium storage facility to current safety standards. 2) Store 6,600 kilograms of plutonium metal and 3,200 kilograms of plutonium compounds. These will be stabilized and packaged for long-term storage and stored in the new interim plutonium storage facility that will be constructed to meet awaiting offsite shipment. 3) 3,100 kilograms of plutonium contained within 100,000 kilograms of residue materials resulting from past production activities will be stabilized, repackaged, and stored for eventual shipment as MTRU waste to DOE's Waste Isolation Pilot Plant (WIPP). 4)

6,700 kilograms of enriched uranium will be packaged and shipped offsite. (RFETS, 1995)

The next activity will be facility decommissioning: 1) All of the site's 500 facilities (of which approximately 50 are radioactively contaminated with plutonium or uranium) will be demolished with the exception of the new plutonium, MTRU waste, and low level radioactive waste storage facilities or any other facilities deemed to be commercially valuable. 2) Waste materials from demolition activities will either be sent offsite for disposal or stored onsite (radioactive waste). (RFETS, 1995)

The third activity to be undertaken by Kaiser-Hill will be waste management. For this Kaiser-Hill will 1) construct a new, interim storage facility for the storage of an estimated 2,500 cubic meters of MTRU waste; 2) ship most TRU waste to WIPP, starting in 1998, averaging 1,200 cubic meters shipped each year. (It is anticipated that shipment of MTRU waste would not be completed until Phase II); 3) construct new, retrievable, monitored storage/disposal facilities for approximately 330,000 cubic meters of low level radioactive wastes (including mixed) and then place all waste in these storage/disposal facilities; 4) ship, for offsite disposal, at least 2,400 cubic meters of low-level radioactive waste annually; 5) and ship an estimated 11,000 cubic meters of hazardous waste offsite for disposal. (RFETS, 1995)

The final activity of the first phase is the environmental cleanup. This is where Kaiser-Hill will attempt to: 1) achieve the following land uses (i.e., cleanup would allow these land uses): approximately 6,300 acres would support open space uses (5,000 acres to residential standards), approximately 100 acres would support future commercial

industrial use, and 100 acres would be closed landfills and capped areas; 2) clean up 55 individual hazardous substance sites to reduce the source of volatile organic contamination. As part of this cleanup, they will treat 135,000 cubic meters of soil. 3) control sources of contamination throughout the life of the project, ensuring that State-mandated water quality standards are not exceeded; 4) construct final covers or caps that would be placed over contaminated soils that remain, over contaminated building debris, over old landfills, and over the low level radioactive waste retrievable and monitored storage/disposal facility to inhibit contaminant migration and finally Kaiser-Hill will; 5) perform continuous environmental monitoring (RFETS, 1995).

DOE'S PROPOSED SITE TREATMENT PLANS

On March 31,1995 the Department of Energy published its overview of proposed site treatment plans. Kaiser-Hill will have to follow all of these plans. This document covered the Rocky Flats site.

For more than 40 years the United States has produced material for nuclear weapons, operated and conducted research on nuclear reactors, and performed various nuclear experiments on reactor equipment. The management of these wastes is particularly challenging to the Department. Currently, there is insufficient capacity, and in some cases a lack of available technologies, to treat these wastes to the standards required by the Resource Conservation and Recovery Act (DOE, 1995 b).

It is the Federal Facility Compliance Act of 1992 (FFCAAct) that requires the Secretary of Energy to develop and submit Site Treatment Plans for the development of capacity and technologies for treating mixed waste. Mixed waste has been defined by the DOE as "waste that contains both hazardous waste and radioactive material (source, special nuclear, or by-product material as regulated by the Atomic Energy Act of 1954 [42

U.S.C. 2011 et seq.]). DOE classifies mixed waste according to the type of radioactive waste that it contains as either mixed low-level waste, or mixed transuranic waste. DOE's high-level waste is assumed to be mixed waste because it contains hazardous components or exhibits the characteristic of corrosivity (DOE, 1995 b). The DOE definitions are as follows: 1) low-level waste is radioactive material that is not classified as high-level waste, transuranic waste, spent fuel, or uranium or thorium mill tailings; 2) Transuranic waste refers to radioactive materials contaminated with greater than 100 nanocuries per gram of alpha-emitting radionuclides with half-lives greater than 20 years and atomic number greater than 92; 3) high-level waste is highly radioactive material containing fission products, traces of uranium and plutonium, and other transuranic elements, that result from chemical processing of spent nuclear fuel or from spent nuclear fuel itself (DOE, 1995 b).

In order to implement a Site Treatment Plan the DOE has followed a three-phase approach for developing its plans. "The National Governors' Association (NGA), through a cooperative agreement with DOE, has coordinated representatives from 20 states and the U.S. Environmental Protection Agency (EPA) to assist the DOE site in evaluating the candidate treatment options and developing mixed waste treatment plans" (DOE, 1995 b). In the first phase of this process, DOE submitted the Conceptual Site Treatment Plans to their State/Federal regulating agency. In these plans they identify the broad range of options available to treat DOE's mixed waste. In the second phase, the Draft Site Treatment Plans narrow the range of treatment options for their mixed waste. The third phase is the submitting to and gaining approval of the STP's by the State and Federal agencies. These plans can be approved, modified or disapproved (DOE, 1995 b).

DOE'S SITE TREATMENT PLAN

The DOE has prepared this Site Treatment Plan pursuant to Section 3021(b) of the Comprehensive Environmental Response Compensation, and Liability Act, as amended by the Federal Facility Compliance Act (FFCA) of 1992.

The plan describes the development of treatment technologies and capacities for treating mixed radioactive and hazardous waste that is subject to the Resource Conservation and Recovery Act Land Disposal Restriction Regulations. The plan will be submitted to the Colorado Department of Public Health and Environment for approval, approval with modification, or disapproval (RFETS, 1997).

This Site Treatment Plan (STP) addresses the treatment of approximately 3,800 cubic meters of solid and liquid mixed low-level waste and 300 cubic meters of solid and liquid transuranic wastes in storage at the site. An additional 5,708 cubic meters of stored mixed low-level waste referred to as Pondcrete and 1,086 cubic meters of Solar Pond Sludge may require treatment as mixed low-level waste, depending on the final Operable Unit 4 closure decision. The projected waste generation for the next five is are estimated as 4,000 cubic meters of mixed low-level waste and 186 cubic meters of mixed transuranic waste (RFETS, 1997).

The treatment of mixed low-level waste has been set up in three phases. The first phase will deal mainly with the treatment of waste for which we currently have the required technology. This waste will be treated onsite and will be continuously monitored for the rest of the life of the waste. This waste has been labeled miscellaneous waste and forms an immobilization system. There are some important dates for this phase. They are December 1998; by this time Kaiser-Hill will submit an Resource Conservation and Recovery Act (RCRA) permit modification applications to Colorado Department of Public Health and Environment (CDPHE). By April 2000, Kaiser-Hill will initiate

construction of new storage facilities for treated waste. By June 2005, they will commence operations (RFETS, 1997).

Phase two will deal with waste that has been labeled Surface Organic Contaminant waste. For this mixed waste there are no specific treatment technologies that have been developed; thus a treatment technology must be modified or adapted to be made applicable for this mixed waste. These wastes will also be treated on-site. There are some important dates for this phase of waste treatment as well. By February 1996 Kaiser-Hill identify funding requirements for identification and development of technology; by October 1997 they must identify and develop technologies; and by August 2000 they will submit a schedule that will have future dates in regards to the cleanup of the waste (depending on the new technologies) (RFETS, 1995).

Phase three deals with waste for which no treatment technologies have been identified. This waste has been labeled System 2/4B Buildings 374/774 Sludge Immobilization System. The dates for this cleanup are all dependent on the development of new treatment technologies. Ideally they would like to keep this waste treated and retained on-site (RFETS, 1995).

There will also be a large amount of waste that is going to be shipped off-site. This waste is too contaminated for the site to treat, or there is too much of the waste at the site. The waste storage facilities are all full. "For mixed waste that shall be shipped offsite for treatment, the final target date/milestone for the treatment of such waste shall be completion of shipment of the mixed waste to the offsite treatment facility" (RFETS, 1995). The exact location of the offsite storage area is not yet definite and will not be final until all of the options for storage are completed. For example, if the Yucca Mt. Site

is finished by the time Rocky Flats is ready to ship its waste, then that could be an option for the storage of offsite waste. Presently there is no major high level nuclear waste storage site in the United States. All of the plants that have produced waste or any type of untreatable waste have no place to send it. The DOE is currently characterizing the Yucca Mt. Site in Nevada as a possible place. A location of an appropriate storage facility is crucial to the closure of Rocky Flats. To be completely cleaned up, the site will have to send its waste somewhere, and until a storage facility is created, this cannot happen. In the current Site Treatment Plan there are two locations to which the waste will be shipped. One is a commercial treatment plant, and another is the Idaho Waste Processing Facility (IWPF). The schedule for shipment of the waste to the commercial site is uncertain, since "each activity depends on the waste stream and the selected offsite facility, and will be determined once these two factor are conclusively determined" (RFETS, 1995).

The first activity required by the official responsible cleanup, is to request the necessary approval for transport of waste(s). This means that the selected offsite facility will require an official written request, and it will only approve the shipment of a waste to that facility thirty days after the offsite facility receives validated data showing that the waste complies with that facility's waste acceptance criteria. If more than one waste stream is being processed concurrently for offsite shipment, a separate schedule will apply to each waste stream (RFETS, 1995). The schedule for mixed waste to be shipped offsite for commercial treatment has no specific dates, only amounts of time required for completion once it can get started.

The other place to which waste from Rocky Flats will be shipped is the Idaho Waste Processing Facility (IWPF). Similar to the shipment of waste to a commercial location, shipment of waste to the IWPF will depend on consulting with the Idaho National Engineering Laboratory to determine current dates applicable to the construction and operation of the IWPF. "Shipments of waste must comply with all transportation and waste permitting requirements of the receiving state and, possibly as well, of intermediate states through which the waste will be transported" (RFETS, 1995). This is also the same as shipment to a commercial treatment facility. Milestones and target dates for offsite shipment to the IWPF will be established annually in accordance with the terms of the Compliance Order. These dates are also dependent upon the starting date for the shipment.

MIXED TRANSURANIC WASTE TREATMENT PLAN

The DOE plans to achieve compliance with the requirements of the FFCAct for mixed transuranic (MTRU) waste destined for the Waste Isolation Pilot Program (WIPP) by using the no-migration variance petition approach described in Title 40 of the Code of Federal Regulations, Section 268.6. "Under this strategy, the DOE intends to continue interim storage of such MTRU waste at Rocky Flats, continue preparation of such wastes for shipment to the WIPP, and then to ship and dispose of such wastes in the WIPP" (RFETS, 1995). Rocky Flats will coordinate with the DOE Carlsbad Area Office in developing the shipment schedule to ensure proper throughput and receipt of waste at the WIPP. Presently the STP has an initial plan. This is because the WIPP has not been 100% guaranteed to open on time or to open at all. "Rocky Flats began discussions with the

Colorado Department of Public Health and Environment (CDPHE) regarding alternative treatment options for MTRU waste in January 1998 since the Secretary had not decided to operate the WIPP as a disposal facility by that time. There is also a concern that the no-migration variance petition may not be granted by CDPHE within a time frame that is mutually agreeable to the DOE and CDPHE. These modifications will describe planned activities and schedules for the new MTRU strategy" (RFETS, 1995). The initial option for the Rocky Flats MTRU waste is to prepare the waste for shipment to the WIPP for disposal. "All Rocky Flats MTRU wastes are expected to be shipped to the WIPP. Any new treatment systems required for treatment of some of the Rocky Flats MTRU waste to meet the WIPP Waste acceptance criteria (WAC), when they are finalized, will be developed in accordance with this section of the STP (RFETS, 1995). There will be very little, if any, onsite treatment of the MTRU. The only treatment that will happen will be used to meet the WIPP WAC. The methods used are re-packing and real-time radiography to identify wastes that meet the WIPP WAC. "For MTRU wastes, no specific treatment technologies have been identified, modified, or adapted for an onsite treatment system" (RFETS, 1995). There will be some MTRU waste that will have to be treated onsite. The STP gives a schedule for MTRU Waste Treatment System as follows: 1) Identify funding requirements for identification and development of technology by October 1999. 2) Identify and develop technology by September 2000. 3) Submit treatability study exemption application by October 2000. 4) Submit research, development, and demonstration permit applications by April 2001. 5) Submit schedule in accordance with the Compliance Order or new schedule for development of alternative treatment technologies in accordance with this section by October 2002 (RFETS, 1995).

For the MTRU that presently complies with the current WIPP WAC, shipments to the WIPP will occur as follows: 1) Apply for shipping classification codes by September 1997. 2) Apply for approval to ship wastes by January 1998. "In the event that the status of the WIPP changes or that the LDR treatment is deemed necessary, the commitments to the dates are no longer effective and new activities and schedules will be provided through the STP modification process" (RFETS, 1995). With the opening of the WIPP site in New Mexico, there is a definite site for the MTRU waste. The exact dates of transport have not officially been announced; they are still tentative, depending on the exact regulation that the WIPP will approve.

MIXED HIGH-LEVEL WASTE

"Rocky Flats has never generated, treated, stored, nor disposed mixed high-level waste, nor does the site have the capability to do so. Consequently, this section is not applicable to Rocky Flats" (RFETS, 1995).

ACCOMPLISHMENTS

The team at Kaiser-Hill has set out to solve the Rocky Flats Cleanup problem. In doing so they have set goals or time-lines by which to accomplish this goal. Many of these timelines depend on the timely opening of waste deposit sites by the DOE. At the present time the Kaiser-Hill team has encountered some challenges to obtaining their goals. "Safety is part of everything we do at Rocky Flats. Closing this high-risk site will be the ultimate expression of safety for the workers and the two million Denver-area

residents. Doing the work also must be safe. Even though we have achieved many safety indices lower than industry average, we will not rest as long as any potential for an accident exists" (Kaiser-Hill, 1996 c). The ultimate goal of the project is to get the site back to its original uncontaminated condition. In a perfect world, Kaiser-Hill would have enough money and resources to accomplish this objective. Unfortunately, we do not live in a perfect world, and they must operate on a limited budget. Also the federal government is finding out that cleaning up these sites will be extremely expensive. "Reducing costs and directing funds toward more closure work is a major challenge for Fiscal Year (FY) 97 and ensuing years. The site arguably should be producing much more closure work for its budget. When we began the project on July 1, 1995, the FY95 budget was \$650 million per year. We are pleased that with the projected FY97 budget of \$530 million we will allocate roughly the same amount to closure work and, in fact, accomplish much more" (Kaiser-Hill, 1996 c).

Kaiser-Hill has also established five major features of the Rocky Flats Closure Project. They include: 1) stabilizing and consolidating Special Nuclear Material, on an interim basis in stages, first retrievable and monitored storage and then shipping the waste as soon as a receiving site and a shipping corridor become available; 2) shipping and disposing of transuranic and transuranic mixed wastes at the Waste Isolation Pilot Plant in Carlsbad, New Mexico; 3) consolidating and shipping low-level and low-level mixed waste offsite; 4) safely deactivating, decontaminating, and demolishing (or designating for future use) the site's 500 facilities, including the disposition of excess and classified property and documents; and 5) remediating soil and groundwater and protecting surface water and ecological resources (Kaiser-Hill, 1996 c). It is the

effectiveness and the rate at which these goals are accomplished that is a concern among many of the skeptics. A cleanup of this magnitude and cost will always be in the public eye, and each dollar spent will lead to questions (RFETS, 1995).

The Kaiser-Hill team did not take over the cleanup of the Rocky Flats site until April 1995, and they assumed operation of the 6,500-acre site July 1, 1995. The Rockwell International Corporation was performing the entire cleanup to that point. So from the 1989 closure until 1995, the DOE classified all of the contaminants, performed an Environmental Assessment, and carried out various other administrative duties (RFETS, 1995).

The accomplishments that Kaiser-Hill did complete on the site are broken into three categories. 1) Removing material from Rocky Flats: 36,070 cubic feet of low-level mixed wastes were shipped offsite. Approximately 5.3% or 21,943 cubic feet of hazardous wastes were shipped offsite. Approximately 5.3% or 3,713 feet of straight low-level wastes were removed. 3,537 pounds of excess beryllium were shipped. Nine shipments of Special Nuclear Materials were completed. Production equipment was transferred to other facilities. (RFETS, 1995)

Category 2) of Kaiser-Hill accomplishments reducing the risks. There needs to be 2,696 total residue drums vented 710 items of plutonium brushed, repackaged. This is approximately 59% of the total. There has been 10 low-level tanks drained, 622 liters of plutonium solutions stabilized, 43 of 76 tanks with potential hydrogen buildup sampled/purged. This is approximately 56% of the total problem in these areas. (RFETS, 1995)

Category 3) of the team's progress includes accelerating environmental cleanup accelerated. A former chemical dumpsite was excavated (Ryan's Pit). This led to the cleanup of Trenches 3 & 4, which is currently underway. Contaminated soil has been treated with Low Temperature Thermal Desorption. PCB contaminated areas have been cleaned. Two Operable Units have been decontaminated. (RFETS, 1995)

Finally, there has been some building deactivation or decommissioning. Building 889 was the first radioactive building decommissioned. Initial deactivation activities are underway in Building 779. An electrical substation has been removed. Fuel oil tanks have been removed (RFETS, 1995).

Since the takeover of the site, Kaiser-Hill has finished some of these jobs and has other accomplishments as well; the Kaiser-Hill team broke ground on a major accelerated environmental restoration project at Trenches 3 & 4. The accelerated action involves "source removal through excavation of the trenches period is enough here. Trenches 3 and 4 were used in past plant operations primarily for the disposal of radioactively-contaminated sanitary sewage sludge, but also may contain waste streams with residues of radioactively-contaminated oils, contaminated asphalt and an asphalt-impregnated liner from one of the solar ponds" (Kaiser-Hill, 1996 b).

The primary concern and the reason the cleanup of these trenches was so important and one of the first projects completed is because of concern over groundwater. The potential for contaminating the groundwater was high. "Trenches 3 and 4 are two of the top 10 hazardous substance sites as ranked according to risk factors" (Kaiser-Hill, 1996 b). Workers at the Rocky Flats Plant completed the cleanup of "Ryan's Pit" a former chemical waste dump, in September 1995. There was an estimated 3,000 gallons of

chemical wastes dumped in Ryan's Pit when it was used as a disposal site from 1966 to 1970. Wastes disposed there were dumped in an open, unlined soil trench approximately 20 feet long, 8 feet wide and 3 feet deep. Chemicals disposed there were mainly mineral spirits, trichloroethylene (TCE), toluene and paint thinner (Kaiser-Hill, 1996 b). In February 1996 the first-ever onsite treatment of environmental restoration waste was completed. Approximately 180 cubic yards (all from Ryan's Pit) was cleaned up by Low Temperature Thermal Desorption (LTTD). LTTD involves heating contaminated soils to temperatures from 150 to 300 degrees Fahrenheit, which causes the organic chemicals in the soil to pass off as vapor" (Kaiser-Hill, 1996 b). In an important CERCLA cleanup activity, the Kaiser-Hill Team has remediated nine polychlorinated biphenyl (PCB) sites. The soil that was removed was placed into roll-off containers and is being shipped to the Kettleman Hills facility in central California. Finally, the Kaiser-Hill Team successfully consolidated the water treatment facilities from Operable Units 1 and 2, creating a site-wide water treatment facility for environmental restoration of the generated liquid waste streams (Kaiser-Hill, 1996 b). All of these accomplishments are as of May 17, 1996. Information on anything past then was unavailable in the references identified.

STAKEHOLDERS VALUES

Will the planned cleanup program reduce concentrations of hazardous wastes to values acceptable to stakeholders and to the general public? Currently there is one main public interest group that is receiving and evaluating all of the complaints. This citizens action group, Rocky Flats Citizen Advisory Board (CAB), meets regularly and has its own web site. The opening concerns of CAB included what the community around

Rocky Flats perceived its health and safety needs to be during the cleanup of the site. Questions such as the following were raised: "Is the community concerned about potential health effects?" " Does the community know what is going on at the site?" "Does the community feel that its views have been heard?" "Do current Rocky Flats communication strategies meet the needs of the community?" It is these questions that CAB set out to answer. For the first time, the DOE funded a community needs assessment before implementing a community-based health study. The University of Colorado School of Nursing and the Jefferson County Department of Health and Environment were granted the money to conduct the community needs assessment.

It was a big breakthrough for the government to help sponsor the CAB in its attempts to obtain the public's perception of the cleanup. In most cleanups a few vocal groups, such as Greenpeace or citizen's groups, form the only public participation alert groups. These groups are both underfunded and small in numbers. Also public opinion tends to be formed from the people who participate in the public comment period that the EPA requires after most proposals. These groups are too small and don't usually represent the general public. However, the cleanup of Rocky Flats has gotten the public very much involved. The involving of local colleges, as well as having a citizen advisory board has gained the attention of many people that might not have taken interest in the site. Because of this new approach, the CAB found eight areas of concern. They are: 1) a communication "Black Hole" based on a lack of basic, understandable information, 2) distrust of non-local government entities, 3) a lack of knowledge about an emergency plan in the event of an accidental release of radiation, 4) concern over land development adjacent to the Rocky Flats site, 5) a need for impartial and appropriate environmental

and health monitoring, 6) concern for potential accidents, including acts of terrorism, 7) feelings of vulnerability related to physical health, quality of life, property value risk and overall stability of the community, and 8) perceptions of the risk for disease and birth defects.(CDPHE, 1998)

Since January 1997, the stakeholders, which are the federal government, public groups, and Kaiser-Hill, have taken on a new load of responsibilities. "As actual dirt-moving, risk-reducing, waste-shipping activities began in earnest at Rocky Flats, stakeholders found themselves concerned with many more project-specific issues. The character of the concerns changed from overarching policy decisions too much more technical implementation matters" (DOE, 1997). The amount of information provided to the public has grown, and this has led to an increase in the number of stakeholders. "Significant issues this past year include community success in constituting a stakeholder panel to oversee an independent review of the [RESRAD] model used to establish soil action levels, WIPP transportation issues, resolution of [HEU] vulnerabilities, findings of the Actinide Migration Panel, and establishment of an active [D&D] to be conducted on the Site" (DOE, 1997). This is only the first major cleanup year that Rocky Flats has witnessed. There will be many more in the future, so the involvement and the satisfaction of the public will change from year to year. It is clear that the Kaiser-Hill team is trying to get the public involved and will be keeping this up throughout the cleanup.

RESPONSIBLE PARTIES

Have the individuals and /or organizations responsible for the problem been identified and required to contribute funds for the clean up?

The agencies involved with the operations have changed, but it has always been a government-owned, contractor-operated-and-run plant. Because of the nature of the actions at the plant, i.e. production of nuclear triggers, no private group has had access to the site. For the cleanup, however, the Department of Energy sought out a private contractor. This means that the Department of Energy will fund the entire bill. The projected cost for this cleanup depends on many things. The amount of initial money put into the project, as well as the amount of continuing funds each year, will be important. Obviously, the more put into the project early on, the more that can get done, and the less time and money the total cleanup will cost.

Before the Kaiser-Hill team was awarded the cleanup project in April of 1995, the DOE Baseline Environmental Management Report estimated a total cost of \$22.5 billion, with the cleanup not being completed until 2065. Now that the Kaiser-Hill team has taken over, they have drastically reduced both the cost and the time. "Since July, we have evaluated a full spectrum of alternatives for site closure. We have confirmed a \$6.7 billion cost and a 9 year completion schedule" (RFETS, 1997). Note that this cost is only to a point of cleanup for non-residential use. To achieve the standard of allowing the land to be used for residential use again would cost in the range of \$20 billion and would take many more years.

Besides the government, the affected public, and now the Kaiser-Hill team, there have been no other parties involved with the Rocky Flats site. This is not to say that five years down the road there will not be any more parties involved; there most likely will. Anytime the Government opens up a site for public use, there is always a large number of groups that want to get involved.

COST VS. BENEFITS

This is probably the toughest question to answer about the Rocky Flats site. Is the cost, ranging from 7.3 billion to 13 billion dollars worth the cleanup of this one site? The first part of this question is, "Will the Kaiser-Hill team's cleanup plan accomplish its goal at a reasonable cost?" Clearly the goal of this project is simple: to restore the site to its original uncontaminated state, before it was tampered with. Now the tricky part of this question is, "What is a reasonable cost?" A cleanup of a site like this has never before been attempted, so there is no base costs for many of the cleanups. In fact, some of the radioactive waste storage sites are either not open yet or have not even started to accept waste. So many of the costs for this cleanup are still unknown. Then there is another question: "How clean do you want the site?" The level of cleanliness is in direct correlation with the cost of the project; the cleaner or closer to its original state the site becomes, the more it will cost, and the more time it will add to the schedule. The Kaiser-Hill team has come up with a level that meets government regulations, so that businesses can be located there, but not clean enough so that schools and parks can be placed there. This level of cleanup has been acceptable to the stakeholders so far. The numbers are very high, in the billions. So the question becomes, "Is anything worth cleaning if it is going to cost the taxpayers roughly 10 billion dollars, when this land is only going to be used by a very small number of people?" Under the present leadership, our government feels that it is a worthwhile cost and that it should be done. Maybe in the future there will be too many of these types of sites to justify the cost.

All of these contributing questions lead to the central question: "Will the benefits from the cleanup outweigh the costs of the cleanup?" At this stage of the cleanup, it is

almost impossible to answer. No one will know how much the final bill is going to be, so no one right now can say that it is worth 10 billion dollars. Is the same land worth 20 billion dollars to be cleaned? No one knows or is going to be willing to answer that question. Since the federal government made the mess and is paying to clean it up, the stakeholders are only concerned with the actual cleanup. They have not expressed much, if any, concern for the cost of the project. If an individual or a small group were responsible for the cleanup, most likely the only concern would be the cost. When the government tries to get individual companies to pay for cleanup of sites under the terms of the Superfund Act, the cost and how much that company polluted, compared to how much the cleanup will cost, is usually the only concern. The debate over the answer to this question will probably go on for a very long time. Kaiser-Hill has set out both a timeline and a corresponding cost structure in its Site Implementation Plan, the Department of Energy has agreed with it, and the public has not brought up any problems with it. So, for now, this plan will be followed until such time as better or cheaper alternatives emerge.

References

Colorado Department of Public Health and Environment. (1998, March). *Background Information on Rocky Flats* [On-Line]. Available: http://www.state.co.us/gov_dir/cdphe_dir/rofl/overview.htm

Department of Energy. (1995 a). *Compliance Volume Revision 3, Rocky Flats Environmental Test Site Proposed Site Treatment Plan*.

Department of Energy. (1995 b). *Overview of Proposed Site Treatment Plan. Rocky Flats Environmental Test Site*.

Department of Energy, (1998 a). *Rocky Flats Plant: Administrative and General: Introduction, Administrative History* [On-Line]. Available: <http://www.doe.gov>.

Department of Energy. (1998 b). *Rocky Flats Plant: Facilities and Equipment: Introduction of History of Facilities and Equipment* [On-Line]. Available: <http://www.doe.gov>.

Department of Energy. (1998 c). *Rocky Flats Plant: Introduction, Background* [On-Line]. Available: <http://www.doe.gov>.

Department of Energy. (1998 d). *Rocky Flats: Introduction, Site History* [On-Line]. Available: <http://www.doe.gov>.

Department of Energy. (1997, December). *State of the Flats, Rocky Flats Annual Report of Progress Toward Site Closure Fiscal Year 1997*.

Environmental Protection Agency. (1998, May). *EPA's Final Certification Decision for The Waste Isolation Pilot Plant* [On-Line]. Available: <http://www.epa.gov/radiation/wipp.htm>

Environmental Protection Agency. (1996, October). *EPA National Priorities List: Rocky Flats Plant (USDOE)* [On-Line]. Available: <http://www.epa.gov/superfund/index.htm>

Kaiser-Hill Company, L.L.C.. (1996 a). *An Introduction*.

Kaiser-Hill Company, L.L.C.. (1996 b). *FY 96 Report and FY97 Outlook*.

Kaiser-Hill Company, L.L.C.. (1996 c). *Environmental Restoration Accomplishments and Successes*.

Rocky Flats Environmental Test Site. (1998). *Rocky Flats Fact Closure Project* [On-Line]. Available: <http://www.rfets.gov/Rfclosre.htm>

Rocky Flats Environmental Test Site. (1997, February 25). *Rocky Flats Project Origins* [On-Line]. Available: http://134.167.74.198/oepa/facility/rocky_rv.htm

Rocky Flats Environmental Test Site. (1995, December). *Rocky Flats Sheet 1995 Accomplishments* [On-Line]. Available:

<http://www.rfets.gov/PublicItems/General/Facts/95ACCS.htm>.

Westphal, David A. (1998). *Rocky Flats Plant* [On-Line] Available:

<http://apollo.osti.gov/techtran/rocky.html>.