DOE/EA-1146

ENVIRONMENTAL ASSESSMENT, FINDING OF NO SIGNIFICANT IMPACT, AND RESPONSE TO COMMENTS

RADIOACTIVE WASTE STORAGE

United States Department of Energy
Rocky Flats Environmental Technology Site
Golden, Colorado

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LIST OF ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEDE	committed effective dose equivalent
D&D	deactivation, decontamination, and decommissioning
DOE	United States Department of Energy
HEPA	high efficiency particulate air
IDC	item description code
LL	low-level
LLM	low-level mixed waste
nCi/g	nanoCuries of radioactivity per gram of waste
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
Site	Rocky Flats Environmental Technology Site
TRUM	TRU mixed waste
TRU	transuranic

1.0 PURPOSE AND NEED FOR ACTION

1.1 Introduction

The Department of Energy's (DOE) Rocky Flats Environmental Technology Site (the Site), formerly known as the Rocky Flats Plant, has generated radioactive, hazardous, and mixed waste (waste with both radioactive and hazardous constituents) since it began operations in 1952. Such wastes were the byproducts of the Site's original mission to produce nuclear weapons components. Since 1989, when weapons component production ceased, waste has been generated as a result of the Site's new mission of environmental restoration and deactivation, decontamination and decommissioning (D&D) of buildings.

It is anticipated that the existing onsite waste storage capacity, which meets the criteria for low-level waste (LL), low-level mixed waste (LLM), transuranic (TRU) waste, and TRU mixed waste (TRUM) would be completely filled in early 1997. At that time, either waste generating activities must cease, waste must be shipped offsite, or new waste storage capacity must be developed.

The cessation of waste generating activities would directly impact routine operations, the Site's emerging Accelerated Site Action Plan; building D&D; Residue Stabilization Programs; the National Conversion Pilot Project; activities to meet regulatory requirements of the Clean Water Act, Clean Air Act, and Resource Conservation and Recovery Act (RCRA) including the RCRA Closure Program; compliance activities related to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and the Site's ability to meet its milestones under the Interagency Agreement, which governs site cleanup and related activities. In addition, the absence of new waste storage capacity would affect DOE's ability to deactivate any building that now stores waste because there would not be an alternative storage location for those wastes. The result would be an inability to close many Site buildings in accordance with current schedules. Currently, there is only one permitted offsite location (Envirocare in Utah) that accepts some LLM and two sites (Nevada Test Site and Hanford in Washington) that accept certain LL waste from Rocky Flats. Stringent new waste acceptance criteria of the receiving sites for these wastes have substantially increased the difficulty and time involved in transporting waste offsite to the point that the Site's capacity to prepare waste to meet waste acceptance criteria is less than current and projected waste generation rates.

Resolution of the issues surrounding offsite shipment appears to be several years away. For example, the Waste Isolation Pilot Project in New Mexico, originally forecast to open in 1988, is not scheduled to open until 1998. Because of the uncertainty of offsite waste shipment locations, it is incumbent on DOE to develop safe, temporary onsite waste storage capability prior to consuming existing capacity.

1.2 Background

In 1995, the Site stored 29,770 cubic yards of radioactive and mixed waste. Storage capacity for such waste is 34,403 cubic yards. Estimates are that this capacity will be reached in early 1997. By 2,000, Waste Management Planning estimates that the Site will have approximately 46,500 cubic yards of radioactive waste requiring onsite storage. In addition, up to approximately 206,500 cubic yards could be generated by environmental restoration activities. However, the extent to which environmental restoration programs will be implemented in the near- and mid-term is highly uncertain in the face of budget reductions and competing priorities such as plutonium management, risk reduction, and waste management.

If environmental restoration activities are undertaken at a slower pace than earlier planned, radioactive waste storage needs would be substantially less than the estimate given above. Consequently, in this environmental assessment, while DOE considers alternatives for meeting all the radioactive waste storage needs of non-environmental restoration programs, only a small portion of the environmental restoration program's maximum radioactive waste storage needs are considered. If environmental restoration activities generate significant quantities of radioactive waste sooner than currently expected, additional storage facilities would have to be identified, planned, and made available, or the quantities of waste shipped offsite would have to increase substantially.

The wastes for which storage is necessary consist of four types: LL, LLM, TRU, and TRUM waste. Each type is defined by the level of radioactivity and the presence or absence of chemical constituents. LL waste is radioactive waste containing less than 100 nanoCuries of radioactivity per gram of waste (nCi/g). LLM is LL waste that also contains hazardous chemical constituents. TRU waste is radioactive waste with 100 or more nCi/g. TRUM waste is TRU waste that also contains hazardous chemical constituents.

The wastes include existing waste and waste to be generated in the future. The wastes are composed of a variety of materials including sewage sludge, lead, oily sludges, interior and exterior building and construction materials, high efficiency particulate air (HEPA) filters, pondcrete and saltcrete, various solvents and other liquids, solidified materials, transformers and light ballasts, plastics, glass, blacktop, concrete, dirt, and sand. Most are in solid form and are packaged and stored in various buildings at the Site. No liquid TRU or TRUM waste IDCs (item description codes) would be stored as part of this Proposed Action though some liquid LL and LLM wastes would be stored. A list of the TRU wastes and their corresponding IDCs is presented as an attachment to Appendix A.

Wastes sent offsite are subject to waste acceptance criteria set by the individual waste repository sites and vary from site to site. Waste acceptance criteria of individual waste disposal sites include site-specific requirements as well as the standards under applicable laws such as RCRA and the Atomic Energy Act. All receiving sites require proper certification that the waste will meet their acceptance criteria before they accept the waste. To receive the certification that will allow the shipments to start, the Site will have to review much of the existing onsite waste and update its documentation. Site personnel will also have to characterize or re-characterize a significant quantity of the waste already packaged and repackage it as necessary. Recertification of waste includes both recharacterization and repackaging and is necessitated by changes to the waste acceptance criteria of receiving locations and to changes in other applicable regulations (such as those of the Department of Transportation) since the original certification was done. The certification process for new waste will continue as long as waste-generating activities continue at the Site. Recertification of existing waste will take several years to accomplish for a number of reasons including:

- There are several types of waste containers including 55-gallon drums, 85-gallon overpack drums (which contain a damaged 55-gallon drum), full-size (4x4x7 feet) and half-size (2x4x7 feet) plywood crates, triwall (cardboard) containers, a variety of metal containers (which may contain damaged triwalls), TRUPACT II containers, and some special containers, each requiring individual characterization and analysis;

- A large amount of repackaging work is required for many waste containers to meet certification requirements;

- Environmental restoration activities mandated by the Interagency Agreement and D&D activities will continue to generate waste requiring characterization and certification in large quantities;

- Financial resources are continually being reduced.

These obstacles have made large-scale offsite shipment of waste from the Site either financially infeasible or physically impossible with the result that the Site expects to reach its waste storage capacity in early 1997.

1.3 Purpose and Need

By 1997, the Site will need additional onsite storage capacity for LL, LLM, TRU, and TRUM wastes until DOE can permanently dispose these wastes. In addition, more areas to characterize and repackage the wastes will be needed because of insufficient existing capacity for these activities. The additional storage must be environmentally and physically safe and secure and facilitate retrieval for ultimate disposition.

As a result, the DOE has determined that additional onsite waste storage capacity for LL, LLM, TRU, and TRUM waste is both essential for continuing the implementation of the mission of the Site and necessary to meet regulatory requirements and legal obligations.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This section describes the Proposed Action and alternatives considered. Alternatives considered include:

- The No Action alternative;
- Use of Other Buildings; and
- Constructing a New Facility.

The Proposed Action is discussed in Section 2.1, the No Action alternative is discussed in Section 2.2, the Use of Other Buildings Alternative is discussed in Sections 2.3.1 and 2.3.2, and the Constructing a New Facility Alternative is discussed in Section 2.3.3.

2.1 Proposed Action

The Proposed Action consists of converting some or all of the following buildings at the Site from their former uses to interim waste storage facilities: 374, 440, 444, 551, 865, 881, 883, 906 (also known as the Centralized Waste Storage Facility), and the IDM Drum Storage Facility. IDM is the acronym for investigatively-derived material such as waste soil generated by site characterization activities. Each of these candidate buildings currently exists onsite with the exception of the IDM facility, which DOE has not yet constructed. DOE did, however, evaluate and select the IDM facility in another environmental assessment and Finding of No Significant Impact (DOE 1994a). Candidate Buildings 374, 444, 881, 883, 865, and 906 already partially or completely store wastes; they are included here because DOE expects to increase the quantity of waste, or change the type of waste, they store. Buildings 440, 551, 906, and the IDM facility would be used exclusively for radioactive waste storage, while the other five buildings would contain other non-waste storage uses as well. Buildings 444, 865, and 883 have previously been prepared for use by the National Conversion Pilot Project.

Some or all of the buildings would be converted to waste storage as needed, based on several considerations: their appropriateness for the type of waste for which additional storage capacity is needed, availability, ease and cost effectiveness of conversion, capacity, and the availability of funding. In addition, since three of the projects are proposed fur use by the National Conversion Pilot Project, the needs of that program, or any other program addressing commercial use of Site buildings, would be taken into account at that time. Use of buildings for radioactive waste storage would be contingent on their not being required for commercial use. The order of conversion of the buildings would be a function of the timing of their availability (completion of their present mission and needs of the National Conversion Pilot Project or other commercial use activities) and suitability for the waste for which storage space was required. It is expected that Buildings 440 and 906 would be converted first. The second priority buildings in numerical order are 444, 881, and the IDM Facility. Buildings 374, 551, 865, and 883 are the third priority group for conversion. These priorities could change as circumstances change. If waste generation rates were significantly lower than forecast, or if DOE's ability to ship waste offsite or dispose of waste onsite were significantly greater than forecast, it may not be necessary to convert all nine buildings to waste storage. The location of the buildings is presented in Figure 2-1. A summary of the storage capacity of the candidate buildings is presented in Table 2-1.

Conversion of all nine buildings to waste storage would increase the Site's waste capacity by approximately 60% from 34,403 cubic yards to 54,945 cubic yards.

2.1.1 Selection of Buildings

The identification of potential buildings for storage of LL, LLM, TRU, and TRUM waste was based on several criteria. The criteria include:

- Physical features and configuration;
- Physical condition;
- Capacity (area available for waste storage);

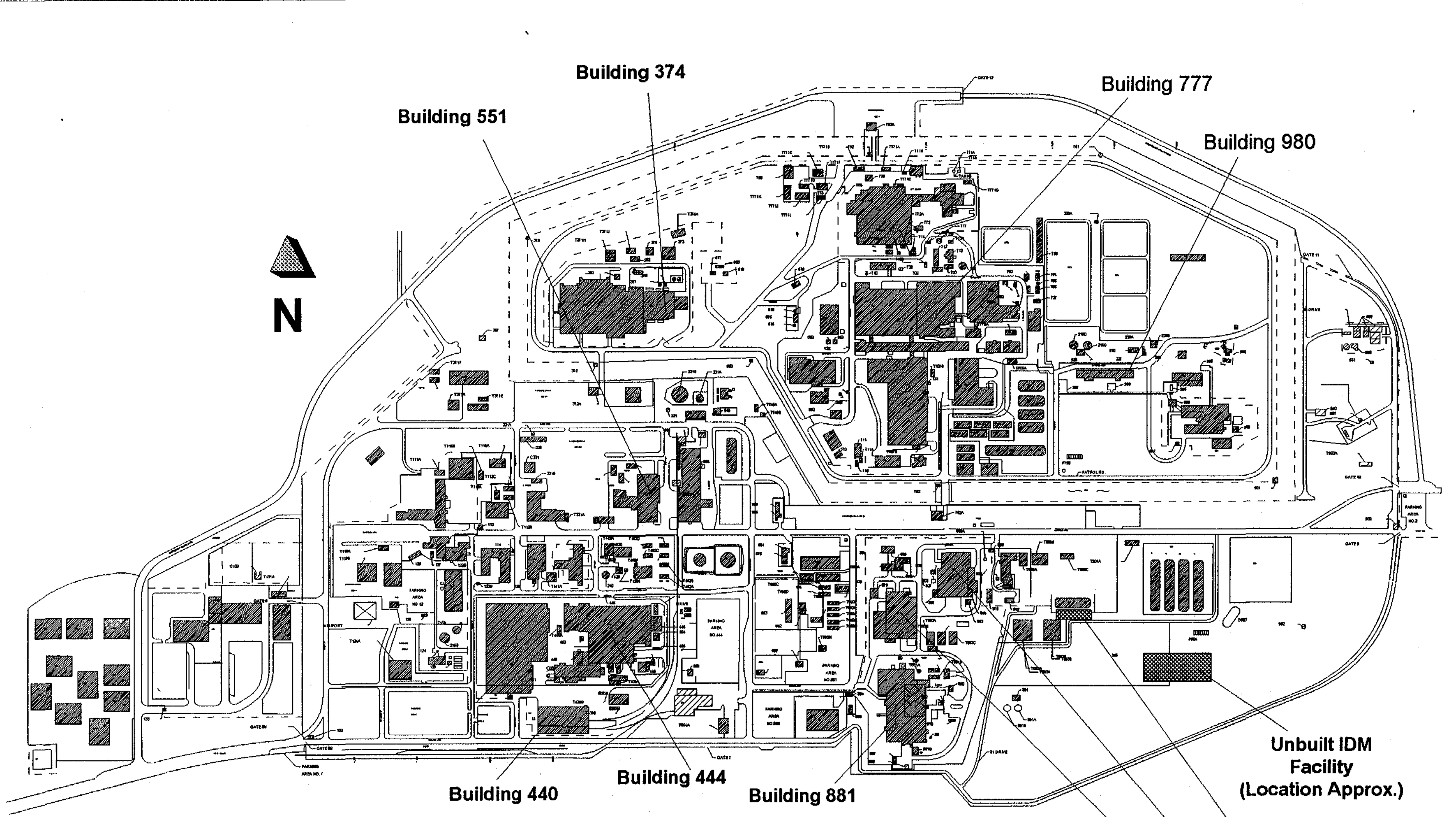

FIGURE 2-1

MAP OF THE INDUSTRIAL AREA

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

TABLE 2-1
SUMMARY COMPARISON OF AVAILABLE WASTE STORAGE SPACE IN CANDIDATE BUILDINGS

Building	Available Space (square feet)	Comments
374	30,000	Process equipment would need to be removed
440	25,000	Would use entire building
444	105,000	No special issues
551	40,000	No special issues
865	25,000	No special issues
881	21,000	Only 8 rooms would be used
883	42,000	No special issues
906	25,000	Not all of this space may be available
IDM	7,200 - 14,400	Not yet built

- Availability;
- Ease and cost effectiveness of conversion;
- Ability to convert the building to waste storage for less than $2 million.

With regard to the last factor, DOE is using the $2 million ceiling because of the federal budgeting process. Congress makes capital projects in excess of $2 million budget line items requiring up to three to five years of pre-construction design review, while similar capital expenditures can be approved much more quickly. An approval period of three to five years (plus construction time) would not meet the need DOE has identified to have the additional waste storage capacity available by early 1997.

All of the candidate buildings generally meet these criteria. Based on preliminary surveys, the buildings were determined to be structurally sound. Formal analyses would be completed early in the design phase for each building. DOE intends to make some modifications based on the need for storing a type of waste, the cost of improving storage capacity, and the resulting available storage space. Potential modifications are described in Section 2.1.2.

A more detailed description of the candidate buildings is provided in Section 3.2. In addition to the candidate buildings, Buildings 980 and 777 were also considered and are described in Sections 2.3 and 3.2.

2.1.2 Modifications to the Buildings

General Modifications

Regulatory requirements for modification include adherence to RCRA, Toxic Substances Control Act, Colorado Hazardous Waste Act, and applicable DOE Orders regulating general design criteria, environmental protection, safety and health protection, management of construction projects, and the Conduct of Engineering Manual.

Generally, building modifications could include:

- Cleaning out any loose materials (e.g., papers, files, and books) and removing all unused and unnecessary equipment and fixtures such as cabinets and shelving;
- Removing furniture and unnecessary floor coverings;
- Removing interior walls and partitions to increase contiguous floor space;
- Removing or replacing doors;
- Widening and increasing the height of interior and exterior doors for forklift access and to account for maximum waste container size;

- Removing and relocating or replacing utility fixtures such as electrical components (lighting, outlets, switches, and control panels) and conduit, plumbing lines and fixtures, storm water and safety drains, and communication wiring;

- Removing and relocating or replacing fire protection fixtures including detection and suppression systems and warning devices;

- Modifying or otherwise improving the heating, ventilation, and air conditioning system;

- Modifying and upgrading exterior building features and sealants for weather and atmospheric protection (including insulation);

- Providing structural modifications necessary for compliance with civil engineering codes for load capacity, environmental loads (rain/snow and wind) and for DOE and Site standards for seismic forces; and

- Designing and completing new architectural construction, which would include modifications to existing floor surfaces such as installing berms, new interior finishes, doors, and designing safe means of egress. Berms would be designed to contain spills of contaminated materials in the event a waste container is breached. They would also reduce the flow of fire suppression water leaving the building in the event sprinkler systems are activated. Berm design and placement would take into account criticality concerns regarding co-location of liquids and fissionable material.

Specific Modifications

DOE plans to convert the paint booth in Room 113 in Building 440 to a dedicated area for repacking waste drums and crates. The paint booth would act as a contamination control cell to minimize or eliminate releases of contaminants to other parts of the building. At a minimum, the conversion would require:

- Seal all seams and penetrations to minimize air infiltration;
- Clean and repaint the interior to provide a surface for easy decontamination;
- Modify the booth's existing heating, ventilation, and air conditioning system to include two stages of HEPA exhaust filters, differential pressure instrumentation, and a single stage HEPA inlet (supply) filter, as well as a continuous air monitoring system;
- Provide cooling to the booth either from a separate air conditioning unit or from the cooling tower outside the building immediately to the west;
- Install airlocks at the equipment and personnel entries;
- Fabricate and install a downdraft table or hood; and
- Evaluate additional required modifications to convert the booth to a decontamination cell.

In Building 881, Room 144 currently contains a Permacon unit which would be placed into service as a waste repackaging facility because it can be separately ventilated. A Permacon unit is a portable room which can be set up inside an existing room for activities which must be segregated from other activities. In this case, its use would prevent contamination from spreading elsewhere in Building 881 during repackaging of waste. The Permacon unit would have two stages of HEPA exhaust filters and a single stage HEPA supply filter as well as continuous monitoring of exhaust air.

Similar activities to construct or modify facilities for repackaging wastes could take place in any or all of the other buildings. The specific modifications would be dictated by Site standards in effect at the time for the type(s) of waste to be stored in a particular building.

If asbestos, chemical, or radiological contamination were found in the course of building conversion, it would be left in place unless it interfered with waste storage or presented a hazard to workers. Contamination removed would follow applicable regulations and procedures.

Physical and Administrative Controls

To ensure the safety of workers in candidate buildings, the Site would mitigate the possibility of risks posed by penetrating gamma and neutron radiation with physical and administrative controls intended to reduce risks of accidents and prevent potential exposure to radioactivity above accepted annual exposure limits. Such measures are currently in use across the Site and have been proven effective in providing radiological protection.

Administrative Controls include:

- Establishing criticality safety limits (i.e., maximum quantities and configurations of radionuclides in a given space); and
- Measuring any neutron radiation present on the opposite sides of walls of areas containing TRU waste. If detected, the Site would determine a safe distance from the wall, mark it visually, and limit access within the marked area.

Physical controls include:

- Installing criticality detection systems if necessary;
- Installing selective alpha air monitoring systems;
- Adding lead shielding to walls as necessary;
- Continuing the use of engineered waste containers; and
- Installing continuous air monitoring equipment on plenums in stacks as necessary.

Ventilation calculations would be completed to verify that hydrogen and methane concentrations would not accumulate beyond allowable levels. If calculations show additional ventilation is required, the heating and ventilation system would be modified to provide the level of protection necessary for the quantity and type of waste which would be stored in a building.

2.1.3 Sources of Waste Intended for Storage

The waste planned for storage has been or would be generated by a variety of activities at the Site including: routine operations, the Environmental Restoration Program, D&D, the Residue Stabilization Programs, the RCRA Closure Program, and the National Conversion Pilot Project. These and other activities (such as CERCLA compliance activities) are projected to produce as much as 253,000 cubic yards of new wastes requiring onsite storage by 2000. A secondary source of waste is expected to be wastes already in storage in other buildings. It is expected that some buildings that now store waste will be identified for different uses or for deactivation with the result that the waste they now store would be sent to an alternative location, such as the buildings intended for use under this Proposed Action.

In addition, any of the buildings may also be used as a temporary staging area for offsite shipments of waste and other materials now stored in other buildings. However, such waste would arrive in the buildings that are the subject of this proposed action, packaged in appropriate containers, and would neither be repackaged nor opened in these buildings. The Site currently expects to use Building 440 for this type of staging activity.

Routine operations encompass many Site activities that produce LL, LLM, TRU, and TRUM wastes. The six main areas of waste production are:

- Routine maintenance, surveys, and inspections;
- Incidental construction;
- Waste operations;
- Laboratory activities;

- Technology development; and
- Special nuclear material management, including consolidation, repackaging, thermal stabilization, and offsite shipment, all of which are essential to the safe management of special nuclear material.

The Environmental Restoration Program is projected to be the largest future source of LL and LLM wastes at the Site. The purpose of the Environmental Restoration Program is to assess and clean-up contaminated sites (grouped in Operable Units) in compliance with applicable federal and state environmental regulations and the Interagency Agreement. Both short-range and long-range remedial and corrective actions are planned.

D&D involves the safe disposition of surplus facilities. Activities include removing equipment and gloveboxes, draining and isolating process lines, removing contamination in preparation for safe disposition, and possible re-use or demolition of buildings. These activities would generate primarily LL, some LLM and smaller quantities of TRU and TRUM waste. It is expected that the D&D and environmental restoration programs will generate the largest quantities of waste.

Residue stabilization consists of two programs: the Solid Residue Stabilization Program and the Liquid Residue Stabilization Program. Materials generated under these programs are currently stored in eight different buildings and some will require treatment for continued safe storage. Most of the waste generated would be LL, TRU, and TRUM waste and small amounts of LLM waste in the form of metal, combustibles, and filter media.

The RCRA Closure Program requires the closure of approximately 400 RCRA storage tanks, 100 container storage units, and 10 miscellaneous treatment units. Closure activities would generate small to moderate quantities of LL, LLM, TRU, and TRUM waste. It is also possible, according to a recently announced state position, that some environmental restoration will ultimately be run as RCRA Closures. This approach would likely increase the amounts of waste generated.

The National Conversion Pilot Project for the Site was approved by the Secretary of Energy, Hazel R. O'Leary on December 15, 1993. The goal of the five-year project is to convert former production facilities at the Site to beneficial use. The primary initial activity involves a proposal to recycle radioactively-contaminated scrap metal into waste containers. Four buildings are intended to be used for the National Conversion Pilot Project and the renovation of these facilities would generate LL and LLM waste.

2.1.4 Description of Waste Intended for Storage

The wastes intended for storage in the candidate buildings include LL, LLM, TRU, and TRUM wastes. A list of the item description codes and a brief description of each type of waste proposed for storage in the candidate buildings is included following Table 3 in Appendix A. In addition, the Proposed Action contemplates that these buildings may also store lesser quantities of hazardous (non-radioactive) waste and radioactively-contaminated asbestos and polychlorinated biphenyls (PCBs).

The wastes proposed for storage are radioactive due to plutonium or uranium contamination. Other contaminants may also be present, depending on the type of wastes. No drums containing more than 200 grams of plutonium (or the radiologic equivalent of 200 grams of plutonium) would be stored. As previously mentioned, no liquid TRU or TRUM waste IDCs would be stored in the candidate buildings as part of this Proposed Action. Most radioactive wastes stored in drums are vented to prevent buildup of pressure in the drum. All vents are HEPA filtered.

Any one waste, combination of wastes, or all wastes could be stored in any or all of the candidate buildings. Operating requirements would determine the mix of wastes in each building (e.g., the type of waste for which storage space was needed) and safety considerations. Safety considerations include the physical features of a building which may or may not be conducive to safe storage of a given waste type (e.g., buildings containing liquid wastes would have appropriate berms or other secondary containment features), and storage methods (e.g., LL waste could be placed around TRU to provide a partial shield for workers from the higher radiation levels of TRU).

2.1.5 Transportation of Wastes to Candidate Buildings

The waste intended for storage in the buildings would include both existing waste and new waste generated as a result of ongoing and future activities and programs at the Site. Newly generated waste would be transported by truck to the candidate buildings from the buildings where it was generated. Then the waste would be stored, prepared, and certified for shipment offsite. As space becomes available in the candidate buildings, existing waste may be moved to these buildings from where it is currently stored.

The waste would be managed in accordance with the Radiological Operating Instructions and its parent document, the DOE Radiological Control Manual (DOE/EH-0256T). The Radiological Operating Instructions specify that all packages containing radioactive material be surveyed for gamma and neutron radiation and for removable and fixed surface contamination before leaving a building. Surveys for alpha and beta radiation would also be performed to ensure worker health. Shipping containers involved in onsite transfers must display a radioactive shipping label which displays the surface radiation dose equivalent rate for gamma and neutron radiation. The dose equivalent rate is not to exceed a limit of 100 mrem per hour at the surface of the waste container. The integrity of all shipping containers is to be verified prior to being loaded onto a vehicle.

In accordance with the U.S. Department of Transportation regulations, waste containers are engineered to withstand severe shock from accidental drops or falls. The primary types of containers used are 55-gallon drums, plywood boxes, and TRUPACT II containers. The drums are engineered to withstand a drop from four feet. TRUPACT II containers (see Glossary) are designed to maintain integrity from a drop of 30 feet. Safety practices and engineered features would help ensure the safe handling of all waste materials.

2.1.6 Waste Management, Storage, and Preparation

The quantity of waste in any single building would be dependent on the number of grams of radionuclides in each waste container. An accounting system would be established to keep track of the number of grams of plutonium or uranium in each drum, and each building would be assigned a maximum number of grams of such material that could be stored in the building at any one time. The maximum number of grams would be a function of the type of construction (e.g., metal or concrete, additional structure reinforcing), and existing and planned building features and safety equipment (e.g., HEPA filters, air emissions monitoring equipment, and fire suppression systems). Each building would be authorized to contain up to that number of kilograms of radionuclides which, in the event of a bounding accident (typically an earthquake or fire), would be expected to release a dose of not more than 5 rem to the maximally-exposed offsite individual, as calculated using conventional risk assessment methods and the approach and general assumptions described in Appendix A. This authorization would be expected to result in limits of between 35 to 50 kilograms of radionuclides in drums per 1,000 square feet of storage area. Thus, based on nuclear safety considerations, the quantity of radionuclides in each building would vary depending on the type and size of the building and the safety features that would exist in the building at the time of waste storage.

In addition, each building would be operated in accordance with Clean Air Act requirements. These include installation of expensive air emissions monitoring equipment if the annual estimated dose to the maximally-exposed offsite individual from normal operations in any one building were estimated to exceed 0.1 mrem per year, not taking into account any emissions control equipment such as HEPA filters. Any waste storage area, in routine operation, whose contribution to the uncontrolled committed effective dose equivalent (CEDE) to the public exceeds 0.1 mrem/year will require monitoring or other annual assessment of emissions that is acceptable to the Environmental Protection Agency or the Colorado Department of Public Health and Environment, if delegated authority by the Agency. With monitoring in place, additional waste could be stored in the area as long as the total emissions for the site does not exceed 10 mrem/year CEDE. Permitting of the waste storage area is required should the estimated emissions cause in excess of 0.1 mrem/year CEDE, controlled. No monitoring or permitting requirement is expected to be implemented based on planned waste storage activities. Vented drums and other waste containers are considered sealed sources, not contributing to site emissions, except for those that are known to be leaking. For any building to stay below the monitoring threshold, the maximum quantity of radionuclides that could be stored in containers that are not treated as sealed sources lies in the 40 to 60 kilograms range (KH 1995a).

Thus, the quantity of waste, expressed in terms of the quantity of radionuclides, that could be stored in a building at any one time without air emissions monitoring would be the lesser of: 1) that quantity calculated to yield a dose of less than 5 rem to the maximally-exposed offsite individual in case of the bounding accident, or 2) that quantity calculated to result in a dose, taking no credit for emissions controls, of less than 0.1 mrem per year to the most maximally-exposed offsite individual from normal operations, unless continuous air emissions monitoring equipment were in use.

Should the drums be treated as sources, absence of air monitoring would be the limiting factor on the quantity of radionuclides that could be stored in a building. If air emissions monitoring and HEPA filtration equipment were in operation, the quantity of radionuclides in a single building could increase by three orders of magnitude (a factor of 1000) from the 40-to-60 kilograms range before additional permitting requirements are applicable. This increase would cause the limiting factor in most cases (i.e., in all but the largest buildings) to become the 5 rem dose from the bounding accident.

The quantity of radionuclides in a given building would then be a function of building size. Though the exact number of square feet that would be available for waste storage in each of the candidate buildings would not be known until detailed plans are developed for each building, it is estimated that the average of the candidate buildings is approximately 45,000 square feet, albeit the buildings vary in size from less than half that figure to more than twice that figure. Thus, on average, the candidate buildings could contain up to 1,575 kilograms to 2,250 kilograms of radionuclides. Actually placing such quantities of radionuclides in a waste storage building is unlikely because of the small quantities of radionuclides in most waste drums.

Typical routine waste handling activities would include off-loading waste containers from the delivery truck by forklift and moving the waste containers to a storage area. The waste would be safely stored and prepared in accordance with Radiological Operating Instructions for eventual shipment to offsite disposal facilities as they become available. At a later time, waste containers would be moved from the storage area, prepared for shipment offsite, staged for shipment, and shipped.

Preparation activities for eventual offsite shipment would include:

- Characterization of any waste lacking adequate documentation, since a large number of older waste containers have not been characterized to current standards (characterization is conducted to identify the specific contents of a container as a means of determining if the waste disposal acceptance criteria are met);

- Re-characterization of waste if existing documentation does not meet waste acceptance criteria certification requirements for offsite facilities;

- Re-packaging (involving opening waste containers, removing waste, sorting and repackaging it) and characterization as necessary for continued safe storage; and

- Completion of the documentation required for proper certification.

Storage areas would be located to mitigate potential exposure of workers to any emissions from stored waste. In addition, comprehensive radiological protection reviews would be conducted by Radiological Engineering to meet as-low-as-reasonably-achievable exposure levels. The following administrative controls would be used:

- Waste drums with lower concentrations of radionuclides would be placed nearest walls adjacent to office areas to provide shielding for office workers from drums containing higher concentrations of radioactive waste;

- Office area floors would be delineated to indicate where dose rates might exceed limits for routine, nonoccupational exposure. Office equipment, such as chairs, desks, phones, and coffee pots would not be placed inside of those areas to limit other than transient occupation. Signs would be posted to decrease occupancy times in areas with higher dose rates; and

- Postings as per the Radiation Control Manual and Radiological Operating Instructions would be used as required.

2.2 The No Action Alternative

The No Action alternative involves leaving existing LL, LLM, TRU, and TRUM waste where it currently resides and ceasing the generation of new waste as Site capacities for various types of waste are reached. Waste is currently located in approximately 45 locations across the Site, though the number varies routinely as waste is moved and consolidated.

The generation of new waste by activities mandated by environmental regulations and various agreements would eventually cease as there would be no place to store the waste in compliance with regulations or to repackage the waste for eventual shipment offsite. These activities include: routine operations, the Environmental Restoration Program, D&D, the Residue Stabilization Programs, the RCRA Closure Program, compliance activities related to CERCLA, and the National Conversion Pilot Project. Environmental contamination would remain where it currently is. As a result, DOE would potentially be in violation of RCRA for improper storage of waste and the Interagency Agreement for missed milestones.

2.3 Alternatives Considered but Not Analyzed in Detail

Other Site buildings were reviewed as alternatives to the candidate buildings based on the same criteria used to select the buildings in the Proposed Action (see Section 2.1.1).

2.3.1 Building 980

Building 980 would provide only 13,500 square feet of waste storage capacity, sufficient for approximately 2,000 drums. This capacity is small compared with the estimated capacities for other buildings. The building was constructed in 1969 and 1970. Building 980 is rectangular in shape and divided into three levels, each connected by a ramp. In their current configuration, the ramps are too steep for a forklift carrying drums of waste and so would have to be lengthened, thus reducing the area available for storage of waste. Ceilings over the two lower levels are high enough to permit drums to be stacked either three or four high, but on the upper level two high would be the maximum possible. The cost of preparing Building 980 for waste storage is approximately $1.2 million, which is within the criterion, but significantly higher on a per-drum basis than other buildings. As a result of the high per-drum cost and small capacity without any off-setting benefit, Building 980 was eliminated from further consideration.

2.3.2 Building 777

Building 777 is a two-story structure comprising the eastern half of a larger building referred to as Building 776/777 in the Site's Protected Area. Radiological operations have historically been conducted in this building. The rooms potentially available for waste storage contain various kinds of equipment or gloveboxes, which are remnants of the building's earlier manufacturing role. The equipment and gloveboxes would have to be removed and stored as radiological waste before drums or crates of waste could be stored. It is estimated that preparing the selected rooms in Building 777 for waste storage would generate approximately 800 cubic yards of waste but provide space for storage of only approximately 500 cubic yards (approximately 1,500 drums). The cost of converting the selected portion of Building 777 to waste storage is estimated to be substantially in excess of $2 million. In addition, current planning calls for Building 776/777 to be emptied of waste during 1996 and 1997 and to be subsequently deactivated, decontaminated, and demolished. Thus, the building would not be available during the period needed.

Building 777 was not considered further because preparation of the building would generate more waste than it would store, costs of converting the building to waste storage are very high, and the building is scheduled for deactivation and demolition at the time it would be needed for storage of waste.

2.3.3 Constructing a New Facility

The advantage of this alternative is that new buildings could be designed specifically for storing, repackaging and staging new waste containers for offsite shipment. Construction of one new relatively small waste storage facility, in fact, is part of the Proposed Action (the IDM facility). In addition, it may be necessary to construct additional waste storage buildings in the future if the capacity of the Proposed Action buildings is reached. However, it would take 11 new 25,000 square-foot buildings to provide the same storage capacity as the Proposed Action. Two factors mitigate against undertaking such a construction project, including:

- The cost of a 25,000 square-foot building with a repackaging facility (comparable in size to Building 440, the smallest to the buildings in this Proposed Action) would exceed the $2 million capital cost limitation discussed in Section 2.1.1 with the result that the buildings would not be available until four to five years after the Site will need the capacity.

- There is not sufficient space in the Industrial Area of the Site at this time for such buildings. Constructing new waste storage buildings in the Buffer Zone is considered undesirable at this time because it would both disturb previously undisturbed areas and would bring the possibility of introducing contamination into an uncontaminated area.

3.0 AFFECTED ENVIRONMENT

3.1 Location, Demographics, and Land Use

The Site is located on 6,266 acres in rural Jefferson County, Colorado, approximately 16 miles northwest of downtown Denver. Figure 3-1 presents the location of the Site within the Denver Metropolitan Area. The Industrial Area occupies approximately 395 acres that is centrally located within the Site boundaries. The remaining 5,871 acres form the Buffer Zone around the Industrial Area. The Industrial Area is separated by at least 1 mile from public roads and private property by the intervening Buffer Zone.

The nearest school is 6 miles and the nearest hospital is 10 miles from the Site. Jefferson County Airport is within 5 miles of the Site (EG&G 1994a). Approximately 331,000 people live within a 10 miles radius of the Site, with about 1,200,000 people living within a 20 miles radius of the Site. All of metropolitan Denver, with a population of over 2,200,000, is within 50 miles of the Site. Generally, the population centers are northeast and southeast of the Site (DOE 1995a).

The Site is located on a broad alluvial terrace along the eastern flank of the Rocky Mountains at an elevation of approximately 6,000 feet above mean sea level, with the higher western portions of the Site generally descending toward the east and south.

Land adjacent to the Site is not considered prime agricultural land due to the shallow, rocky soil (EG&G 1994a). The major agricultural uses of the land include livestock grazing and the production of hay and wheat. Clay and gravel pits are operated along the Site's western boundary and there is potential for a gravel mining operation on the western portions of the Site in the future. In addition to grazing lands, public open space is located north of the Site. Lands east of the Site are characterized by grazing, with extremely low density residential areas gradually increasing in density toward the east and the community of Broomfield.

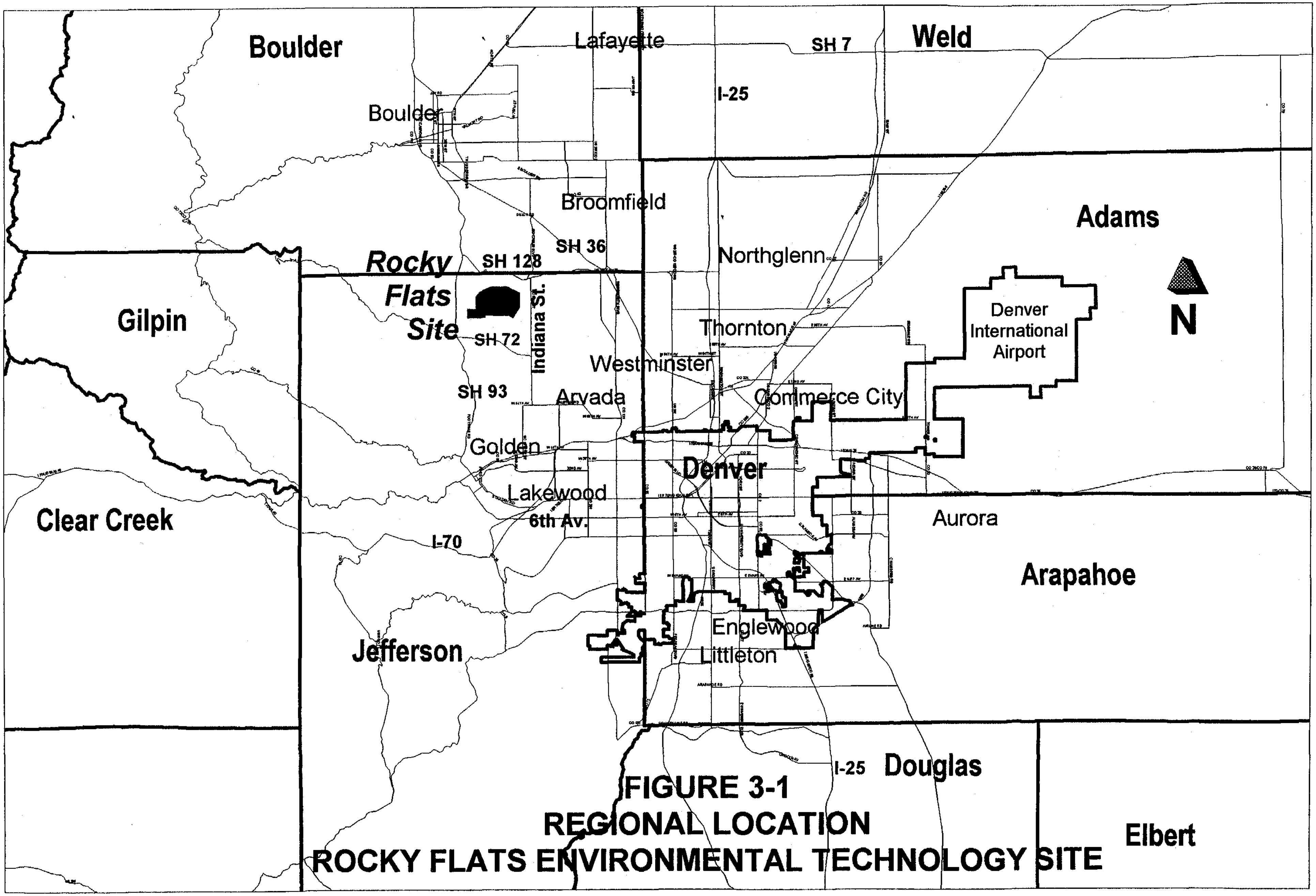

FIGURE 3-1
REGIONAL LOCATION
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

3.2 Built Environment

The Rocky Flats built environment is the previously mentioned Industrial Area, a 395-acre fenced security area, in which the majority of work activities occur and where most of the Site's workers are located. The main plant has 436 buildings, facilities, systems, and structures, of which 150 are permanent buildings and 90 are trailers used mainly for office space. The remaining facilities are smaller structures, additional temporary structures, and parts of support systems attached to or near larger buildings.

The industrial facilities are divided by Central Avenue into two main areas. The Protected Area to the north contains all of the facilities related to plutonium operations. Security fences and intrusion-detection systems surround all buildings in which plutonium is handled or stored, and various other measures are used to provide safeguards and security. The area to the south of Central Avenue contains buildings that were part of non-plutonium manufacturing facilities, some of which are located in secured areas, and many of the general plant support facilities. The locations of buildings at the Site are shown in Figure 2-1.

The remainder of this section provides a description of the buildings considered under this environmental assessment.

3.2.1 Building 374

Building 374 was constructed in the early 1970s. The building treats process aqueous (liquid) waste generated on the plant site. The building became operational in 1977. The basement level contains offices, chillers, and a motor control center. The first floor contains process equipment and the second floor contains a chemical preparation area (chemical storage). A small area above the second floor contains offices and the building mechanical equipment. Decontamination of areas within the building would be required prior to using the building for waste storage. Building 374 has approximately 42,000 square feet of floor space, of which approximately 30,000 square feet could be utilized for waste storage if process equipment and offices were removed.

The exterior walls consist of hardened concrete. The walls are insulated with either transite or fiberglass batt insulation. Building 374 and Building 371 are connected and share common utilities.

3.2.2 Building 440

Building 440 was originally used for the modification of transportation equipment. The building contained fabricating equipment, offices, and rail and truck loading facilities. The facility is approximately 39,000 square feet in area and started operation in November 1971. Three additions were completed in the late 1970s and 1980s.

Building 440 is currently empty except for wastes stored in the RCRA 90-day accumulation area and a few items from the Modification Center that have been left for temporary storage. The RCRA 90-day waste accumulation area is approximately 800 square feet. It is used for temporary storage of closed containers of non-radiological waste and small quantities of excess chemicals.

The building is constructed primarily of metal walls with fiberglass insulation. The structure of the interior walls varies according to usage. The roof is constructed of reflective aluminum foil over fiberglass insulation on a metal deck.

3.2.3 Building 444

Building 444 was originally constructed for uranium manufacturing, machining and casting in the foundry, chemical processing, and plating. Building 444 has three stories: a basement, a first, and a second floor. The building is currently filled with machinery and has very limited open areas. Extensive decontamination of the machines still located in the building would be required prior to using the building for waste storage. Building 444 contains offices, a cafeteria, machining area, foundry, laboratory, and shower/locker rooms. The building has a floor area of 130,000 square feet. Approximately 105,000 square feet could be utilized for waste storage. Building 444 is connected to Building 447 with a common, hardened wall.

The building is constructed of hardened concrete with foam insulation. Building 444 has three truck docks.

3.2.4 Building 551

Building 551 was constructed in the late 1950s and consists of a single story. The south side of the building is used as a spare parts warehouse for utilities, maintenance supplies, construction supplies, and D&D supplies, and has a small amount of office space. A small mezzanine (approximately 300 square feet) is located above the office area on the south side of the building. The north side of the building is currently used by the onsite contractor as a machine shop. Approximately 40,000 square feet of the 44,000 square foot building could be used for waste storage.

The building has reinforced concrete walls, a concrete slab floor and a built-up, flat roof.

3.2.5 Building 777

Building 777 was designed with Building 776 as a complex and is considered a single structure. Building 776/777 was originally built for six major categories of operations: 1) weapons production support; 2) site-return processing; 3) waste operations; 4) research and development; 5) special projects; and 6) support groups such as radiation monitoring, maintenance, and process material support.

Building 776/777 is a two-story facility with approximately 156,200 square feet of floor space. It is constructed primarily of structural steel covered with transite. Some vault areas are poured, reinforced concrete. A second roof was added above the original in 1972 to provide a better seal. The new roof is on a tapered structural steel frame and metal decking overlain with insulating concrete and built up composition roofing. This building was eliminated from consideration for the Proposed Action (see Section 2.3.2).

3.2.6 Building 865

Building 865 was constructed in 1969. The single-story building has standard height ceilings in the offices on the north side of the building and a high bay on the south side. The high bay contains rolling and forming metal working equipment. Uranium and beryllium were formed and machined in the high bay. This area would require decontamination prior to use for waste storage. The building area is 32,000 square feet, of which approximately 25,000 square feet could be used for waste storage. Building 865 has two truck docks and two grade-level truck doors.

The exterior walls of the high bay area consist of concrete prefabricated sections and are insulated with fiberglass. The exterior wall of the office area consists of cinder blocks and is insulated with styrofoam. The building floor is a concrete slab.

3.2.7 Building 881

Building 881 is a three-story reinforced concrete structure that is largely below ground surface. Its roof is flush with the finished grade along the north and along most of the east and west sides. On the south, the finished grade is at the second and third floor levels. The east side also has a finished grade level with two second-floor portals. Each floor has mezzanine areas and the building has a partial basement. The total floor space including mezzanines is about 245,000 square feet. Wastes currently located in Building 881 include three drums containing LL (mostly plutonium) waste, an abandoned scrubber, and hazardous chemicals in laboratory quantities (typically under 5 gallons).

A variety of administrative support operations is conducted in Building 881. The operations include general accounting, payroll and cost accounting, computing and information services, records management and storage, and future systems. The building formerly contained material processing operations such as machining, assembling, inspecting, testing, and support functions. Building 881 is HEPA filtered.

3.2.8 Building 883

The main area of Building 883 was constructed in 1957 as a foundry for uranium manufacturing and machining. Additions, including office areas, were added to the building in 1958, 1968, and 1972. The three-story building consists of a basement, and first and second floors. Equipment currently in the building includes salt baths, rolling mills, furnaces, presses, metal working equipment, and tanks. The majority of the metal working areas of the building are filled with machinery, leaving limited open areas. Extensive decontamination of machines and work areas within the building would be required prior to using the building for waste storage. Manufacturing Sciences Corporation is currently decontaminating, removing equipment and renovating equipment in portions of the building. Only that portion of the building not used by the Corporation would be available for waste storage.

The exterior of the building contains three types of construction: transite, corrugated steel, and block wall. The building is insulated. The main level of the building is approximately 52,000 square feet. Approximately 42,000 square feet could be used for waste storage. The building contains four truck docks, one grade-level truck access, and is HEPA filtered.

3.2.9 Building 906

Building 906 was constructed in 1995 for the storage of solid LL and LLM waste. The 25,000 square foot, one-story building contains an open storage area and no offices. The building has a loading dock and grade-level truck access.

The building is constructed of corrugated steel walls (a Butler style building) with a concrete slab floor. The walls and ceiling are insulated with fiberglass batt insulation. The building currently stores solid LL and LLM waste, but is included in the Proposed Action because it may be used to store TRU or TRUM.

3.2.10 Building 980

Building 980 was previously used as a combination machine, tool storage, and paint shop. The building is being emptied of all tools and equipment, leaving only the paint shop in the building.

The building is constructed of metal and is 45 feet by 300 feet (13,500 square feet). The building was constructed in 1969 or 1970. Building 980 does not contain any nuclear materials, but does hold stored paint thinner. This building was eliminated from consideration for the Proposed Action (see Section 2.3.1).

3.2.11 IDM Facility

The IDM Facility has not yet been constructed. The facility was designed to house waste materials generated by environmental restoration activities. These wastes include soil, sediment, rock and geologic material, and also small quantities of other wastes from site investigations and interim remedial measures such as retired well casings, filtercake, spent granular activated carbon, and similar materials. The building would strictly be used for waste storage and would not contain office space. The IDM Facility would normally be unoccupied by personnel except during movement or inspection of stored waste. The front and back of the building are designed to have roll up vehicle doors for truck access. These doors would accommodate vehicles as large as a semi-trailer truck.

The building would be constructed of prefabricated steel on a concrete slab. The building is proposed to ultimately contain 14,400 square feet of storage space, or 120 by 120 feet. A 14,400 square-foot IDM facility could be constructed for less than $2 million.

3.3 Safety Systems and Practices

The safety systems include all health and safety rules and operating procedures currently enforced on the Site, all of which are in compliance with all federal and state regulations. These include standard work procedures; a criticality safety program; machinery utilization and maintenance requirements; the use of personal protective clothing and equipment; environmental monitoring systems; filtration units; fire monitoring, detection, and suppressant systems; life safety/disaster warning systems; emergency power systems; and emergency response personnel and equipment.

3.4 Cultural Resources

The Rocky Flats Industrial Area was reviewed and analyzed for historic significance in the Final Cultural Resources Survey Report (SAIC 1995). No significant archaeological sites have been identified on the Site.

However, 64 facilities at the Site that may be historically significant were identified in the 1995 Final Cultural Resources Survey Report. DOE and the National Park Service are considering whether to create an historic district at the Site and, if so, on what conditions. Most of the buildings considered for storage of radioactive waste in this environmental assessment would be eligible for inclusion in the historic district, if formed.

The 64 primary contributing facilities at the Site that have been determined eligible for listing on the National Register of Historic Places will require continued efforts to document both their physical characteristics and their historic role in the Plant's nuclear weapons mission. This documentation must be complete for a given building before any activity that could affect the character or integrity of the building could be implemented.

If an historic district is created at Rocky Flats, actions taken with regard to any buildings in the district, including modifying them for waste storage, would have to be consistent with the conditions underlying creation of the district. Those conditions may prevent making any changes to buildings, allowing changes only to building interiors, permitting changes to both the interior and exterior of a building, or allowing full or partial demolition.

3.5 Natural Environment

This section provides a description of the climate, habitats and biota, and air quality at and around the Site. Because the Proposed Action would take place in buildings, it would not be expected to have any effects to any elements of the natural environment with the possible exception of air quality due to the possibility of air emissions. Other elements, such as geology, surface and groundwater, wetlands, and floodplains are consequently not discussed.

3.5.1 Climate

The climate at the Site is moderate, with cold and hot extremes usually of short duration and cloud cover absent about 70 percent of the time (DOE 1992a). The area is semi-arid with an average annual precipitation of 15 inches. The prevailing winds are out of the northwest with an average velocity of 10 miles per hour in the springtime, but westerly gusts in excess of 60 miles per hour are not uncommon and occasional winter gusts may exceed 100 miles per hour (DOE 1992a, 1995b).

3.5.2 Habitats and Biota

The plant and animal communities within the habitats at the Site are comprised of 512 plant, 174 arthropod, 8 reptile, 4 amphibian, 9 fish, 167 bird, and 36 mammal species (DOE 1992a). The majority of these species occur in the Buffer Zone. Table C-1 (see Appendix C) lists the species of concern known to occur at the Site and Table C-2 (also in Appendix C) lists those species of concern that have potential habitats at the Site.

The habitat types and species diversity at the Site are primarily determined by the amount of moisture available for the production of plant material. The distribution of moisture may be broadly categorized into xeric (dry), mesic (moderate moisture) and hydric (wet) zones (see Glossary). The habitats that are most closely associated with, and in proximity of, the Proposed Action are the disturbed xeric mixed grasslands and mesic mixed grasslands within the Industrial Area, the mesic mixed grasslands on the hillside south of Building 440 and

Building 881, and the short upland shrub and bottomland shrub subcommunities within the riparian habitat (part of the hydric zone) along Woman Creek. The majority of the Industrial Area is developed and although these disturbed lands are within the xeric and mesic zones, there is very little area of vegetation or natural habitat.

3.5.3 Air Quality

The greater metropolitan Denver area, including the Site, is in a non-attainment area for carbon monoxide and particulate matter less than 10 microns in diameter and is in interim compliance for ozone. Emissions from the Site are within regulatory limits for all potential pollutants, including radionuclides, that have published standards (DOE 1995b).

4.0 ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION AND ALTERNATIVES

Activities planned for the Proposed Action and No Action alternatives would take place entirely within the Industrial Area and primarily inside existing buildings. Therefore, neither of the alternatives is expected to affect water or biological resources. A review of wetlands and floodplains indicates that neither the Proposed Action nor the No Action alternative would result in adverse impacts to either resource. Air emissions would not exceed health-based radiological standards set by the Environmental Protection Agency in 40 CFR 61(h). A DOE facility also cannot emit radionuclides in amounts that would cause any member of the public to receive a dose in excess of 10 mrem/year. At the safety limits for the bounding accident, 2,250 kilograms of stored radionuclides per building (see Section 2.1.6), the CEDE is approximately 0.06 mrem/year per building, assuming one stage of HEPA filtration. All nine of the buildings proposed here, if filled to that capacity, would contribute only 0.6 mrem/year to the Site-derived dose to a member of the public, far below the standard.

All Proposed Action buildings expect Building 906 and the un-built IDM Drum Storage Facility have been determined to be eligible for listing on the National Register for Historic Places. The Proposed Action has the potential to adversely affect the remaining seven buildings that are proposed for conversion to waste storage (Buildings 374, 440, 444, 551, 865, 881, and 883). Consequently, prior to alterations to any of the seven buildings, possible adverse impacts would be mitigated through negotiations with the State Historic Preservation Officer prior to beginning work.

None of the alternatives is expected to cause any adverse environmental effects; therefore, this section focuses on human health risks. Potential human health risks may arise from routine operations or accidents. Routine operations are those that proceed according to a predetermined plan and are conducted in strict accordance with DOE guidance. In contrast, accidents are unplanned, but the probability of their occurrence (or frequency) can be estimated. DOE guidance classifies individual accident risks according to their expected frequencies and consequences (DOE 1992b, 1992c, 1994b, and 1994c). The frequency of an accident is considered "anticipated" if it is estimated to occur more than once in 100 years; "unlikely" if it is estimated to occur less often than once in 100 years but more frequently than once every 10,000 years; and "extremely unlikely" if it is estimated to occur less often than once in 10,000 years. For example, an earthquake at the Site would be considered an unlikely event because it is estimated to occur 1.2 times in 1,000 years.

Potential consequences from accidents may involve releases of radionuclides or chemicals; however, for the public and co-located worker, radiological consequences are the most significant due to the small quantities of chemicals present in most waste types and, therefore, this assessment only considers radiological exposure in its human health risk analysis. Radiological consequences are evaluated based on the CEDE a person may experience from an accidental release. LL, LLM, TRU, and TRUM waste emit ionizing radiation at low levels; however, alpha and beta radiation is blocked from reaching the public or workers by containers and buildings. An accident may cause the containers to be breached such that waste is spilled resulting in a potential exposure to radionuclides. Radiological accident consequences are considered "high" if the CEDE to the maximally-exposed offsite individual exceeds 5 rem or if the CEDE to the co-located worker exceeds 25 rem. Consequences are "moderate" if the maximally-exposed offsite individual CEDE is less than or equal to 5 rem but greater than 0.1 rem, or if the co-located worker CEDE is less than or equal to 25 rem but greater than 0.5 rem. Consequences are considered "low" if the maximally-exposed offsite individual CEDE is less than or equal to 0.1 rem or if the co-located worker CEDE is less than or equal to 0.5 rem.

Criticalities (an accidental, self-sustained atomic chain reaction; see Glossary) are not considered in the accident assessment. An important study has shown that no configuration of LL or LLM waste could cause a criticality (Mitchell 1993). A criticality resulting from improper stacking of TRU waste containers is conceivable but extremely unlikely. The Site's Criticality Safety Program would provide assurance that a criticality remains extremely unlikely through criticality safety evaluations and regular program reviews for each waste storage building. The following sections summarize both routine and accident risk for the Proposed and No Action Alternatives.

5.0 AGENCIES AND PERSONS CONSULTED

None

6.0 REFERENCES

EG&G Rocky Flats, Inc. (EG&G). 1994a. Strategic Engineering Analysis Risk Assessment Methodology (SEA RAM), Volume I, Part II: Ecological Risk Assessment Methodology. July 29, 1994.

EG&G Rocky Flats, Inc. (EG&G). 1994b. Hazard Communication Program, HSP 9.07. EG&G Rocky Flats, Inc., Golden, CO. March.

Kaiser-Hill Company (KH). 1995a. Interoffice Memorandum to Bill Moore from Robyn Ramsey regarding Air Emission Assessment of Proposed Waste Storage and Repackaging Activities - RSR-024-95. December 13, 1995. (See Appendix A).

Kaiser-Hill Company (KH). 1995b. Interoffice Memorandum to Bill Moore from Don Swanson regarding Latent Cancer Risks. December 7, 1995

Kelsey, C.T. 1995. External Exposure Controls Applicable to Planned Waste Drum Storage in Buildings 881 and 440. Radiation Engineering Projects and Programs, Kaiser-Hill Company, Golden, CO. September 1995.

Mitchell, M.V. 1993. Criticality Analysis of Rocky Flats Plant Low Level Waste. NSTR-0002-93. Criticality Safety Engineering, EG&G Rocky Flats, Inc., Golden, CO. February 23, 1993.

Science Applications International Corporation (SAIC). 1995. Final Cultural Resources Survey Report. Golden, CO. October 1995.

U.S. Department of Energy (DOE). 1992a. Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant. Final Report. September 1992.

U.S. Department of Energy (DOE). 1992b. Nuclear Safety Analysis Reports, DOE Order 5480.23. U.S. Department of Energy, Washington, DC. April 30.

U.S. Department of Energy (DOE). 1992c. Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports. DOE Standard 1027-92. U.S. Department of Energy, Washington, DC. December.

U.S. Department of Energy (DOE). 1994a. Final Environmental Assessment and Finding of No Significant Impact Drum Storage Facility for Interim Storage of Materials Generated by Environmental Restoration Operations. DOE/EA-0995. September 1994.

U.S. Department of Energy (DOE). 1994b. Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports, DOE Standard 3009-94. U.S. Department of Energy, Washington, DC. July.

U.S. Department of Energy (DOE). 1994c. Guidance for the Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans, DOE Standard 3011-94, U.S. Department of Energy, Washington, DC. November 1994.

U.S. Department of Energy (DOE). 1994d. Rocky Flats Environmental Technology Site Environmental Report for 1994. USDOE, Golden, CO.

U.S. Department of Energy (DOE). 1995a. 1994 Population, Economic, and Land Use Data Base for Rocky Flats Environmental Technology Site. Final Report. March 1995.

U.S. Department of Energy (DOE). 1995b. Draft Environmental Assessment for the Consolidation and Interim Storage of Special Nuclear Material at Rocky Flats Environmental Technology Site. April 1995.

7.0 GLOSSARY

This glossary is provided to aid in the understanding of technical terms used in this Environmental Assessment. Alternate definitions may exist that are not applicable to the intended usage in this document. Also provided are conversions from Scientific International units to the American units to aid in understanding various units of measure.

air pollutant: Any fume, smoke, particulate matter, vapor, gas, or combination thereof that is emitted into or otherwise enters the atmosphere, including, but not limited to, any physical, chemical, biological, radioactive (including source material, Special Nuclear Material, and byproduct materials) substance, or material, but does not include water vapor or steam condensate.

alpha particle: A positively charged particle emitted from the nucleus of an atom having the same charge and mass as that of a helium nucleus (2 protons, 2 neutrons).

as-low-as-reasonable-achievable: An approach to radiation protection to minimize and control exposures to workers and the public to "as-low-as-reasonably-achievable," taking into account social, technical, economic, and public policy considerations.

beta particle: A negatively charged particle emitted from the nucleus of an atom having a mass and charge eqaal to that of an electron.

bounding accident (scenario): In general, the accident of the event that results in the release of the largest quantity of radioactive or chemically hazardous material.

Buffer Zone: The undeveloped portion of the Site consisting of approximately 5,882 acres surrounding the developed, or industrial area.

committed effective dose equivalent: A calculated value used to allow comparisons of total health risk, based on cancer mortality and genetic damage, from exposure of different types of ionizing radiation to different body organs. It is calculated by first calculating the dose equivalent to those organs receiving significant exposures, multiplying each organ dose equivalent by a health risk weighting factor, and then summing those products. One millirem effective dose equivalent from natural background radiation would have the same health risk as one millirem effective dose equivalent from an artificially produced source of radiation.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): A Federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The Acts created a special tax that goes into a trust fund, commonly known as Superfund, to investigate and address the nation's abandoned or uncontrolled hazardous waste sites. Under the program, EPA can either: 1) pay for cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work; or 2) take legal action to force parties responsible for site contamination to clean up the site or pay back the federal government for the cost of the cleanup.

concentration: The amount of a specified substance or amount of radioactivity in a given volume or mass.

contamination: The deposition of unwanted radioactive or hazardous material on or in structures, areas, objects, air, water, or personnel.

criticality: A condition which results in an emission of a large quantity of radiation. Criticality occurs when the number of neutrons initiating a fission reaction results in the production of an equal number of neutrons, and is a necessary condition for a sustained nuclear chain reaction. The events are hazardous if they do not occur under controlled conditions.

decay, radioactive: The spontaneous transformation of one radionuclide into a different radioactive or nonradioactive nuclide, or into a different energy state of the same radionuclide.

decontamination: The removal of hazardous or radioactive material from other material.

dose: The quantity of a beneficial or harmful substance which a person receives. Refers to the radiation protection concepts of dose equivalent and effective dose equivalent.

dose, absorbed: The amount of energy deposited by radiation in a given mass of material.

dose commitment: The total radiation dose projected to be received from an exposure to radiation or intake of radioactive material throughout the specified remaining lifetime of an individual. In theoretical calculations, this specified remaining lifetime is usually assumed to be 50 years.

dose equivalent: A modification to absorbed dose that expresses the biological effects of all types of radiation (e.g. alpha, beta, gamma) on a common scale. The unit of dose equivalent is the rem.

downdraft table: A working area with an air removal system that draws air across the working surface and vents it to the outside to prevent the exposure of workers to hazardous gasses.

emission: A release of a gas, liquid, solid, or radionuclide from a process.

enriched uranium: Uranium in which the amount of one or more fissionable isotopes has been increased above that occurring in nature.

exposure: A measure of the ionization produced in air by X-ray or gamma radiation. The unit of exposure is the Roentgen or rem. Also, to subject to the harmful effects of hazardous or radioactive materials.

gamma ray: High-energy, short-wavelength electromagnetic radiation emitted from the nucleus of an atom. Gamma radiation frequently accompanies the emission of alpha or beta particles. Gamma rays are identical to X-rays except for the source of the emission.

glovebox: A sealed system that provides containment of radioactive materials, in which workers, using gloves attached to and passing through openings in the box, can handle radioactive materials safely from the outside.

half-life, radioactive: The time required for a given radionuclide to lose half of its activity by radioactive decay. Each radionuclide has a unique half-life.

health effects: For radiation exposure, health effects are the excess cancer deaths above background expected to occur from the exposure of a population.

HEPA filter: High-efficiency particulate air filters remove minute particles from the air stream; used in the plenums filtering exhaust air from buildings where radioactive or toxic material is present. HEPA filters are capable of a particulate removal efficiency of 99.97 percent for 0.3 micron particles.

hydric: Habitat characterized by an abundance of moisture.

Industrial Area: The 384-acre area in the center of the Site where production and support buildings are located.

interim storage: The temporary holding of material when disposal space is not available. Monitoring and security are provided, and subsequent action involving treatment, transportation, or final disposition is expected.

ionizing radiation: Radiation capable of removing one or more electrons from atoms, leaving positively charged particles such as alpha and beta, and nonparticulate forms such as X-rays and gamma radiation.

low-level mixed waste (LLM): Low-level radioactive waste that also contains contaminants classified as hazardous.

low-level waste (LL): Waste material having a concentration of less than 100 nanoCuries of alpha activity from transuranic elements per gram. Transuranic elements have atomic numbers greater than 92 and half-lives greater that 20 years.

Maximally-exposed Offsite Individual: The person in the position to receive the maximum exposure from release of contamination. For routine air emissions calculations, the maximally-exposed offsite individual is the nearest downwind resident (approximately 4,000 meters east-southeast of the Site's Industrial Area). For accident exposure calculations, the maximally-exposed offsite individual is the individual at the nearest point of public access to the accident site (approximately 1,900 meters to the west).

mesic: Areas characterized by moderate moisture conditions.

nanoCurie (nCi): 10^{-9} Ci, one-billionth of a Curie; 37 disintegrations per second.

National Conversion Pilot Project: The National Conversion Pilot Project for the Site was approved by Secretary of Energy Hazel R. O'Leary on December 15, 1993. The goal of the five-year project is to convert former production facilities at the Site to beneficial use. The primary initial activity involves a proposal to recycle radioactive contaminated scrap metal into waste containers.

natural phenomena: Earthquakes, tornados, floods, high winds, lightning, meteorites, or any other naturally occurring event.

natural radiation: Radiation arising from cosmic sources and from naturally occurring radionuclides (such as radon) present in the environment.

neutron: An uncharged particle of a slightly greater mass than a proton; a constituent of atomic nuclei (except hydrogen) able to penetrate extreme thicknesses of certain materials.

order of magnitude: A range of values extending from some value to ten times that value.

pathway: Potential route for exposure to radioactive or hazardous materials.

Permacon: a stand-alone containment house for repackaging waste.

person-rem: The traditional unit of collective dose to a population group. For example, a dose of 1 rem to 10 individuals results in a collective dose of 10 person-rem.

plenum: A chamber in a ventilation system generally housing banks of filters.

plutonium (Pu): A heavy, radioactive, man made, metallic element with an atomic number of 94, produced by neutron irradiation of uranium-238. Its most important isotope is fissile Pu-239. It is used for reactor fuel and in nuclear weapons.

Protected Area: The portion of the Site's Industrial Area encompassed by physical barriers, such as walls or fences, to which access is controlled, and that contains Special Nuclear Material or surrounds a material access area or a vital area.

radiation: The electromagnetic energy or particles emitted from atoms as a result of a nuclear transformation. The term includes alpha and beta particles, gamma radiation, X-rays, neutrons, and cosmic radiation. Nuclear radiation is that emitted from atomic nuclei in various nuclear reactions.

radioactivity: The spontaneous emission of radiation, generally alpha or beta particles, often accompanied by gamma rays from the unstable nucleus of an atom.

radiological: That which involves radioactive or nuclear materials.

radionuclide: An atom having an unstable ratio of neutrons to protons so that it will tend toward stability by undergoing radioactive decay. A radioactive nuclide.

release: The discharge of contaminants into the environment (air, water, or soil).

REM (Roentgen equivalent man): The traditional unit of dose equivalent. Dose equivalent is frequently reported in units of a liquid, which is one-thousandth of a rem.

residues: A variety of solid industrial materials used in process and fabrication operations at the Site that become contaminated with Special Nuclear Materials (chiefly plutonium) at levels high enough that it was considered desirable to recover the nuclear materials. Residues were collected and stored at the Site pending initiation of recovery processes. With the end of the Cold War and the Site's change of mission, recovery of the nuclear materials became much less desirable and residues were reclassified as waste.

riparian: The habitat immediately adjacent to flowing water.

risk: An expression of the probability of a negative or unwanted consequence. Mathematically, it can be expressed as the probability of an undesirable event occurring in an interval of time multiplied by the consequences of the event.

safeguards: Precautionary measures to prevent the unwanted or unauthorized diversion of nuclear materials.

seismicity: The relative magnitude, frequency, and distribution of earthquakes.

Special Nuclear Material: Plutonium, uranium enriched in isotope 233 or in isotope 235, and any other material which is determined to be Special Nuclear Material, pursuant to Section 51 of the Atomic Energy Act of 1954, but does not include source material, or any material artificially enriched by any of the forgoing.

standards: Acceptable limits established by recognized authorities.

transuranic (TRU) waste: Radioactive waste containing primarily alpha emitters of elements heavier than uranium, in an amount producing 100 nCi or more of alpha activity per gram of waste.

transuranic: Those elements on the chemical periodic chart that have element numbers higher than that of uranium (92). These elements include plutonium and americium.

TRUPACT-II containers: TRUPACT-II containers are certified by the Nuclear Regulatory Commission as Type B packaging per 10 CFR 71. Type B packages are utilized for larger quantities of radioactive materials and, in addition to meeting "normal" transportation conditions, are designed and tested to a series of hypothetical accident conditions. Test conditions for Type B containers include a free drop of 30 feet onto a flat, unyielding surface; a 1 meter free drop onto a steel bar designed to test for puncture resistance; a thermal test at temperatures of 800 degrees Celsius for a period of 30 minutes; and, an emersion test where the drum is immersed in 50 feet deep water for a period of 8 hours. The major components of the packaging include stainless steel containment vessels with removable lids surrounded by thermal insulation and a steel shell. TRUPACT-II containers have a capacity of up to fourteen 55-gallon drums.

Uranium (U): A radioactive element with the atomic number 92 found in naturally occurring ores. It has an average atomic weight of approximately 238. The two principal natural isotopes are U-235 (0.7 percent by weight of natural uranium), which is fissile, and U-238 (99.3 percent by weight of natural uranium), which is fertile. Natural uranium also contains a minute amount of U-234.

vital safety system: A system that is relied upon to detect or mitigate the radiological consequences of an accident, including criticality. Examples are heating, ventilation and air conditioning systems, alarm systems, and public address systems.

waste: A term applied to any source or Special Nuclear Material which is no longer useful and which is uneconomical or infeasible to recover, including that which has become radioactive to the extent that the material itself exhibits radioactivity of such a level that it must be handled and disposed of by special methods in order to protect workers or the general public.

xeric: Habitat characterized by a low supply of moisture such as a dry, rocky plateau and ridge top areas.

APPENDICES

APPENDIX A

Air Emissions Assessment of Proposed Radioactive Waste Storage Activities

KAISER • HILL
COMPANY

INTEROFFICE MEMORANDUM

DATE: December 13, 1995

TO: Bill Moore, Environmental Protection NEPA Group, Bldg. T130C, X8132

FROM: Robyn Ramsey, Air Quality Management, Bldg. T130C, X3484 Robyn S. Ramsey

SUBJECT: AIR EMISSION ASSESSMENT OF PROPOSED RADIOACTIVE WASTE STORAGE ACTIVITIES - RSR-024-95

Concerning radioactive waste to be stored in buildings at the Rocky Flats Environmental Technology Site (Site), per your request, I have calculated the quantities of radionuclides which would trigger monitoring and permitting requirements under federal Clean Air Act regulation 40 CFR 61, Subpart H. In addition, I have calculated the number of drums stored in a building at the Site, assuming bounding volatile organic compound (VOC) and hazardous air pollutant (HAP) concentrations for head space, that would trigger Air Pollutant Emission Notice (APEN) and air permitting requirements. Summaries of the assessment results are provided in three tables in Attachment 1.

The current waste storage scope includes Buildings 374, 440, 444, 460, 551, 865, 881, 883, 906, 991 and the proposed Investigative Derived Materials (IDM) building. These assessments are based on the information and assumptions described below. Air Quality Management (AQM) must be notified if and when it is determined that the proposed waste storage activities will be implemented so that appropriate reporting and documentation can be completed.

Summary of Information and Assumptions

- The waste to be stored includes existing and future solid and liquid low-level (LL), low-level mixed (LLM), and low-level Toxic Substances Control Act (LLT) wastes and solid transuranic (TRU) wastes.
- The types of radionuclides that may be present in the waste to be stored at the Site include weapons grade plutonium (WG Pu), depleted uranium (U), and enriched U.
- The mixture of drums and crates to be stored in any given building is unknown at this time and may vary over the life of waste storage activities. However, the worst case air emission scenario would be to store just drums in a building, because drums are typically vented and crates are not.
- For this assessment, it is assumed that all the non-liquid waste drums are vented to the room atmosphere to alleviate any hydrogen gas accumulation due to continuing radiolysis.
- Drums of liquid waste are sealed and are not vented; therefore, no air emissions are anticipated from them.

- Drum vents consist of a carbon composite filter assembly mounted in the lid of each drum that is at least 99.97 percent efficient in collecting 0.3 to 0.5 micron size particles (equivalent to a High Efficiency Particulate Air [HEPA] filter with respect to particulate). NOTE: A 99 percent efficiency is used for radionuclide emission calculations.
- The VOCs present in the drum headspace will vent with the hydrogen. Some of the VOCs are also characterized as HAPs.
- Potential non-radioactive HAP and VOC air emissions generated during drum storage are estimated based on the information and methodology provided by Terry Hummel and Eric D'Amico of Radioactive and Regulated Waste Programs (a draft of 95-RM-WM-00071-KH was received December 12, 1995). The memo describes how results of headspace analysis of various Item Description Codes (IDCs) of waste for 28 VOCs (12 of which are also characterized as HAPs) can be used to determine bounding concentrations for the 86 IDCs of waste that will be stored in the 11 buildings being reviewed in this assessment. Of the 43 IDCs for which head space analysis has been completed, 27 are among the 86 IDCs to be reviewed in this assessment. A list of the IDCs to be stored and/or for which head space analysis has been done is provided in Attachment 2.
- The highest average contaminant level, by IDC (of the 27 IDCs in this assessment for which head space analysis available), is considered to bound the population of drums to be stored (87 IDCs). Air emissions generated during drum storage are calculated by assuming that each of the drums vents 104 liters of gas (50 % of the drum volume) annually.
- Based on a review of the IDCs and waste forms listed in the Backlog Waste Reassessment Baseline Book, the wastes to be sheltered in the buildings are primarily solid (as opposed to particulate solid) material. The drum contents are contained within two plastic drum liner bags, or within one plastic drum liner bag inside a solid drum liner. Because of this physical state the radioactive component of the waste is best represented as a solid for air emission analyses.
- If, during storage, containment will be breached or if the liner of the drum is known to be damaged, the radioactive component of the waste should be treated as a particulate solid for air emission analyses.
- During repackaging activities the containment for the waste is breached and the potential to release particulate and VOCs exists. Because of this, the physical state of the radioactive component of the repackaged waste is best represented as a particulate solid for air emission analyses.
- At no time during waste repackaging are liquids allowed to evaporate for the purpose of disposal.
- For the purpose of calculating Am-241 ingrowth, the average age of WG Pu present in the waste is assumed to be 20 years.
- The activity of WG Pu, enriched U, and depleted U are listed in Attachment 3.
- Building exhaust stack heights and diameters are listed in Tables 1 and 2 of Attachment 1 and their origins are listed in Attachment 4.

- The most impacted receptor is at the corner of 96th and Indiana (for radioactive air emission analysis purposes) and the distance for each of the buildings to that corner is listed in Tables 1 and 2 of Attachment 1 as well as in Attachment 5.

Radioactive Air Emission Assessment

40 CFR 61 Subpart H requires that continuous air effluent monitoring be in place in all locations whose uncontrolled emissions result in a dose of 0.1 mrem/year or greater. This means that no filtration efficiencies can be used in calculating the potential emissions. The Site uses the dose model CAP88-PC (Version 1.0) for calculating the EDE to the public, as specified in 40 CFR 61 Subpart H. Printouts of the dose model results are included in the back-up documentation for this assessment and are on file with AQM. Table 1 shows the mass of WG Pu, enriched U, and depleted U that would result in an uncontrolled dose of 0.1 mrem/year under normal operating scenarios. The quantities of radionuclides listed in Table 1 only apply if only WG Pu or only enriched U are present in the waste. If multiple radionuclides are present in the waste then the actual dose is the sum of the doses from the individual radioactive components.

i.e. In Building 374 if you have:

	63.29 kg	WG Pu	-->	0.1 mrem/year
and				
	2.27E+05 kg	Enriched U	-->	0.1 mrem/year
therefore:				
	TOTAL DOSE			0.2 mrem/year

However, in Building 374 if you have:

	30 kg	WG Pu	-->	0.0474 mrem/year
and				
	1.0E+05 kg	Enriched U	-->	0.0441 mrem/year
therefore:				
	TOTAL DOSE			0.0915 mrem/year

If the potential (uncontrolled) dose is greater than 0.1 mrem/year, continuous radionuclide air effluent monitoring is required and a shrouded probe monitor must be installed in the exhaust duct of the subject building. Please contact Bob Nininger of Compliance & Performance Assurance at X4663 for more information on shrouded probe monitoring requirements.

In addition 40 CFR 61 Subpart H requires that notification be made to the Environmental Protection Agency (EPA) for all sources whose controlled emissions result in a dose of 0.1 mrem/year or greater. Table 2 shows the mass of WG Pu, enriched U, and depleted U that would result in a controlled dose of 0.1 mrem/year assuming only the control efficiency of the carbon filter drum vent. Additional filtration (i.e. HEPA filtration for the buildings) can result in allowable increases in quantity stored. As stated above, the quantities of radionuclides listed in Table 2 only apply if only WG Pu or only enriched U etc. are present in the waste. If multiple radionuclides are present in the waste then the actual dose is the sum of the doses from the individual radioactive components.

Non-Radioactive Air Emission Assessment

The Colorado Air Quality Control Commission (CAQCC) Regulation No. 3 regulates non-radioactive air pollutant emissions for all Colorado industries. The provisions of this regulation identify criteria air pollutants and HAPs, establish air inventory reporting thresholds for regulated air pollutants, and set forth both construction and operating permit application guidelines. The reporting and permitting thresholds are 250 pound for any individual HAP and 2,000 pounds for total HAPs or VOC air emissions.

Based on the assumptions noted above, the air pollutant demonstrating the highest concentration in the headspace gas is methylene chloride. The number of vented drums required to reach the 250 pound reporting threshold for potential methylene chloride air emissions is 8,639 drums stored in one building. A summary of the pollutant concentrations and emissions is listed in Table 3. The total estimated potential VOC and HAP air emissions generated annually during the storage of 8,605 drums in one building are 478 pounds per year of VOCs and 382 pounds per year of HAPs (potential methylene chloride air emissions from storage of 8,605 drums is 249 pounds - less than the 250 pound APEN and permitting threshold).

In addition, a log of actual drums stored in each building must be maintained and be available for inspection by the Colorado Department of Public Health and Environment (CDPHE). If more than 8,639 drums is to be stored in any one building then the appropriate air emission inventory and air permitting requirements from CAQCC Regulation No. 3 must be followed. Total HAP and VOC emissions from drum storage activities will be included in the cumulative Site total. If cumulative Site emissions exceed 10 tons per year for a single HAP or 25 tons per year for all HAPs, additional regulatory requirements must be met which will impact all future activities at the Site.

If you have any questions on this air emission assessment please contact me at extension 3484 or digital pager 1868.

Attachments:
As Stated (5)

cc:
T. L. Hummel
R. C. Nininger
C. A. Patnoe
G. L. Potter

TABLE 1

Approximate Mass of Radionuclide Required to Reach 0.1 mrem/yr (uncontrolled) EDE Monitoring Threshold

(kilograms)

	Modeling Variables (in meters)			Weapons Grade Plutonium		Enriched Uranium		Depleted Uranium	
	Distance to Receptor	Stack Height	Stack Diameter	Particulate Solid	Solid	Particulate Solid	Solid	Particulate Solid	Solid
Bldg 374	4,648 m	13.11 m	1.10 m	6.33E-02	63.29	227.41	2.27E+05	4.24E+04	4.24E+07
Bldg 440	4,343 m	7.62 m	1.83 m	5.71E-02	57.14	205.32	2.05E+05	3.82E+04	3.82E+07
Bldg 444	4,458 m	4.19 m	2.14 m	6.02E-02	60.24	216.45	2.16E+05	4.03E+04	4.03E+07
Bldg 460	4,496 m	8.54 m	1.51 m	5.99E-02	59.88	215.15	2.15E+05	4.01E+04	4.01E+07
Bldg 551	4,343 m	10.00 m	0.50 m	5.71E-02	57.14	205.32	2.05E+05	3.82E+04	3.82E+07
Bldg 865	3,924 m	4.65 m	1.55 m	4.95E-02	49.50	177.87	1.78E+05	3.31E+04	3.31E+07
Bldg 881	3,886 m	16.46 m	2.44 m	4.98E-02	49.75	178.76	1.79E+05	3.33E+04	3.33E+07
Bldg 883	3,962 m	11.49 m	1.77 m	5.00E-02	50.00	179.65	1.80E+05	3.35E+04	3.35E+07
Bldg 906	3,658 m	2.80 m	0.61 m	4.52E-02	45.25	162.58	1.63E+05	3.03E+04	3.03E+07
Bldg 991	3,734 m	3.99 m	1.31 m	4.61E-02	46.08	165.58	1.66E+05	3.08E+04	3.08E+07
IDM Bldg	3,467 m	2.80 m	0.61 m	4.17E-02	41.67	149.71	1.50E+05	2.79E+04	2.79E+07

NOTE: For the determination of a monitoring requirement, no credit may be assumed for any reduction in emissions due to filtration.

It is assumed that the radioactive component of waste stored in drums is best represented as "solid" during storage and "particulate solid" during waste repackaging.

TABLE 2

Approximate Mass of Radionuclide Required to Reach 0.1 mrem/yr (controlled) EDE Permitting Threshold

(Monitoring already in place)

(kilograms)

	Modeling Variables (in meters)			Weapons Grade Plutonium		Enriched Uranium		Depleted Uranium	
	Distance to Receptor	Stack Height	Stack Diameter	Particulate Solid	Solid	Particulate Solid	Solid	Particulate Solid	Solid
Bldg 374	4,648 m	13.11 m	1.10 m	6.33	6,329.11	22,740.97	2.27E+07	4.24E+06	4.24E+09
Bldg 440	4,343 m	7.62 m	1.83 m	5.71	5,714.29	20,531.85	2.05E+07	3.82E+06	3.82E+09
Bldg 444	4,458 m	4.19 m	2.14 m	6.02	6,024.10	21,645.02	2.16E+07	4.03E+06	4.03E+09
Bldg 460	4,496 m	8.54 m	1.51 m	5.99	5,988.02	21,515.41	2.15E+07	4.01E+06	4.01E+09
Bldg 551	4,343 m	10.00 m	0.50 m	5.71	5,714.29	20,531.85	2.05E+07	3.82E+06	3.82E+09
Bldg 865	3,924 m	4.65 m	1.55 m	4.95	4,950.50	17,787.49	1.78E+07	3.31E+06	3.31E+09
Bldg 881	3,886 m	16.46 m	2.44 m	4.98	4,975.12	17,875.99	1.79E+07	3.33E+06	3.33E+09
Bldg 883	3,962 m	11.49 m	1.77 m	5.00	5,000.00	17,965.37	1.80E+07	3.35E+06	3.35E+09
Bldg 906	3,658 m	2.80 m	0.61 m	4.52	4,524.89	16,258.25	1.63E+07	3.03E+06	3.03E+09
Bldg 991	3,734 m	3.99 m	1.31 m	4.61	4,608.29	16,557.94	1.66E+07	3.08E+06	3.08E+09
IDM Bldg	3,467 m	2.80 m	0.61 m	4.17	4,166.67	14,971.14	1.50E+07	2.79E+06	2.79E+09

NOTE: These allowable mass quantities are derived assuming that drums are vented through a carbon filter with 99% efficiency and no HEPA filtration for the buildings. Additional filtration can result in allowable increases in quantity stored.

It is assumed that the radioactive component of waste stored in drums is best represented as "solid" during storage and "particulate solid" during waste repackaging.

TABLE 3

ESTIMATED EMISSIONS FROM STORAGE OF DRUMS
(assuming all drums are vented through a carbon filter assembly)

Compound	Molecular Weight	IDC with Worst Average (Detected)	Bounding Worst Case Average (ppmv)	Volume assumed to release to the air (l)	Pounds per Drum (lbs)	Number of Drums Required to Reach 250 lbs	Emissions from Maximum Drums Allowed to Stay Under the Threshold (lbs) 8,605 Drums
Methanol	32.04	480	11,479.0	104	2.81E-03	88,811	24.22
Ethyl ether	74.12	852	168.9	104	9.58E-05	2,609,141	0.82
Trichlorotrifluoroethane	187.38	330	54.8	104	7.86E-05	3,180,964	0.68
1,1-Dichloroethene	96.94	480	228.2	104	1.69E-04	1,476,536	1.46
Acetone	58.09	332	461.6	104	2.05E-04	1,218,135	1.77
Methylene Chloride	84.93	852	44,517.4	104	2.89E-02	8,639	249.00 *
1,1-Dichloroethane	98.96	852	168.7	104	1.28E-04	1,956,536	1.10
cis-1,2-Dichloroethene	96.94	807 & 441	0.3	104	2.23E-07	1,123,151,484	0.00
2-Butanone	72.11	480	1,061.2	104	5.86E-04	426,845	5.04
Chloroform	119.37	336	1,748.1	104	1.60E-03	156,531	13.74
1,1,1-Trichloroethane	133.4	339	3,766.9	104	3.85E-03	65,001	33.09
Cyclohexane	84.18	825	1,022.1	104	6.59E-04	379,630	5.67
Carbon Tetrachloride	153.81	336	4,343.3	104	5.11E-03	48,894	44.00
Benzene	78.12	480	228.2	104	1.36E-04	1,832,250	1.17
1,2-Dichloroethane	98.96	480	228.0	104	1.73E-04	1,447,665	1.49
1-Butanol	72.12	480	2,748.6	104	1.52E-03	164,777	13.05
Trichloroethene	131.38	480	691.0	104	6.95E-04	359,795	5.98
4-Methyl-2-Pentanone	199.18	480	1,667.0	104	2.54E-03	98,374	21.87
Toluene	92.15	480	584.5	104	4.12E-04	606,433	3.55
Tetrachloroethene	165.83	803	1.7	104	2.16E-06	115,864,551	0.02
Chlorobenzene	112.56	341	0.4	104	3.45E-07	725,468,449	0.00
Ethylbenzene	106.18	821	925.1	104	7.52E-04	332,530	6.47
m,p-Xylene	106.18	821	3,929.9	104	3.19E-03	78,278	27.48
o-Xylene	106.18	821	1,282.8	104	1.04E-03	239,806	8.97
Bromoform	252.75	852	168.9	104	3.27E-04	765,142	2.81
1,1,2,2-Tetrachloroethane	167.84	821	41.7	104	5.36E-05	4,666,928	0.46
1,3,5-Trimethylbenzene	120.12	821	41.8	104	3.84E-05	6,505,355	0.33
1,2,4-Trimethylbenzene	120.12	480	455.8	104	4.19E-04	596,586	3.61
Total VOC							**477.84**
Total HAP							***381.88***

Note: *VOCs which are also HAPs are indicated with italics*

* The number of drums required to reach the 250 pound reporting threshold for methylene chloride emissions is 8,639 drums stored in one building. Therefore, drum storage is limited to 8,605 drums in one building, which results in 249 pounds of methylene chloride air emissions per year (if more than 8,605 drums are to be stored in one building an APEN is required).

IDC List - Overall Waste Storage EA

IDC	Head Gas Anal Done Y/N	Drums in Data-base	Dup Anal Done on Drums	Anal Results for Drums	Plans to Store?	Description
0					yes	Empty Containers
7	Y	6	1	6	yes	Bypass Sludge - Bldg 374
69					yes	Roaster Oxide D-38
201					yes	Sealed Sources
295					yes	Sewer Sludge
296					yes	Compost Waste
300					yes	Graphite Molds
301					yes	Classified Graphite Shapes
302					yes	Benelex and Plexiglass
303					yes	Scarfed Graphite Chunks
312	Y	3	0	0	yes	Coarse Graphite
320					yes	Heavy Non-SS Metal (Ta, W, Pt)
321	Y	1	0	1	yes	Lead
325					yes	Mixed IDCs Outside PA (Mixed Waste)
326					yes	Mixed IDCs, Low-Level Waste Outside PA
327					yes	Cemented Composite Chips
330	Y	4	1	4	yes	Dry Combustibles
332	Y	1	0	1	yes	Oily Sludge, Liquid
332	Y	1	0	1	yes	* Oily Sludge, in Diatomaceous Earth
335	Y	1	0	1	yes	Absolute Drybox Filters, Not Acid Contaminated
336	Y	7	0	7	yes	Wet Combustibles
337	Y	3	1	3	yes	Plastic (Teflon, PVC, Poly, etc.)
338	Y	6	2	6	yes	Filter Media
339	Y	14	2	12	yes	Leaded Drybox Gloves, not acid contaminated
341	Y	6	2	6	yes	Leaded Drybox Gloves, acid contaminated
342	Y	1	0	0	yes	Absolute Drybox Filters, Acid Contaminated
360					yes	Al Oxide Ceramic Crucibles
368	Y	3	1	3	yes	Mg Oxide Ceramic Crucibles - Not LECO
370					yes	LECO Crucibles
372					yes	Grit
374					yes	Blacktop, Concrete, Dirt, and Sand
375	Y	1	0	1	yes	Oil Dri
376	Y	3	0	3	yes	Processed Filter Media
377	Y	1	0	1	yes	Fire Brick, coarse
378	Y	1	0	0	yes	Fire Brick, pulverized or fines
398	Y	1	0	1	yes	Pulverized Sand, Slag, and Crucibles
409	Y	5	0	0	yes	Molten Salt, 30% Unpulverized
411	Y	26	3	13	yes	Electrorefined Salt - Final Disposition
412	Y	1	0	0	yes	Gibson Salt

IDC List - Overall Waste Storage EA

IDC	Head Gas Anal Done Y/N	Drums in Database	Dup Anal Done on Drums	Anal Results for Drums	Plans to Store?	Description
430					yes	Unleached Resin
431	Y	1	0	0	yes	Leached Resin
438					yes	Insulation
440	Y	2	0	2	yes	Glass (Except Raschig Rings)
441	Y	2	0	2	yes	Unleached Raschig Rings Only
442					yes	Leached Raschig Rings
443					yes	Raschig Rings, Solvent Contaminated
444					yes	Ground/Leaded Glass
480	Y	36	5	32	yes	Light Metal
481					yes	Light Non-SS Metal (Fe, Cu, Al, SS) Prepared
483					yes	Scrap D-38 Metal (unclassified)
484					yes	Classified Non-NM Scrap Metal Shapes - Non Be
485					yes	Scrap D-38 Classified Shapes
486					yes	Classified Tooling for Disposal
487					yes	Classified Plastic Shapes
488					yes	Glovebox Parts with Lead
489					yes	Classified Be Scrap Metal Shapes
490	Y	1	0	1	yes	HEPA Filters (24X24), Not Acid Contaminated
491	Y	3	0	3	yes	Plenum Pre-Filter
492					yes	HEPA Filters (24X24), Acid Contaminated
529					yes	Miscellaneous Organic Liquid/Solution
777					yes	Empty Waste Box (Crate)
802					yes	Solidified Laboratory Waste - Bldg. 774
803	Y	38	8	36	yes	Solidified Sludge - Bldg. 374
804					yes	Saltcrete
805					yes	Pondcrete
807	Y	36	6	34	yes	Solidified Bypass Sludge - Bldg. 374
813					yes	RCRA Regulated Sludge - LLM Hazardous Waste
821	Y	22	1	22	yes	Dry Combustible TRU Waste
822	Y	3	0	3	yes	Wet Combustible TRU Waste
823					yes	Cemented Miscellaneous Sludge
824					yes	Light Metal TRU Waste
825	Y	37	5	37	yes	Plastic TRU Waste
851					yes	Combustible Dry LLM Waste (NMC, NDA, and Non-PA)
852	Y	4	1	4	yes	Combustible Wet LLM Waste (NMC, NDA, and Non-PA)
853					yes	Plastic LLM Waste (NMC, NDA, and Non-PA)
855					yes	Ground Glass
861					yes	Combustible Dry LLW (NMC, NDA, and Non-PA)
862					yes	Combustible Wet LLW (NMC, NDA, and Non-PA)
863					yes	Plastic LLW (NMC, NDA, and Non-PA) - Repack
864					yes	Medical/Infectious Waste

IDC List - Overall Waste Storage EA

IDC	Head Gas Anal Done Y/N	Drums in Data-base	Dup Anal Done on Drums	Anal Results for Drums	Plans to Store?	Description
869					yes	U-238 (D-38) Oxide Low Level Waste
871					yes	Titanium Turnings
970					yes	Low-Level TSCA Waste - PCB Liquids
971					yes	Low-Level TSCA Waste - PCB Fluorescent Light Ballast
972					yes	Low-Level TSCA Waste - Miscellaneous PCB Debris
973					yes	Low-Level TSCA Waste - PCB/Transformers/Capacitors
2216					yes	SARF Combustible Waste (Combination of IDCs 821, 822, 825)
290	Y	7	1	7	not on list	Filter Sludge
292	Y	2	0	2	not on list	Incinerator Sludge
299	Y	2	1	2	not on list	Misc. Sludge
331	Y	5	0	5	not on list	Filters, Ful-Flo, From Incinerator
340	Y	2	0	2	not on list	Sludge from Size Reduction Area
371	Y	2	1	0	not on list	Fire Brick
391	Y	1	0	0	not on list	Unpulverized Sand & Crucible
392	Y	3	1	3	not on list	Unpulverized Sand, Slag, & Crucible
394	Y	1	0	0	not on list	Sand from BBO
404	Y	1	0	0	not on list	Molten Salt; CA, ZN, K
405	Y	2	0	0	not on list	Molten Salt, unknown % unpulverized
408	Y	1	0	0	not on list	Molten Salt, 8 % unpulverized
410	Y	1	0	0	not on list	Molten Salt, 30 % unpulverized
413	Y	2	0	0	not on list	Impure Salt from cell cleanout
414	Y	5	1	3	not on list	Direct Oxide reduction salt - unoxidized CA
415	Y	1	0	0	not on list	Plutonium Chloride Mixed Salt
420	Y	14	1	13	not on list	Pulverized Incinerator Ash
421	Y	6	2	6	not on list	Ash Heel
425	Y	15	2	15	not on list	Fluid-Bed Ash
427	Y	1	0	0	not on list	MSE Spent Dicesium Salt
429	Y	1	0	0	not on list	Scrub Alloy spent salt
433	Y	1	0	0	not on list	Scrub Alloy spent dicesium salt
800	Y	105	20	105	not on list	Solidified Sludge - Building 774
801	Y	149	27	143	not on list	Solidified Organics - Building 774
831	Y	90	13	90	not on list	Combustible Dry TRU Mixed Waste (NMC, NDA, and Non-PA)
832	Y	24	1	24	not on list	Combustible Wet TRU Mixed Waste (NMC, NDA, and Non-PA)
833	Y	64	11	64	not on list	Plastic TRU Mixed Waste (NMC, NDA, and Non-PA)

Weapons Grade Plutonium, Including Ingrowth of Am-241

(Average age of Pu - 20 years)

Nuclide	Activity Ci/g Mix
Pu-238	4.27E-03
Pu-239	5.76E-02
Pu-240	1.29E-02
Pu-241*	1.28E-01
Pu-242	1.20E-06
Am-241	7.28E-03

* Beta Activity

Rocky Flats Enriched Uranium

Nuclide	Activity Ci/g Mix
Th-231*	2.00E-06
Th-234*	1.80E-08
U-234	6.20E-05
U-235	2.00E-06
U-236	2.50E-07
U-238	1.80E-08

* Beta Activity

Rocky Flats Depleted Uranium

Nuclide	Activity Ci/g Mix
Th-231*	4.90E-09
Th-234*	3.40E-07
U-234	3.70E-08
U-235	4.90E-09
U-238	3.40E-07

* Beta Activity

Stack Information

Building	Height		Diameter		Resource Code
Bldg 374	43.00 ft	13.11 m	3.60 ft	1.10 m	*
Bldg 440		7.62 m		1.83 m	**
Bldg 444	13.75 ft	4.19 m	7.02 ft	2.14 m	*
460-30	40.00 ft		2.00 ft		
460-54	13.00 ft		2.00 ft		
460-High Bay (4)	113.20 ft		23.60 ft		
460-High Bay (6)	171.00 ft		33.60 ft		
460-23	27.00 ft		3.00 ft		
Total	364.20 ft		64.20 ft		
Bldg 460	28.02 ft	8.54 m	4.94 ft	1.51 m	***
Bldg 551		10.00 m		0.50 m	****
Bldg 865	15.25 ft	4.65 m	5.10 ft	1.55 m	*
Bldg 881		16.46 m		2.44 m	**
Bldg 883	37.70 ft	11.49 m	5.80 ft	1.77 m	*
Wall vents (4)	8.00 ft		8.00 ft		
Wall vents (4)	48.00 ft		8.00 ft		
Wall vents (2)	36.00 ft		4.00 ft		
Total	92.00 ft		20.00 ft		
Bldg 906	9.20 ft	2.80 m	2.00 ft	0.61 m	*****
Bldg 991	13.10 ft	3.99 m	4.30 ft	1.31 m	*
IDM Bldg - proposed location		2.80 m		0.61 m	*****

*	AP McManigle Rad NESHAP project notes - dated 6/23/92
**	RSR-023-95 memo & EA info - dated 10/24/95
***	APEN forms
****	Estimate - no information was available
*****	Notes from Terry Hummel - dated 12/4/95

Distance to 96th & Indiana

(measured by R. S. Ramsey 12/5/95)

Bldg 374	7.625 inches	15,250 feet	4,648 meters
Bldg 440	7.125 inches	14,250 feet	4,343 meters
Bldg 444	7.3125 inches	14,625 feet	4,458 meters
Bldg 460	7.375 inches	14,750 feet	4,496 meters
Bldg 551	7.125 inches	14,250 feet	4,343 meters
Bldg 865	6.4375 inches	12,875 feet	3,924 meters
Bldg 881	6.375 inches	12,750 feet	3,886 meters
Bldg 883	6.5 inches	13,000 feet	3,962 meters
Bldg 906	6 inches	12,000 feet	3,658 meters
Bldg 991	6.125 inches	12,250 feet	3,734 meters
IDM Bldg - proposed location	5.6875 inches	11,375 feet	3,467 meters

Measurements made on map in A. P. McManigle's office.

Scale on map is 1 inch = 2000 ft

APPENDIX B

Consequence Analysis for TRU Waste Storage Facilities Without Mitigating Factors

KAISER • HILL
COMPANY

INTEROFFICE MEMORANDUM

DATE: December 13, 1995

TO: G. L. Potter, ER/WM&I Operations, Building T130C, x4283

FROM: D. R. Swanson, Safety Analysis, Building 130, x7009

SUBJECT: RESULTS OF SAFETY ANALYSIS REVIEW OF THE PU LOADING LIMITS FOR TRU WASTE STORAGE FACILITIES – DRS-105-95

PURPOSE

The purpose of this memo is to transmit the results of a review by Safety Analysis of the Pu loading limits for TRU waste storage facilities without mitigating features.

DISCUSSION

DOE, RFFO has not objected to the approach of investigating maximum limits for waste facilities without mitigating features based on consequence thresholds from DOE-STD-3011-94 of 5 rem to the maximally-exposed offsite individual (MOI) and 25 rem to the collocated (100 m) worker. These are not taken to be acceptance limits but, in the case of an accident, reflect consequences with few significant long-term adverse health effects.

A qualitative evaluation of accident scenarios for a typical waste storage facility was performed. Two scenarios were identified for quantitative analysis, a spill caused by building collapse, and a fire following a small airplane crash. The spill scenario was selected because it was expected to be the bounding scenario for the collocated worker. The airplane crash fire was selected because it was expected to be the bounding scenario for the MOI. Spreadsheets were prepared using standard dose equations and parameters to calculate the amount of material required for each variable which determined the amount of material required to be available for release, also known as the material at risk (MAR), to result in a 5 rem dose for the MOI and 25 rem dose for the collocated worker. Of all parameters in the dose equation, the value for the damage ratio (DR) has the most uncertainty.

Facility inventories required to reach the calculated MAR were calculated on a grams of Pu per 1,000 ft^2 basis. This allowed for comparison of inventories between the two scenarios. The limit per 1,000 ft^2 basis also allows for discussion of generic facilities without having to identify a specific facility description. The Pu limit per drum is 200 grams and for some DRs would be the limiting factor on inventory limits.

Review of calculated inventories using a range of DRs shows that both a large spill caused by an event such as building collapse and the airplane crash fire will be required to be evaluated on a facility-specific basis to determine an inventory that does not exceed either dose threshold. Currently accepted equation parameters, assumptions, a range of DRs, and the accident scenarios discussed above result in a range of Pu inventories shown in the Attachment. Review of the inventories show that under median weather, the bounding Pu limit per 1,000 ft^2 is expected to fall in the 35 to 50 kg range. The span of the inventory range is due to the uncertainty in DRs noted above. The uncertainty in DRs can be reduced on a facility-specific basis through more in-depth analysis than that contained in the Attachment. The facility-specific analysis will be directed at refining the DRs used to reflect the effects of building collapse and an airplane crash based on building construction considering the structure, standards, and materials.

The Attachment contains a narrative of the process used to develop the range of inventory limits, a discussion of the uncertainties and conservatisms, and includes a summary copy of the spreadsheets used for the quantitative portion of the analysis.

Please be advised of the following caveats pertaining to this analysis:

- The calculations supporting this analysis have not been formally checked. This task should be completed within a week. We will advise you of any changes in the results, although we don't expect any changes to be significant.

- The release fraction (RF) assumed for unconfined combustible waste is 0.01 based on the guidance in DOE-HDBK-3010-94. This is much lower than an RF of 0.5 being applied by Emergency Preparedness in their current hazard assessments as directed by the State of Colorado, and its application in this analysis could severely restrict further increases in Pu inventory for waste storage facilities. A course of action for resolving this disparity will have to be addressed further with Emergency Preparedness.

<u>RESPONSE REQUIREMENT</u>
No response is required. If you have any questions or comments, please contact me or Shannon Walker-Lembke at Extension 8151 or Pager 7570.

SWL:clf

Attachment:
As Stated

cc:

J. A. Broad	J. L. Morse
C. Burns	D. G. Satterwhite
J. A. Ciucci	S. Walker-Lembke
T. L. Hummel	J. J. Zimmer
W. Moore	File

CONSEQUENCE ANALYSIS FOR TRU WASTE STORAGE FACILITIES WITHOUT MITIGATING FEATURES

The following discussion is a review of the equations and assumptions commonly used when calculating the consequences of unmitigated releases from waste storage facilities. The assumptions made are generally conservative but as realistic as possible. The goal is to provide a basis for the analysis needed to develop limits for waste storage facilities without mitigating features that are higher than the historically used 10 kg limit for WG Pu. These higher limits are needed for waste storage to support the needs for immediate and short term storage of TRU waste at Rocky Flats pending construction of a single TRU waste storage facility or until a permanent storage location is approved.

The most common release scenarios analyzed in safety analyses are criticalities, spills, fires, and explosions. Each type of scenario is discussed in general followed by a description and analysis of specific scenarios.

General Scenarios

A facility storing packaged waste has limited scenarios that could significantly affect the public or collocated worker. Various types of accident scenarios were qualitatively evaluated to determine what type of scenarios should be developed and analyzed in detail to bound the affects of an accident. The storage facilities considered in this discussion will store only limited volumes of liquids, if any. Release scenarios will, therefore, be limited to significant releases of solid waste.

A sitewide applicable analysis of TRU waste storage drums showed that for even maximally loaded waste containers, planar arrays are not favorable for a criticality. As long as there are not large volumes of liquids available for release coincident with a spill from solid waste containers, a criticality following a spill is not credible. Therefore, criticality scenarios are not included in the discussion. The remaining types of scenarios likely to result in bounding consequences are a spill, fire, or explosion.

For a waste storage facility, multiple release scenarios can be postulated. A scenario involving the release of the contents of multiple drums will be the most significant spill scenario. An earthquake or other event which causes a building collapse thereby breaching and knocking over drums is expected to be the bounding spill scenario. A fire scenario of a magnitude significant enough to have more than only minimal release of material would be an aircraft crash initiated fire. This is due to the protection a drum provides to its contents from a fire. Therefore, to significantly impact the waste, the drums would need to be damaged and release material making unconfined materials available to the fire. Explosions in the type of facility considered would be related to maintenance or normal handling operations. A maintenance activity related explosion could involve welding activities with an acetylene bottle acting as a missile and causing breach of waste containers followed by a fire. A second explosion scenario, initiated by normal waste handling operations, could be a vehicle crash into the waste storage area followed by an explosion and subsequent fire.

In addition to the release initiator, waste storage configuration including waste form and type of container influence the amount of material released during an accident. A waste storage configuration may be comprised of drums, plywood crates, metal boxes or combinations of these containers. Although crates and boxes afford the most effective use of storage space, a review of WEMS shows that a majority of the current TRU waste is stored in drums. Since future TRU waste storage needs may be significant, it is expected that most future TRU waste will be 200 gram drums. The current waste forms include wet and dry combustibles, non-combustible solids and sludges, as well as cemented waste. The material released in the general scenarios above was qualitatively evaluated considering that the future TRU waste will likely be stored in drums and will continue to be a combination of the current waste forms. The scenarios most likely to bound the consequences to the collocated worker and the public were qualitatively reviewed considering waste forms and containers. The results are provided in the following paragraphs.

Both of the explosion with subsequent fire scenarios would have little affect on the public or the collocated worker. This is because very few drums are expected to be breached and release significant material. Also, the fire will not be sustained due to lack of fuel. The vehicle crash with a subsequent fire should be further evaluated if it is likely the vehicle could be something other than a forklift potentially having significant amounts of fuel available for the fire.

The aircraft crash will cause multiple drums to breach in the area directly impacted by the plane. If a fuel spill is postulated to occur and be involved in the subsequent fire, other drums will become involved. Combustible wastes will require special attention. This scenario may have less effect on the collocated worker than the spill since a plume from this fire would loft material over the collocated worker. However, an airplane initiated fire will likely bound the consequences to the public and will be analyzed further.

The earthquake-initiated spill will be a significant scenario for the collocated worker. Multiple containers will be breached and the plume will not be lofted. This combination of parameters will result in significant consequences to the collocated worker. This scenario will be analyzed further.

<u>Analysis Parameters</u>

The parameter selections and definitions below are applicable to all the calculations performed. Scenario-specific assumptions are included in the scenario description.

- The Generic Facility is a Butler-type steel building with 15,000 ft^2 of storage space. This will allow for 4,380 drums in the facility.
- Waste may be uniformly distributed throughout the facility or may be controlled as specified by a particular scenario.
- Pu content per drum is limited to 200 grams.
- 3,250 ft^2 holds 950 drums stacked four high. Therefore, there are 292 drums per 1,000 ft^2 with 73 drums per layer. (Kaiser-Hill 95)
- The material at risk (MAR) is the material considered to be available for release as a result of the accident conditions analyzed. The MAR will likely be different than the facility inventory since it is the material contained in containers at discrete locations which cause the material to be available for release during the postulated accident.

- Calculations were made using both median and 95th percentile weather.
- Breathing rate was chosen to be moderate.
- The dose conversion factor used was for WG Pu, Class Y.

Spills

The Building 664 FSAR states that the magnitude of an earthquake would have to be 0.3 g or greater to have substantial breach of drums due to falls unless the earthquake collapses the structure. A majority of damage is, therefore, expected to be from portions of the structure collapsing on the waste containers. The top two layers of drums are the most vulnerable for release and was assumed to be the only layers of drums which receive significant damage.

Selecting an appropriate damage ratio is significant for this scenario. The Building 664 FSAR damage ratio (DR) and supporting rationale was reviewed. The roof of Building 664 was assumed to collapse. This approach is conservative since it is unlikely that the roof would fail in its entirety. It is also unlikely that all drums damaged would release their contents. However, lacking experimental data regarding the effects of a roof collapse and drum performance, the approach is considered reasonable. Since the beams in the roof structure covered 7% of the floor space projected onto a grid, 7% of the drums on the top two layers were assumed damaged. The Building 664 scenario went on to assume that the entire population of the damaged drums released their entire contents. This Building 664 FSAR approach was used for the generic facility analysis.

The MAR required to reach the dose thresholds for both the collocated worker and the MOI under both median and 95th percentile weather conditions was calculated. The waste involved was assumed to be packaged which results in a ARF x RF value from DOE-HDBK-3010-94 of $1x10^{-4}$ for a spill. The results of the analysis are shown on the attached spreadsheets. The results show that the MAR is bounded by the collocated worker threshold.

Fires

Any fire scenario assumed will have more significant consequences if the storage configuration includes plywood boxes. This is due to the added fuel the plywood would provide thus allowing the fire to propagate and increasing the amount of time the fire would burn if unmitigated. As noted above, since most TRU waste is currently stored in 55 gallon drums and the future plans for waste storage indicate continuing the use of drums, due to the gram loading expected to be needed in the future, this analysis assumed there are no plywood crates in the facility. The lack of fuel to propagate or prolong a fire lead to the assumption of a 10 minute plume duration for the analysis.

The fire scenario used in Chapter 11 of the Building 664 FSAR was reviewed. The Building 664 FSAR noted that a crash into a specific building at Rocky Flats is more credible for a small plane than a large plane. The area involved in a fuel fire from a small plane crash was assumed to be 3,250 square feet per the fire analysis performed for Building 906. (Hughes 92) For a waste storage configuration similar to that used in Building 664, this equates to 950 drums.

The aircraft used in this analysis is assumed to be a small plane. This analysis assumed that 950 drums were involved in the scenario. The MAR for this scenario is then the contents of 950 drums.

Considering the discussion contained in DOE-HDBK-3010 regarding the behavior of drums in fires, the assumption used in the Building 664 analysis that all 950 drums are breached and burned is considered overly conservative for this analysis. This analysis used a range of values for the fraction of drums which breach and the fraction of drums which remain intact but are involved in the fire. The values used assume that all 950 drums are somehow involved in the scenario. This is conservative since it would be expected that the impact of the plane would not only breach some drums but would also throw some drums out of the area involved in the fire. The fraction of drums that breach are assumed to spill their entire contents onto the area involved in the fire. A release fraction for unconfined materials from DOE-HDBK-3010 was applied to this portion of the waste.

When analyzing a fire of the magnitude included here, the presence of combustible waste needs to be considered. The release fractions contained in DOE-HDBK-3010 are one order of magnitude greater for combustible waste in a fire versus non-combustible. Characterization for current TRU-waste IDCs was reviewed to determine an appropriate value to use for the percent of combustible waste. Based on this review, it was assumed for this analysis that 25% of the inventory in the building is considered combustible. Damage to drums was considered to be uniformly distributed throughout the waste in the affected area (i.e., location within the affected area did not influence whether or not a drum was breached).

Evaluation of Results

Using median weather conditions, the MAR for the worker dose threshold is bounded by the spill scenario and for the MOI threshold the aircraft crash scenario bounds the MAR. The range of MARs for a specific facility will result in an inventory on a per 1,000 ft^2 basis of between 35 and 50 kg of Pu. The determining factor will be the DRs determined to be appropriate for each scenario.

Uncertainties and Conservatism

The largest uncertainties in analysis of both of these scenarios lies with selection of an appropriate DR. Therefore, the ratios selected were conservative. To develop facility Pu limits that are high enough to accommodate the Site's waste storage needs and maintain the consequences of a bounding accident in the moderate range, a balance needs to exist between the uncertainty and conservatism in parameter selection.

For the spill initiated by an earthquake (or other building collapse), it is considered conservative to assume that the number of drums damaged is equal to the percentage of floor space the roof beam structure covers and that all drums damaged are breached making the entire contents available for release. This is based on the force required to cause a significant drum breach as reported by Sandia (SAND 83). Restricting this significant damage to the top two layers of drums offsets the assumption that all damaged drums breach and spill their entire contents. Restricting damage to the top two layers of drums is conservative, because the drum storage configuration uses a sheet of plywood between layers of drums which would act to distribute the impact forces, effectively reducing the force seen at the point of impact.

For the aircraft crash scenario, the most uncertainty lies with selection of the ratio of drums which breach either as a result of the impact or after being involved in the fire. This is particularly important for combustible waste. DOE-HDBK-3010 provides some guidance regarding application of release fractions for unconfined combustible waste. A portion of the discussion includes a summary of various drum fire studies performed across the DOE complex. The fire tests reviewed showed that while some drums forcefully ejected their contents many drums did not. The manner in which a drum failed appears to be a function of the loading in the drum, the general integrity of the container, and location in the storage configuration. Drums that were lined, had secure lids, had a layer of drums stacked on them, or were not located directly in the fuel pool failed in a manner that did not forcefully eject the drum contents or did not fail at all. The authors of DOE-HDBK-3010 caution against cavalierly applying the unconfined combustible release fractions on the basis that drums will fail violently as a result of being involved in the fuel pool fire due to both the uncertainty regarding drum failure and the conservatism in the release fraction values. This supports the assumption that most unconfined material involved in the fire will be material released as a result of the crash itself and reinforces the need to not select an overly conservative DR.

This analysis used a range of DRs for the aircraft crash scenario. The number of drums these ratios correlate to ranges from 95 to 19. Even the lower end of this range may be overly conservative for analysis of a specific facility since the release fraction for unconfined materials in a fire is applied to the entire contents of all damaged drums. Aircraft penetration of a specific facility should be evaluated in detail to refine DR selection. The methods contained in the draft DOE standard for accident analysis of aircraft crashes into hazardous facilities would provide an estimate of penetration depth and overall structural response. While this information will not eliminate all uncertainty in the selection of DRs, the penetration depth will provide a basis for DR selection.

References

DOE 94 — *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, U.S. Department of Energy, DOE-HDBK-3010-94, December 1994.

Hughes 92 — *Fire Hazard Analysis for Rocky Flats Building 906*, C.L. Beyler, S.P. Hunt, Hughes and Associates, July, 1992.

Kaiser-Hill 95 — *Final Safety Analysis Report and Technical Safety Requirements for the Building 664 Waste Storage & Shipping Facility Rocky Flats Plant*, Kaiser-Hill Safety Analysis, Revision 0, October 1995.

SAND 83 — *Analysis, Scale Model and Full-Scale Testing of Type A Packaging*, Sandia National Laboratories, SAND 80-2571, M. Huerta, G.H. Lamoreaux, L.E. Romesburg, H.R. Yoshimura, B.J. Joseph, and R.A. May, January, 1983.

	A	B	C	D	E	F	G
1	Range of X/Q values for analysis from RFP-4965						
2		MOI/1900 m		Worker/100 m			
3		No Fire	6 MW Fire	No Fire	6 MW Fire		dose = MAR x DR x ARF x RF x FI x X/Q x DCF x BR
4	Median, 10 minute plume	1.12E-05	2.45E-06	1.29E-03	8.48E-07		
5	95th Percentile, 10 minute plume	1.08E-04	1.03E-05	1.05E-02	3.59E-04		MAR is material at risk (g)
6	Median, 2 hour plume	6.02E-06	1.32E-06	6.93E-04	4.56E-07		DR is damage ratio appropriate for scenario
7	95th Percentile, 2 hour plume	5.80E-05	5.53E-06	5.64E-03	1.93E-04		ARF is airborne release fraction
8							RF is respirable fraction
9	ARF x RF for Waste Forms and Release Conditions from DOE-HDBK-3010						FI is fractional involvement for cemented wastes in fires
10		Fire	Spill	3010 page #			X/Q is dispersion factor (s/m3)
11	Packaged Combustible	5.00E-04	1.00E-04	p. 5-1, 5-4			DCF is dose conversion factor (rem/g)
12	Uncontained Combustible	1.00E-02	1.00E-03	p. 5-2, 5-4			BR is breathing rate (m3/s)
13	Packaged Noncombustible	6.00E-05	1.00E-04	p. 5-5, 5-4			
14	Uncontained Noncombustible	6.00E-03	1.00E-03	p. 5-5 scaled, 5-4			
15							
16	DCF value from RFP-4965						Generic Facility description: Butler-type building with storage
17	WG Pu, Class Y	2.77E+07	rem/g				space of 15,000 sq ft. Based on the Building664 FAR, with 950
18							drums per 3,250 sq ft, the facility has 292 drums per 1,000 sq ft.
19	BR, moderate breathing	3.50E-04	m3/s				with drum stacking 4 high (73 drums per layer).
20							This results in 4,380 drums in the facility.
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							

	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	Scenario 1: Seismic initiated spill. The calculated MAR is the inventory needed in the top two layers of drums												
2	to reach the dose threshold for the the damage ratio (DR) shown. Waste is all stored in drums. Inventory values are grams/1,000 sq ft for the												
3	entire facility assuming the inventory in the top two layers is equal to the MAR and the bottom two layers are 200 g drums.												
4													
5	Inven of bottom 2 layers	29,200	per 1,000 sq. ft.										
6													
7	DR =	0.05		0.07		0.1		0.15		0.2			
8		MAR	Inventory	MAR	Inventory	MAR	Inventory	MAR	Inventory	MAR	Inventory		
9	MOI = 5 rem												
10	Median Weather	9.21E+06	6.43E+05	6.58E+06	4.68E+05	4.60E+06	3.36E+05	3.07E+06	2.34E+05	2.30E+06	1.83E+05		
11	95th Percentile	9.55E+05	9.29E+04	6.82E+05	7.47E+04	4.78E+05	6.10E+04	3.18E+05	5.04E+04	2.39E+05	4.51E+04		
12													
13	Worker = 25 rem												
14	Median Weather	4.00E+05	5.59E+04	2.86E+05	4.82E+04	2.00E+05	4.25E+04	1.33E+05	3.81E+04	9.99E+04	3.59E+04		
15	95th Percentile	4.91E+04	3.25E+04	3.51E+04	3.15E+04	2.46E+04	3.08E+04	1.64E+04	3.03E+04	1.23E+04	3.00E+04		
16													
17			indicates needed drum capacity of facility exceeds "Generic Facility" capacity										
18			of 4,380 drums if all drums are loaded to 200 g (i.e., a waste storage facility larger than the "Generic Facility"										
19			would be needed to reach the calculated MAR.)										
20													
21													
22	DR =	0.05		0.07		0.1		0.15		0.2			
23		g/drum	# of 200 g	g/drum	# of 200 g	g/drum	# of 200 g	g/drum	# of 200 g	g/drum	# of 200 g		
24	MOI = 5 rem												
25	Median Weather	4.21E+03	4.60E+04	3.00E+03	3.29E+04	2.10E+03	2.30E+04	1.40E+03	1.53E+04	1.05E+03	1.15E+04		
26	95th Percentile	4.36E+02	4.78E+03	3.11E+02	3.41E+03	2.18E+02	2.39E+03	1.45E+02	1.59E+03	1.09E+02	1.19E+03		
27													
28	Worker = 25 rem												
29	Median Weather	1.83E+02	2.00E+03	1.30E+02	1.43E+03	9.13E+01	9.99E+02	6.09E+01	6.66E+02	4.56E+01	5.00E+02		
30	95th Percentile	2.24E+01	2.46E+02	1.60E+01	1.75E+02	1.12E+01	1.23E+02	7.48E+00	8.19E+01	5.61E+00	6.14E+01		
31													
32	The g/drum number is the per drum loading needed for the inventory in the top two layers of drums to equal the calculated MAR.												
33	"# of 200 g" is the number of drums loaded to 200 g required for the inventory of the top two layers of drums to equal the MAR.												
34	(For the Generic Facility, the number of drums in top two layers is 2.19E+03.)												

Scenario 2: Small plane crash into "Generic Facility" with 10 minute plume. The number of drums involved in the release is 950.
The number of square feet involved is 3250. The MAR is calculated as the amount of material required to reach the dose threshold.
The facility inventory is 25% combustible waste. The combustible waste is uniformly distributed throughout the facility. Inventory values are expressed in grams per 1000 square feet for the entire Generic Facility assuming the calculated MAR is the contents of 3250 sq ft. "Fraction Unconfined" is that portion of the drums involved which spill their entire contents into the fire.

Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
Fraction Unconfined	0.02		0.05		0.10		0.15		0.20	
Fraction Confined	0.98		0.95		0.90		0.85		0.80	
MOI = 5 rem	MAR	Inventory	MAR	Inventory	MAR	Inventory	MAR	Inventory	MAR	Inventory
Median Weather	6.87E+05	2.11E+05	4.12E+05	1.27E+05	2.47E+05	7.59E+04	1.76E+05	5.42E+04	1.37E+05	4.22E+04
95th Percentile	1.63E+05	5.02E+04	9.79E+04	3.01E+04	5.87E+04	1.81E+04	4.19E+04	1.29E+04	3.26E+04	1.00E+04
Worker = 25 rem										
Median Weather	9.92E+06	3.05E+06	5.94E+06	1.83E+06	3.56E+06	1.10E+06	2.55E+06	7.83E+05	1.98E+06	6.09E+05
95th Percentile	2.34E+04	7.21E+03	1.40E+04	4.32E+03	8.42E+03	2.59E+03	6.01E+03	1.85E+03	4.68E+03	1.44E+03

══ Indicates a calculated MAR which is greater than 200 g per drum for 950 drums (MAR>1.90E+05 g) (i.e., the MAR can not be reached and thus the dose threshold can not be exceeded using drums loaded to 200 g Pu.)

APPENDIX C

Species of Concern at the Rocky Flats Environmental Technology Site

TABLE C-1
Species of Concern Known to Occur at the Site

Common Name	Scientific Name	Status [a] / Occurrence at Site
AMPHIBIANS AND REPTILES		
Northern leopard frog	*Rana pipiens*	state species of concern; suitable habitat present in marshland and riparian corridors
Eastern short horned lizard	*Phrynosoma douglassii brevirostra*	C-2 federal status; found onsite in xeric and mesic mixed grassland communities
BIRDS		
American peregrine falcon	*Falco peregrinus anatum*	federal endangered, state threatened status; casual onsite visitor during spring, summer and fall; may forage for birds onsite
Bald eagle	*Haliaeetus leucocephalus*	federal endangered, state threatened status; visitor onsite in winter, may forage opportunistically for prairie dogs or other prey onsite
Northern goshawk	*Accipiter gentilis*	C-2 federal status; an occasional, casual visitor, mostly during migration, typically a forest dweller.
Baird's sparrow	*Ammodramus bairdii*	C-2 federal status; one observation onsite at grassland/shrubland edge
Western burrowing owl	*Athene cunicularia hypugea*	C-2 federal status, state status "uncertain"; observed onsite in several grassland communities during breeding season, but breeding onsite not confirmed
Ferruginous hawk	*Buteo regalis*	C-2 federal status, state species of special concern; fall and winter resident, forages on prairie dogs and presence is correlated with abundance of prey species; Site is important winter range
Loggerhead shrike	*Lanius ludovicianus*	C-2 federal status; observed at Site year-round, probably breeds in shrubland community, but breeding not confirmed
Greater sandhill crane	*Grus canadensis tabida*	state threatened status; observed flying over Site during spring and fall migrations, but onsite foraging not confirmed
Long-billed curlew	*Numenius americanus*	state species of special concern; casual visitors during migration, some suitable foraging habitat available, but likely onsite use is for resting
American white pelican	*Pelecanus erythrorhynchos*	state species of special concern; observed at foraging habitat near impoundments onsite during spring and summer, suitable nesting habitat is not available onsite
MAMMALS		
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	C-2 federal status, state species of special concern, listing of species as threatened or endangered deferred because of Congressional moratorium on new listings; present in riparian communities onsite, including Walnut and Woman Creek corridors

[a] C-2 = Category 2; USFWS has data indicating vulnerability, additional data/information needed to propose listing.

State status of "uncertain" is similar to federal C-2 status.

TABLE C-2
Species of Concern With Potential Habitat at the Site

Common Name	Scientific Name	Status / Potential for Occurrence at Site
PLANTS		
Ute (aka plateau) ladies'-tresses (an orchid)	*Spiranthes diluvialis*	federally listed as threatened / no individuals identified onsite, potential habitat is available onsite; nearest population 8 m. north in Boulder County
Colorado butterfly plant	*Gaura neomexicana* var. *coloradensis*	federal candidate species (C-1) / potential habitat is available onsite
Belle's twinpod	*Physaria bellii*	federal candidate species (C-2) / potential habitat is available onsite
Tulip gentian (prairie gentian)	*Eustoma grandiflorum*	federal candidate species (C-2) / potential habitat is available onsite
Adder's mouth orchid	*Malaxis brachypoda*	federal candidate species (C-2) / potential habitat is available onsite
BUTTERFLIES		
Pawnee montane skipper	*Hesperia leonardus montana*	federally listed as threatened / potential habitat is available onsite, populations known in South Platte River canyon and at Pawnee National Grasslands
Regal fritillary	*Speyeria idalia*	federal candidate species (C-2) / potential habitat (i.e., virgin grassland) is available onsite
FISH		
Plains topminnow	*Fundulus sciadicus*	federal candidate species (C-2) / potential habitat is available onsite
Common shiner	*Luxilus cornutus*	state species of special concern / potential habitat is available onsite
Stonecat	*Noturus flavus*	state species of special concern / potential habitat is available onsite
BIRDS		
Whooping crane	*Grus americana*	federal and state endangered status; species has historically used nearby areas, suitable foraging/nesting/roosting habitat available onsite
Least tern	*Sterna antillarum*	federal and state endangered status; have historically used nearby areas, suitable foraging/nesting/roosting habitat available onsite
Southwestern willow flycatcher	*Empidonax traillii extimus*	federal endangered status (listed 27 Feb 1995), state status uncertain / potential habitat is available onsite
Piping plover	*Charadrius melodus*	federal and state threatened status; have historically used nearby areas, suitable foraging/nesting/roosting habitat available onsite
Western snowy plover	*Charadrius alexandrinus nivosus*	federal candidate species (3C), state species of special concern / potential habitat is available onsite
Mountain plover	*Charadrius montanus*	federal candidate species (C-1), state species of special concern / potential habitat is available onsite
Black tern	*Chlidonias niger*	federal candidate species (C-2) / potential habitat is available onsite
White-faced ibis	*Plegadis chihi*	federal candidate species (C-2), state status uncertain / potential habitat is available onsite

TABLE C-2, Continued
Species of Concern With Potential Habitat at the Site

Common Name	Scientific Name	Status / Potential for Occurrence at Site
Plains sharp-tailed grouse	*Tympanuchus phasianellus jamesi*	state endangered status / potential habitat is available onsite
Barrow's goldeneye	*Bucephala islandica*	state species of special concern / potential habitat is available onsite
MAMMALS		
Black-footed ferret	*Mustela nigripes*	federal and state endangered status; historical presence near Site / potential habitat is available onsite, although presence would likely be the result of a reintroduction
Spotted bat	*Euderma maculatum*	federal candidate species (C-2), state status uncertain / potential habitat is available onsite
Small-footed myotis	*Myotis ciliolabrum*	federal candidate species (C-2) / potential habitat is available onsite
Long-eared myotis	*Myotis evotis*	federal candidate species (C-2) / potential habitat is available onsite
Fringe-tailed myotis	*Myotis thysanodes pahasapensis*	federal candidate species (C-2) / potential habitat is available onsite
Long-legged myotis	*Myotis volans*	federal candidate species (C-2) / potential habitat is available onsite
Pale Townsend's big-eared bat	*Plecotus townsendii pallescens*	federal candidate species (C-2), state status uncertain / potential habitat is available onsite
Plains spotted skunk	*Spirogale putorius interrupta*	federal candidate species (C-2) / potential habitat is available onsite
Swift fox	*Vulpes velox velox*	federal candidate species (C-2), state status uncertain / potential habitat is available onsite

Candidate Species Codes

C-1 Category 1; USFWS has sufficient data to propose listing.

C-2 Category 2; USFWS has data indicating vulnerability, additional data/information needed to propose listing. State status "uncertain" is similar to federal C-2 status.

3C Species is more abundant than originally believed; USFWS may re-evaluate in future.

Tables C-1 and C-2 have been developed using the following references:

Colorado Division of Wildlife (CDOW). 1995a. Lists of Colorado Aquatic Wildlife Species Status. Draft. January 6, 1995.

Colorado Division of Wildlife (CDOW). 1995b. Lists of Colorado Endangered, Threatened, Special Concern, Undetermined Status and Candidate Species. Draft. February 1995.

Colorado Natural Heritage Program (CNHP). 1994. Species of Special Concern Lists. Fort Collins, CO. June 23, 1994.

EG&G Rocky Flats. (EG&G). 1995. Annual Threatened and Endangered Species Status Report for Rocky Flats Environmental Technology Site. Prepared for U.S. Department of Energy. June 7, 1995.

Rocky Mountain Remediation Services, LLC (RMRS). 1995b. Map of Capture Locations of Preble's Meadow Jumping Mouse and its Probable Range. Prepared for U.S. Department of Energy. August 14, 1995.

U.S. Fish and Wildlife Service (USFWS). 1994. Endangered and Threatened Wildlife and Plants; Animal Candidate Review of Listing as Endangered or Threatened Species. 50 CFR Part 17. November 15, 1994.

U.S. Fish and Wildlife Service (USFWS). 1995. Endangered and Threatened Wildlife and Plants. 50 CFR 17.11 and 17.12. Electronic update version. May 31, 1995.

FINDING OF NO SIGNIFICANT IMPACT

U. S. DEPARTMENT OF ENERGY

FINDING OF NO SIGNIFICANT IMPACT

RADIOACTIVE WASTE STORAGE AT ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

SUMMARY: The Department of Energy (DOE) has prepared an environmental assessment (EA) (DOE/EA-1146) to increase the radioactive waste storage capacity at the Rocky Flats Environmental Technology Site (the Site) north of Golden, Colorado by converting certain buildings at the Site from their former uses to radioactive waste storage. The EA describes and analyzes the environmental effects of the proposed action, and considers the alternatives of taking no action, converting certain other Site buildings to radioactive waste storage, and building a new waste storage facility. The EA was the subject of a public comment period from February 19 to March 5, 1996. Comments were received from the Colorado Department of Public Health and Environment, the City of Thornton, and Stone Engineering. Responses to those comments have been incorporated in the Final Environmental Assessment.

PROPOSED ACTION: The Proposed Action consists of converting some or all of the following buildings at the Site from their former uses to interim radioactive waste storage facilities: 374, 440, 444, 551, 865, 881, 883, 906 (also known as the Centralized Waste Storage Facility) and the IDM Drum Storage Facility. Each of these is an existing building except the IDM facility which DOE has not yet constructed but which was analyzed in DOE/EA-995. Buildings 374, 444, 881, 883, 865, and 906 are already partially or totally used to store waste; they are included in the Proposed Action because DOE expects to increase the quantity of waste, or change the type of waste, they store. Buildings 440, 551, 906 and the IDM facility would be used exclusively for radioactive waste storage activities, while the other five buildings would contain non-storage uses as well. The buildings would be converted as needed based on the following considerations: their appropriateness for the type of waste for which additional storage capacity is needed, availability, ease and cost effectiveness of conversion, capacity, and availability of funding. It is expected that Buildings 440 and 906 would be converted first. The second priority buildings in numerical order are 444, 881, and the IDM facility. Buildings 374, 551, 865 and 883 are the third priority group for conversion. It may not be necessary to convert all nine buildings. Conversion of all nine buildings would increase the Site's radioactive waste storage capacity by approximately 60%.

Conversion of buildings would typically involve removal of unneeded materials and equipment; removal of interior walls; removing or increasing the size of doors; removing, relocating or replacing utilities; removing and relocating, modifying or replacing fire detection and suppression systems and warning devices; modifying heating, ventilation and air conditioning systems; modifying building weather and atmospheric protection (*e.g.*, insulation); structural modifications necessary for compliance with civil engineering codes for floor loading, snow and wind loading and for DOE and Site standards for seismic forces; and new architectural construction such as berms for secondary containment, new interior finishes, doors, and improved egress. New equipment, such as downdraft tables or hoods and contamination control cells, would be installed. In addition, safety controls would be installed as necessary. They could include criticality detection systems, selective alpha air monitoring systems, lead shielding, and air emissions monitoring equipment.

Routine operation of the buildings would typically involve off-loading waste containers from the delivery truck by forklift and moving the waste containers to a storage area; movement of waste containers within or between buildings for characterization and/or repackaging; and movement of waste containers to a staging area, preparation for shipment and shipment offsite.

The quantity of waste that would be stored in a building would be dependent on the number of grams of radionuclides in each waste container. The number of grams that could be stored in a building without air emissions monitoring would be the lesser of: 1) that quantity calculated to yield a dose of less than 5 rem to the maximally-exposed offsite individual in case of the bounding accident, or 2) that quantity calculated to result in a dose, taking no credit for emissions controls, of less than 0.1 mrem per year to the maximally-exposed offsite individual from normal operations, unless continuous air emissions monitoring equipment were in use. On average, each of the nine buildings could contain as much as 1,575 to 2,250 kg of radionuclides. Specific building limits would be identified in the safety analysis document for each building.

ALTERNATIVES CONSIDERED: DOE considered the No Action alternative which involves leaving existing radioactive waste where it currently resides and ceasing generation of new waste as Site capacities for the various types of radioactive waste are reached. DOE rejected this alternative because it does not respond to the need to properly store waste that will be generated by activities mandated by environmental statutes and regulations as well as by agreements between DOE and regulatory agencies, and the Defense Nuclear Facilities Safety Board.

DOE also considered alternative buildings (980 and 777) at the Site for conversion to radioactive waste storage. The nine buildings in the proposed action, however, are the only buildings that would be available at the time they were needed and which lend themselves to cost effective conversion to waste storage.

A third alternative considered by DOE was construction of one or more new radioactive waste storage facilities. DOE rejected this alternative because a new facility(ies) could not be ready until after it will be needed, and because there is not sufficient vacant space in the Site's Industrial Area for such buildings.

ENVIRONMENTAL EFFECTS: Virtually all the activities associated with the Proposed Action would take place inside buildings and so would not be expected to have any adverse effects to flora, fauna, or water or air quality under routine conditions. Seven of the nine buildings have been determined to be eligible for listing on the National Register of Historic Places. Adverse effects to the historic characteristics of these buildings would be avoided by consultations with the State Historic Preservation Officer prior to undertaking any construction.

Accident analyses were performed for the Proposed Action. The bounding accident for the public was identified as a plane crashing into one of the buildings and spilling fuel which ignited. The probability of such an accident is estimated at three times in a million years. The buildings would be operated so that such an accident would not be expected to result in a dose of more than 5 rem to the maximally-exposed offsite individual in accordance with DOE guidelines for a moderate hazard facility. This dose would not be expected to result in any adverse health effects. Effects of the accident to the metropolitan Denver area population of 2.2 million are estimated at one excess cancer.

The bounding accident for workers would be spillage from drums due to an earthquake with an estimated probability of once in 840 years. Fatalities would be expected among workers in the immediate vicinity of the accident due to chiefly to falling debris. Collocated workers would be expected to receive a radiation dose of less than 25 rem, consistent with DOE guidelines for a moderate hazard facility resulting in 0.0078 excess cancers.

FOR FURTHER INFORMATION ABOUT THIS ACTION, CONTACT:

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FOR COPIES OF THE EA, CONTACT:

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DETERMINATION: Based on the information and analyses in the EA, DOE has determined that the proposed increase in, and operation of, radioactive waste storage capacity at the Rocky Flats Environmental Technology Site does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969, as amended. Therefore, an environmental impact statement is not required and DOE is issuing this Finding Of No Significant Impact for the Proposed Action .

Signed at Golden Colorado, this 9th day of April 1996.

Mark N. Silverman, Manager
Rocky Flats Field Office
U. S. Department of Energy

COMMENTS ON DRAFT ENVIRONMENTAL ASSESSMENT AND RESPONSES TO COMMENTS

RESPONSE TO COMMENTS ON DRAFT RADIOACTIVE WASTE STORAGE ENVIRONMENTAL ASSESSMENT

Colorado Department of Public Health and Environment

1. **Comment:** The designation of this document as "Public Draft" is curious in that it implies that a "non-public" draft exists. Is this document the basis of decision making for this question? Is there a separate decision making document or process not available to the public nor described in this EA? How does this EA fit into the decision making process?

   Response: The "Public Draft" Environmental Assessment, which might have caused less concern had it been titled simply "Draft Environmental Assessment", is the basis for decision-making for the Proposed Action it describes. The term "Public Draft" was only meant to distinguish it from earlier internal review drafts.

2. a. **Comment:** The EA does not discuss the National Conversion Pilot Project (NCPP), which is currently scheduled to operate three of the buildings that the EA proposes for waste storage. In addition, the document does not reference NCPP supporting documents used for the decision to proceed with the project. For example: a) Building Alternative Use Evaluation Report, EG&G Rocky Flats, Inc., December 1993, b) National Conversion Pilot Project Issue Resolution, June 8, 1994.

   Response: The only building definitely planned for conversion to radioactive waste storage at this time is 440 which is not an NCPP building. The other buildings discussed in the EA are presented as contingency buildings in the event that current estimates of waste generation, treatment, off-site shipment and on-site disposal increase. Until pre-decisional planning documents such as the Accelerated Site Action Plan and Site-Wide Environmental Impact Statement are complete, it is very difficult to estimate exactly what the Site's radioactive waste storage needs will be. It is apparent that at least one additional building will be needed for radioactive waste storage, and DOE is proposing in the EA that that building be 440. Whether any of the other proposed buildings is actually required will depend on the results of planning for future activities at the Site.

   If use of one or more NCPP buildings for radioactive waste storage were determined to be necessary in the future, DOE would review the impacts to NCPP against the benefits of converting the building(s) to radioactive waste storage. The buildings that have been proposed for both NCPP and conversion to waste storage (444, 865, and 883) are lower priority buildings which may not ever actually be needed for waste storage. DOE will decide at the time additional waste storage capacity is needed which building(s) to convert, based on the criteria described in the EA and the needs of the NCPP. The requirements of any programs to convert buildings to commercial uses, including but not limited to NCPP, will be added to the list of criteria to be used in determining whether to convert a building to radioactive waste storage.

It should be noted that the December, 1993, Building Alternative Use Evaluation Report lists the three NCPP buildings (444, 865, and 883) as potential waste storage buildings. The 1994 NCPP Issues Resolutions Document cited indicates that these three buildings would not be needed for waste storage for the five years of the first two phases of NCPP because other buildings will be available for waste storage. However, this same document indicates that waste from NCPP activities may be stored in these buildings and that "Reevaluation of the need for these building to store waste is required after the five year period." See Waste Management Issue 2. This is consistent with the Proposed Action which says that, except for Building 440, actual use of the buildings for waste storage in the future would be dependent on reevaluation at the time.

b. **Comment:** The references also do not include current analyses of waste generation, such as the Site Treatment Plan or ASAP II, leading to a question of the adequacy of the data used for this assessment.

   Response: Waste generation rates in the EA are based on ASAP II, scenario 3C (Retrievable and Monitored Waste Storage [Excavation]) as of January, 1996, the most recent available when the document was published. Disposal (offsite shipment) rates are from the 1995 update of the Site's Comprehensive Waste Management Plan, believed to be more representative of the future than the Site Treatment Plan. All numbers are subject to change until the schedule of future activities at the Site, as described in ASAP or some other document, is final.

3. **Comment:** A major condition imposed by the Colorado Department of Public Health and Environment (CDPHE) on DOE in order to support the NCPP was that the buildings proposed for use were not necessary or desirable for waste storage. DOE provided broad assurances that this was the case. In the reference cited in Comment 2b, these questions were addressed: "Waste Management Issue 1: Are the buildings (444, 447, 865, and 883) suitable for Rocky Flats waste storage? Answer: The four buildings have minimal space that would be suitable for waste

storage." If the buildings are now suitable for waste storage, DOE needs to describe the process used to reevaluate the buildings, provide references for this study, and notify CDPHE and EPA, and others on the NCPP Steering Committee.

Response: DOE assurances concerning other possible uses of the buildings in question, as presented in National Conversion Pilot Project Issue Resolution, June 8, 1994, were tied to the initial five years of the NCPP. DOE does not anticipate the need to convert any of the NCPP buildings to radioactive waste storage during that five-year period. See also the response to comment 2a.

4. **Comment:** 1.0 Purpose and Need for Action Although it is stated that existing on-site waste storage capacity for LL, LLM, TRU and TRUM would be completely filled in early 1997, a briefing of the Low Level Waste Program presented on February 26, 1996 indicates that the capacity for LLW and LLM may already be exceeded. It would be beneficial to see the capacities and amount of waste on site segregated by individual waste types.

Response: The sources of the waste inventory, generation and disposal data are as described in the response to comment 2b. The breakdown of the figures is as follows with quantities in cubic yards:

	1995 inventory	1995 storage capacity	2000 inventory
LL	7,106	7,106	13,603
LLM	19,925	24,439	21,955
TRU	715	715	4,431 (TRU & TRUM)
TRUM	760	1,072	
	28,506	33,332	39,989

Additional storage capacity for TRU and LL waste is needed in 1996, while TRUM waste storage capacity is expected to be exceeded in 1997. It will be noted that the additional radioactive waste storage capacity that would be provided by conversion of all nine buildings is in excess of that needed in 2000. Thus, as pointed out in the EA, it may not be necessary to convert all the proposed buildings. The EA identifies what current projections would suggest to be excess capacity because of 1) the uncertainty surrounding future waste generating activities at the Site that will continue to exist until the Accelerated Site Action Plan and Site-Wide Environmental Impact Statement are completed, and 2) the possibility that some of the buildings now storing radioactive waste will be deactivated with the result that the radioactive waste they store would have to be moved to other buildings.

It should also be noted that the estimate of radioactive waste storage capacity needed in 2000 has been reduced to 39,989 cubic yards from the 46,500 cubic yards identified in the Draft EA. The higher figure included material not classified as waste and was in error.

5. **Comment:** 2.1.2 Modifications to the Buildings No mention is made in this section of any decontamination of the buildings prior to conversion to waste [storage]. It may be necessary to decontaminate these areas of asbestos, chemical and/or radiation contamination.

   Response: Asbestos exists in some areas and would be left in place to the extent that it did not interfere with storage of waste, or present a hazard. If asbestos, chemicals or radionuclides had to be removed, applicable regulations and procedures would be followed to ensure worker and public safety. The document will be modified to make these points.

6. **Comment:** Physical and Administrative Controls This section details that the Site would mitigate the possibility of risks posed by penetrating gamma and neutron radiation with physical and administrative controls and further states that such measures are currently in use in Building 371 and have proven effective in providing radiological protection. It was the Department's understanding that such controls are used throughout the site as part of the ALARA program.

   Response: The document will be modified to make it clear that physical and administrative controls are in use throughout the Site, not just in Building 371.

7. **Comment:** 2.1.6 Waste Management, Storage and Preparation A description is given of administrative controls that would be used to minimize exposure to radiation, It is stated that office floor areas would be delineated where dose rates might exceed limits for routine, nonoccupational exposure. Office equipment such as chairs, phones and coffee pots would not be placed inside of those areas. No mention is made as to whether desks would be located in these areas.

   Response: The document will be modified to add desks to the list of furnishings that would not be allowed in areas where expected doses would exceed standards and to clarify DOE's intent that such areas would not be occupied routinely.

8. **Comment:** 4.0 Environmental Effects of the Proposed Action and Alternatives The statement is made that radiological consequences are the most significant due to small quantities of chemicals present in most waste types. However, there are

some chemicals on-site that are extremely dangerous. These include reactive chemicals and 1A flammable liquids which are now classified as low-level mixed waste. It should also be noted that excess chemicals, including reactive and acutely toxic chemicals, will continue to be found as the plant goes through deactivation and it should be stated that these chemicals will not be stored in the proposed areas.

Response: Present plans do not call for storage of wastes with item description codes of excess, flammable, or reactive chemicals in any of the buildings of the Proposed Action. However, in the event future needs require storage of such chemicals, the Resource Conservation and Recovery Act permitting process would be followed. This process requires public involvement and Colorado Department of Public Health and Environment approval.

9. **Comment:** <u>4.1.2 Risks from Accidents</u> It is stated that examples of potential accidents include drum spills due to an earthquake or fires due to airplane crashes. It is important to note that the potential for these accidents is small while the potential for releases from everyday operations is greater such as damaging a drum with a forklift.

   Response: Adverse health effects from the more probable but lower consequence events such as a forklift puncturing a waste drum would be bounded by the accident analyzed in the EA. Consequently, no discussion was presented of lower consequence events. Analysis of a forklift accident shows that there would be no measurable dose to the public, and that the dose to the immediate worker would be less than 100 millirem out of a Site Administrative Control Limit of 750 millirem annually. Therefore, no adverse health effects would be expected to workers or the public from such an accident.

10. **Comment:** <u>5.0 Agencies and Persons Consulted</u> The EA says that agencies and persons contacted were: "None." However, the firm using the buildings under consideration, Manufacturing Sciences Corporation, the contractor of the NCPP, should be consulted. Similarly, the Steering Committee for the NCPP should have been consulted, as well as the Community Reuse Organization, which is the Rocky Flats Local Impacts Initiative. Given that a major premise of the purpose and need for the storage is the limitation on the availability of off site disposal locations, why were these organizations not contacted?

    Response: DOE agrees that, because of the unique status of the Community Reuse Organization and the land use issues involved, that group should have been consulted prior to the issuance of the Draft EA. DOE will develop, in concert with the Rocky Flats Local Impacts Initiative, a procedure to ensure that such consultations occur in the future.

City of Thornton

11. **Comments:** Thank you for the opportunity to comment on the Department of Energy's (DOE) Draft Environmental Assessment (EA) for Radioactive Waste Storage at Rocky Flats Environmental Technology Site (Site). Thornton is opposed to the current waste storage strategies and the lack of effort to dispose of the existing low level, low level mixed, transuranic (TRU), and TRU mixed wastes.

We encourage DOE to diligently pursue disposal of the 23,055 drums that are currently stored on-site, thereby providing storage for additional materials that may be generated, Also, we appreciate the problems associated with the storage facilities, but it is our understanding there are a number of sites available for mixed and low-level waste. Therefore, Thornton would only support DOE finding alternative and new sites to dispose of the current on-site waste material, as well as limiting the continued use of operational areas for waste storage.

Response: Offsite waste disposal facilities for some low-level and mixed wastes are available, and DOE is shipping waste to these facilities as resources permit. Section 1.2 of the EA describes some of the steps that must be taken before waste can be shipped; these steps are expensive and time consuming. DOE has chosen to focus on processing higher-risk materials at the Site first to achieve the greatest increases in safety, rather than shipping very low risk wastes offsite.

Stone Environmental Engineering Services, Inc.

12. **Comment:** The Public Draft Radioactive Waste Storage Environmental Assessment (DOE-EA-1146, February 1996) makes no mention of Stone Environmental Engineering Services, Inc.'s alternate proposal for a near off-site Repository that is the best and most economical alternative available.

Response: This EA considers only how to store radioactive wastes until they can be sent offsite; questions of where radioactive wastes should be shipped is beyond the scope of the EA.