6 IMPACTS ASSOCIATED WITH MANAGING CYLINDERS OF USEC-GENERATED DEPLETED UF_6*

After the draft PEIS was completed, management responsibility for approximately 11,400 cylinders of depleted UF_6 (about 137,000 metric tons) was transferred from USEC to DOE by the signing of two MOAs associated with the privatization of USEC. The *Memorandum of Agreement Relating to Depleted Uranium Generated Prior to the Privatization Date* (DOE and USEC 1998a), signed in May 1998, transferred management responsibility for approximately 9,400 cylinders from USEC to DOE, with about 6,600 of the cylinders stored at Paducah and about 2,800 stored at Portsmouth. The *Memorandum of Agreement Relating to Depleted Uranium* (DOE and USEC 1998b), signed in June 1998, transfers approximately 2,000 additional depleted UF_6 cylinders from USEC to DOE between 1999 and 2004. (The locations for these cylinders are not specified in this second agreement.)

This chapter provides a brief discussion of the USEC cylinders and the potential environmental impacts that would be associated with their management under each of the alternatives discussed in the PEIS. To account for uncertainties associated with the number of cylinders that would be transferred from USEC to DOE in the future and to provide a bounding analysis of environmental impacts for the purpose of analysis in this PEIS, it was assumed that the number of DOE-owned and DOE-managed cylinders would increase by 15,000 (approximately 180,000 metric tons), with 12,000 of those cylinders being managed at the Paducah site and 3,000 being managed at the Portsmouth site. This assumption is consistent with current operations, under which most or all of the newly generated depleted UF_6 cylinders are at the Paducah site.

6.1 DESCRIPTION OF THE USEC CYLINDER INVENTORY

The USEC-generated cylinders at the Paducah site are located in three storage yards: C-745-C, C-745-Q, and C-745-R (see Figure 3.2). A small number of cylinders are also located for short periods in the C-745-E yard, which is a staging area. The yards used for USEC cylinder storage at the Paducah site had not been paved when the MOAs were signed. Under the terms of the MOAs, yards C-745-Q and C-745-R will be reconstructed with concrete bases, and cylinders from yard C-745-C will then be moved there.

The approximately 2,800 USEC-generated cylinders stored at the Portsmouth site are located in yard X-745-G (see Figure 3.5). This yard has already been paved; however, the cylinders will be restacked onto concrete saddles.

---

* Please note that this entire chapter has been added to the PEIS after the public comment period.

6.2 APPROACH USED TO EVALUATE THE ENVIRONMENTAL IMPACTS ASSOCIATED WITH MANAGING USEC CYLINDERS

The results from detailed analyses on managing DOE-generated cylinders under various options (presented in Appendices D–J) were used to estimate the potential additional impacts that could result from managing the USEC-generated cylinders as well. In most cases, the impacts for specific management options were estimated by extrapolating from the results presented in Appendices D–J to account for the increase in the cylinder inventory. The activities were then combined to determine the overall impacts associated with each PEIS alternative when both DOE- and USEC-generated cylinders are considered. The specific assumptions that underlie the estimation of impacts for the various components of the alternatives are described here.

6.2.1 Continued Cylinder Storage and Preparation Activities

Management of the USEC-generated cylinders must conform with all requirements applicable to the DOE-generated cylinders. These requirements are described in the UF_6 cylinder project management plan (LMES 1997i). For the site-specific evaluation of continued storage of the USEC-generated cylinders, it was assumed that the USEC cylinders would be managed in the same way as were the DOE-generated cylinders. Management activities would include (1) refurbishment of cylinder yards and restacking as necessary, (2) routine and ultrasonic testing inspections of cylinders and valve monitoring and maintenance, (3) cylinder painting as necessary, and (4) repair and/or removal of the contents of any cylinders that might be breached during the storage period. These activities are described in more detail in Appendix D.

In general, the USEC-generated cylinders are newer than the DOE-generated cylinders and do not exhibit the heavy external corrosion that can result from long-term storage in substandard conditions. Moreover, since these cylinders would be regularly inspected and maintained while under DOE management, future external corrosion would be expected to be minimal. Nonetheless, for the purpose of analyzing continued cylinder storage impacts in this PEIS, the USEC-generated cylinders were assumed to be essentially the same as the DOE-generated cylinders; i.e., the rate of corrosion and the cylinder breach rate were assumed to be the same.

For this PEIS, under the no action alternative, potential environmental impacts were estimated from continued cylinder storage through the year 2039. Under the action alternatives (long-term storage as UF_6, long-term storage as oxide, use as oxide, use as metal, and disposal as oxide), it was assumed that continued cylinder storage would extend from 2009 through 2028 at the current storage sites. The inclusion of the USEC-generated cylinders would increase the length of some continued storage at the Paducah and Portsmouth sites from the year 2028 through about the year 2034. On the basis of the assumption that the rate of cylinder breaches would be the same for the USEC-generated cylinders as for the DOE-generated cylinders, it was estimated that the number of cylinder breaches would increase by 42% at the Paducah site and by 22% at the Portsmouth site. (This increase corresponds directly to the increase in the cylinder inventory at each site.) These

assumptions were applied to estimate the number of breaches that would occur in two cases: (1) if painting the cylinders controlled future corrosion and (2) if corrosion continued at the historic rate. For corrosion-induced breaches, these are very conservative assumptions (i.e., are likely to result in overestimates of the number of breaches), because the USEC-generated cylinders are newer than the DOE cylinders.

The other site-specific management option addressed for the PEIS was preparation of cylinders for shipment. As detailed in Appendix E, the number of cylinders that would not meet U.S. Department of Transportation requirements at the time of shipment is unknown. A probable range of values determined by the current cylinder conditions was assumed for the analyses used for Appendix E. To assess the site-specific impacts from the addition of the USEC cylinders, it was assumed that the cylinder preparation options at the Paducah and Portsmouth sites (i.e., preparation of standard cylinders, use of overcontainers, or operation of a cylinder transfer facility) would be extended for about 6 years to accommodate the additional inventory.

Since no USEC-generated cylinders are located at the K-25 site, no impact on continued storage or cylinder preparation at the K-25 site would be associated with the management of the USEC-generated cylinders.

6.2.2 Other Management Options

The additional management options addressed by the PEIS were conversion (including empty cylinder treatment), long-term storage, manufacture and use, and disposal. To account for the management of USEC-generated cylinders for these options, the basic facility designs were assumed to remain the same, but the facilities were assumed to operate over a longer period of time. It was assumed that the period for operations would be extended by about 6 years to accommodate the additional USEC-generated cylinders (i.e., from 20 to 26 years). Under this assumption, annual impacts would generally remain the same as those reported on in Chapter 5 and the appendices, although the total impacts would generally increase by about 30%. Additionally, the land use requirements for the long-term storage and disposal options would be increased to accommodate the additional inventory.

The assumption that operations at these facilities would be extended by 6 years did not change the basic analytical time frame used for the PEIS (i.e., 41 years, from 1998 through 2039). As a result of including the USEC cylinders, the time frame for operations at conversion, long-term storage, manufacture, and disposal facilities was assumed to be from the year 2009 through 2034; monitoring operations at long-term storage facilities were assumed to occur from 2035 through 2039.[1]

---

[1] These estimates were meant to provide a consistent analytical timeframe for the evaluation of all of the PEIS alternatives and do not represent a definitive schedule.

6.3 POTENTIAL ENVIRONMENTAL IMPACTS ASSOCIATED WITH MANAGEMENT OF USEC-GENERATED CYLINDERS

The following sections describe the potential environmental impacts associated with the management of USEC-generated cylinders under each of the PEIS alternatives. The potential impacts associated with the increase in the cylinder inventory are discussed relative to the impacts for the management of the DOE-generated inventory only, as presented in Sections 5.1 through 5.7. If the overall impacts would be the same as those presented in Chapter 5, they are generally not discussed in detail in this section; instead, the appropriate sections within Chapter 5 are referenced. If the inclusion of the USEC-generated cylinders would result in changes to the impacts discussed in Chapter 5, the differences are noted and the total impacts are discussed in this section.

6.3.1 No Action Alternative

The inclusion of USEC-generated cylinders under the no action alternative would increase the number of cylinders managed by DOE at the Paducah site by 42% and at the Portsmouth site by 22%. The activities occurring at the K-25 site would be unaffected. The USEC-generated cylinders would be managed in the same manner as would the DOE-generated cylinders, as described in Appendix D.

6.3.1.1 Human Health and Safety

6.3.1.1.1 Normal Facility Operations

In general, the management of USEC-generated cylinders would result in increased levels of exposure to radiation and chemicals by workers and members of the public, when compared with the management of DOE-generated cylinders only as presented in Chapter 5. However, the increased exposure levels would not be large enough to cause appreciable increases in the potential health impacts under the no action alternative discussed in Chapter 5.

Workers. In general, the management of USEC-generated cylinders would increase the overall level of activity of involved workers by approximately 30%, resulting in a corresponding increase in the total radiation dose to the worker population over the duration of the program. It is estimated that the total dose to involved workers at all three sites would increase from about 1,500 to about 2,000 person-rem. (The dose to noninvolved workers would remain negligible when compared with the involved worker dose.) However, this increase in the radiation dose would not change the estimate of 1 LCF among workers under the no action alternative.

In addition, the average annual radiation dose to individual workers associated with management of the additional USEC-generated cylinders would be the same as that reported for the

management of DOE-generated cylinders only, because additional cylinder yard workers would be used to perform the necessary activities instead of having the same individuals conduct extra activities. Thus, the number of involved workers at the Paducah site would increase from about 30 to 43 and the number at Portsmouth would increase from about 16 to 20. The average annual doses to involved workers would remain at about 740 mrem/yr at Paducah and 600 mrem/yr at Portsmouth, well within applicable standards.

General Public. The management of USEC-generated cylinders would result in a potential increase in the total radiation dose to the public from airborne releases that would be proportional to the increase in the total cylinder inventory and number of hypothetical cylinder breaches (i.e., by approximately 30%). Therefore, it is estimated that the total radiation dose to the general public within 50 mi (80 km) of the three current storage sites combined would increase by 0.11 person-rem, resulting in a total dose of 0.49 person-rem over the duration of the program. This level of exposure would remain well below levels expected to cause any adverse health effects.

The maximum radiation dose to an individual near the Paducah and Portsmouth sites would also increase because of the additional management of USEC-generated cylinders. However, this increase would be such that the dose to an individual near any one of the three storage sites would be less than 0.2 mrem/yr, the same as the dose for DOE-generated cylinders only reported on in Chapter 5. Similarly, the change in the potential for noncancer health effects from exposure to airborne uranium and HF releases would be such that the maximum hazard index for an individual would remain less than 0.1, as reported on in Section 5.1.1.1.2.

The estimated maximum uranium concentrations in groundwater and resulting health effects among members of the public from future cylinder breaches would be the same as those for the management of DOE-generated cylinders discussed in Chapter 5. The reason is that the estimated groundwater concentrations for the DOE-generated cylinders were calculated on the basis of hypothetical breaches occurring in the G-yard at the Paducah site and in both the C-yard and E-yard at the Portsmouth site. This assumption represents a worst-case scenario in terms of groundwater contamination; additional breaches from USEC cylinders stored in different yards would not increase the estimated groundwater concentrations. Therefore, the radiation dose and hazard index estimates given in Section 5.1.1.1.2 for the general public from use of contaminated groundwater under the no action alternative would not change as a result of the additional consideration of the USEC cylinders.

6.3.1.1.2 Facility Accidents

Physical Hazards (On-the-Job Injuries and Fatalities). The activities associated with managing and handling the USEC cylinders would be the same as those required for the DOE-generated cylinders. The number of additional accidental worker injuries and fatalities associated with maintenance and handling of the USEC-generated cylinders at the Paducah and Portsmouth sites would be about 40 injuries and 0.03 fatality through 2039.

The total number of accidental worker fatalities and injuries at the three sites through 2039 under the no action alternative would increase by about 30%. The number of fatalities, when both DOE- and USEC-generated cylinders are considered, would be 0.14, well below 1. The estimated total number of accidental worker injuries would be 182.

Accidents Involving Releases of Radiation or Chemicals. For accident consequences, impacts would be the same as those for the DOE-generated cylinders under the no action alternative discussed in Section 5.1.1.2.2, because the types of accidents assessed would involve only a limited amount of material that would be at risk under accident conditions, regardless of the number of cylinders in storage. (For example, a vehicle-induced fire would be estimated to involve three full cylinders, regardless of the number of cylinders at the sites.) Although the estimated frequencies of some accidents would increase somewhat in association with the management of the additional USEC-generated cylinders (e.g., cylinder handling accidents), this increase would not be expected to be enough to change the overall expected frequency of specific accidents from the broad ranges used for this PEIS (i.e., likely is defined as one time or more in 100 years; unlikely is one time between 100 years and 10,000 years; extremely unlikely is one time between 10,000 years and 1 million years; incredible is less than one time in 1 million years).

6.3.1.2 Transportation

The continued storage of the USEC-generated cylinders under the no action alternative would result in small, additional quantities of LLW and LLMW (from cylinder monitoring and maintenance activities) that would need to be shipped each year. This additional waste would result in less than one additional waste shipment each year. Because of the small number of shipments and the low concentrations of contaminants expected, the potential environmental impacts from these shipments would remain negligible.

6.3.1.3 Air Quality

Continued storage of the USEC-generated cylinders would require refurbishment of the storage yards used for these cylinders. The paving of these yards would result in particulate matter (PM_{10}) emissions (i.e., dust). For the continued storage of DOE-generated cylinders, as described in Section 5.1.3, potential PM_{10} emissions during construction activities would approach regulatory standards. This situation would also occur during refurbishment of the yards used for USEC cylinder storage. Emissions would be expected to be less than or equal to those estimated for the DOE-generated cylinders, because refurbishment of cylinder yards would be conducted sequentially and the yards being used to store USEC-generated cylinders and requiring refurbishment would be approximately the same size and in the same general location as the yards being used for DOE-generated cylinder storage. Mitigative measures, such as water spraying, might be required to reduce the PM_{10} emissions during refurbishment of cylinder yards for both the DOE- and USEC-generated cylinders.

The overall site emissions of criteria pollutants would increase as a result of the continued storage of USEC cylinders; however, the resulting concentrations would remain well below regulatory standards. Painting the USEC-generated cylinders to protect them from external corrosion, as needed, would also not have a significant impact on regional ozone formation.

Under the no action alternative, potential emissions of HF due to hypothetical breaches of some USEC-generated cylinders were estimated to remain well within applicable standards and guidelines at the Paducah and Portsmouth sites, whether or not corrosion control was assumed.

6.3.1.4 Water and Soil

Construction activities associated with refurbishment of USEC storage yards would be limited and occur in previously developed areas; therefore, impacts in assessment areas, such as changes in runoff, recharge to underlying aquifers, and changes in soil permeability or erosion potential, would be expected to be very minimal. Additional water use for continued storage of USEC-generated cylinders was roughly estimated to be 0.8 million gal for construction at the Paducah site, 67,000 gal/yr for operations at the Paducah site, and 13,000 gal/yr for operations at the Portsmouth site. Total water use would be 3 million gal for construction, 230,000 gal/yr for operations at Paducah, and 73,000 gal/yr for operations at Portsmouth.

Releases from hypothetical breaches of the USEC cylinders would, in general, increase concentrations in groundwater in some areas of the sites (i.e., in the areas near or in USEC cylinder storage yards). However, maximum concentrations calculated for evaluating the worst-case impacts to groundwater at the Paducah site (G-yard) and the Portsmouth site (combined C- and E-yards) under the no action alternative would remain the same as those described in Section 5.1.4.2. These concentrations would not change because the number of cylinders at the G-yard and the combined C- and E-yards would be the same (USEC cylinders would be stored at other yards) and because, in the groundwater modeling method used, contaminant plumes emanating from the vicinity of the yards are assumed to be independent and to not interact because of the distance separating the yards, the short travel distance to the assumed receptor (i.e., 1,000 ft), and limited plume spreading caused by lateral dispersion. Therefore, although concentrations of uranium in groundwater beneath some cylinder storage yards would increase because of the addition of the USEC cylinders, the maximum concentrations for the entire site would still be represented by the values given in Section 5.1.4.2 (i.e., 6 and 5 µg/L for the Paducah and Portsmouth sites, respectively).

Maximum concentrations in surface water bodies adjacent to the two sites would also stay about the same (0.3 µg/L at Paducah and 0.7 µg/L at Portsmouth) because of dilution in these water bodies. For soil, worst-case concentrations would remain the same (about 1 µg/g at either site); runoff from the USEC yards would not mix with runoff from the G-yard at Paducah or combined C- and E-yards at Portsmouth to increase local soil contaminant concentrations.

6.3.1.5 Socioeconomics

Additional construction activities that would result from the addition of USEC-generated cylinders at the Paducah site would generate approximately 8 additional direct jobs and about 34 additional total jobs. Operational activities at both the Paducah and Portsmouth sites would create 29 additional direct jobs and 45 additional total jobs per year. Direct additional income from construction at the Paducah site in the peak year would be $0.42 million, and total additional income would be $0.84 million. During operations, additional direct and total income at both the Paducah and Portsmouth sites would be $0.9 million and $1.2 million per year, respectively.

The additional employment and income created in the ROIs for the two sites would represent a very small change (estimated as less than 0.002%) in projected growth in these indicators of overall regional activity. The in-migration expected into each region with each activity would have only a low impact on regional population growth rates and would require less than 0.8% of vacant housing stock at either of the two sites. No significant impacts on local public finances would be expected.

The total socioeconomic impacts under the no action alternative (when both DOE- and USEC-generated cylinders are considered) would be 38 direct jobs and 174 total jobs in the peak construction year, 140 direct jobs and 255 total jobs per year during operations, $1.8 million direct income and $4.3 million total income from construction, and $6 million/yr direct income and $7.9 million/yr total income during operations. These values represent a total change of less than 0.007% of projected growth. A total of less than 3% of vacant housing stock at any of the sites would be required.

6.3.1.6 Ecology

Impacts to ecological resources from the continued storage of the additional USEC-generated cylinders would be minimal. Concentrations of uranium in soil, groundwater, and surface water would remain well below benchmark values for toxic and radiological effects. (Benchmarks are given in Section C.3.3.) In addition, construction activities would take place on previously disturbed areas (i.e., existing yards) and would have no ecological impacts.

6.3.1.7 Waste Management

Painting the USEC-generated cylinders at the Paducah site would add a maximum of an additional 8% to the site's total annual LLMW load (added to the 20% projected from painting the DOE-generated cylinders). Painting at the Portsmouth site would not significantly increase the 1% proportion of LLMW generation at the site that would be attributable to the DOE-generated cylinders only. The continued storage of the USEC-generated cylinders together with the DOE-generated cylinders would thus constitute a moderate potential impact on LLMW management at the Paducah

site. The total impact on the projected annual DOE LLMW treatment volume, however, would be negligible to low.

6.3.1.8 Resource Requirements

Although the total resources required would increase by approximately 30% as a result of the inclusion of USEC-generated cylinders, continued storage activities would not be resource intensive, and no strategic or critical materials would be required. The continued storage of the DOE- and USEC-generated cylinders would have a negligible to low impact on resource requirements at the Paducah and Portsmouth sites.

6.3.1.9 Land Use

The cylinder yards that are or would be used to store USEC-generated cylinders have either already been used as cylinder yards or would be located in previously developed areas and thus would not impact land use at the Paducah or Portsmouth sites under the no action alternative.

6.3.1.10 Cultural Resources

The yards for USEC-generated cylinders at the Paducah and Portsmouth sites are located in previously disturbed areas unlikely to contain cultural properties or resources listed on or eligible for the National Register of Historic Places. Therefore, impacts to cultural resources would not be likely under the no action alternative.

6.3.1.11 Environmental Justice

No disproportionately high and adverse effects to minority or low-income populations would be expected in the vicinity of the Paducah and Portsmouth sites in association with the continued storage of the USEC-generated cylinders.

6.3.2 Long-Term Storage as UF_6

Under the long-term storage as UF_6 alternative, the inclusion of USEC-generated cylinders would increase the number of cylinders managed by DOE at the Paducah site by 42% and at the Portsmouth site by 22%. Activities at the K-25 site would be unaffected. Consequently, the duration of continued cylinder storage at the Paducah and Portsmouth sites would be extended by about 6 years, from 2028 to 2034. In addition, the number of cylinder shipments to a consolidated storage facility would increase by about 30%. The operational and construction (or emplacement) period for

a consolidated long-term storage facility would be extended from 20 to 26 years, with approximately 30% more area being required for storage at the facility. At a long-term storage facility, surveillance and maintenance requirements would increase during the additional years of emplacement, for a total increase of 30% for the surveillance and maintenance period of 2035 through 2039.

6.3.2.1 Human Health and Safety

6.3.2.1.1 Normal Facility Operations

In general, the management of USEC-generated cylinders would increase the level of exposure of workers and members of the public to radiation and chemicals when compared with the management of DOE-generated cylinders only as presented in Section 5.2.1.1. For involved workers, the increased radiation exposure could result in 1 LCF in addition to the potential 1 LCF estimated for the management of DOE-generated cylinders. (The estimated number of LCFs increases by one because of rounding effects and the fact that estimates are presented as a single whole number.) For noninvolved workers and members of the public, the increased levels of exposure would not be large enough to cause appreciable increases in the potential health impacts over those under the long-term storage as UF_6 alternative discussed in Chapter 5.

Workers. Under the long-term storage as UF_6 alternative, the management of the additional USEC cylinders (including continued cylinder storage, cylinder treatment, and consolidated storage) was estimated to increase the total dose to involved workers by about 30%, resulting in 1 additional LCF under each of the three long-term storage options (yards, buildings, and mines). The total number of health effects among involved workers (including both DOE- and USEC-generated cylinders) would be about 1 to 2 LCFs over the duration of the program. (The dose to noninvolved workers would remain negligible when compared with the involved worker dose.)

In general, the average annual radiation dose to individual workers associated with management of the additional USEC cylinders would be the same as that reported on in Chapter 5 for DOE-generated cylinders (i.e., well within applicable standards) because additional workers would be used instead of having the same individuals conduct extra activities at both the current storage sites and a long-term storage facility.

Increased exposure to chemicals would not be expected to increase health impacts among involved or noninvolved workers. The total estimated hazard indices (when both DOE- and USEC-generated cylinders are considered) would be less than 0.002 for noninvolved workers at all three sites and at a consolidated storage facility.

General Public. The management of USEC-generated cylinders would result in a potential increase in the total radiation dose to the public around the three current storage sites from airborne releases. The increase would be proportional to the increase in the total cylinder inventory and

number of hypothetical cylinder breaches (i.e., approximately 30%). Therefore, it was estimated that the total radiation dose to the general public within 50 mi (80 km) of the three current storage sites combined would increase by about 0.3 person-rem, resulting in a total dose of 1.4 person-rem over the period 1999 through 2034. This level of exposure would remain well below levels expected to cause any adverse health effects.

The maximum radiation dose to an individual near the Paducah and Portsmouth sites would also increase because of the additional management of USEC-generated cylinders. However, this increase would be such that the dose to an individual near any one of the three storage sites would be less than 0.2 mrem/yr, the same as the dose reported on for DOE-generated cylinders only in Chapter 5. Similarly, the change in the potential for noncancer health effects from exposure to airborne uranium and HF releases would be such that the maximum hazard index for an individual would remain less than 0.1, as it would be for the long-term storage as UF_6 alternative reported on in Section 5.2.1.1.2.

Potential health impacts from surface and groundwater contamination associated with the management of the USEC-generated cylinders would be the same as those for DOE-generated cylinders discussed in Section 5.2.1.1.2. This result would occur because the modeling of releases to groundwater at the Paducah and Portsmouth sites for the DOE-generated cylinders represents a worst-case scenario; additional breaches from USEC cylinders stored in different yards would not increase the estimated groundwater concentrations under either cylinder corrosion assumption (controlled corrosion or uncontrolled cylinder corrosion).

For the reasons discussed for DOE-generated cylinders in Chapter 5, impacts to members of the general public near a consolidated storage facility would be less than or equal to those presented for the three current storage sites: no health effects would be expected.

6.3.2.1.2 Facility Accidents

Physical Hazards (On-the Job Injuries and Fatalities). For the long-term storage as UF_6 alternative, it was estimated that up to 1 additional worker fatality and up to 240 additional worker injuries could occur in association with management of the USEC-generated cylinders (including continued storage, cylinder preparation, and long-term storage as UF_6). The total physical hazards associated with management of the DOE- and USEC-generated cylinders would be about 2 worker fatalities and up to 1,200 worker injuries, an increase of roughly 30%.

Accidents Involving Releases of Radiation or Chemicals. For accident consequences, impacts would be the same as those for the DOE-generated cylinders under the long-term storage as UF_6 alternative discussed in Section 5.2.1.2.2. Although the estimated frequencies of some accidents would increase somewhat in association with the management of the additional USEC cylinders, this increase would not be expected to be enough to change the overall expected frequency of specific accidents from the broad ranges used for this PEIS.

6.3.2.2 Transportation

The management of USEC-generated cylinders would result in an additional 15,000 truck shipments of UF_6 cylinders from the current storage sites to a consolidated long-term storage site, or an additional 3,750 rail shipments. (The annual number of shipments would be the same as that for DOE-generated cylinders described in Section 5.2.2 and Appendix J.) For normal (incident-free) transportation operations, these additional shipments would increase exposure to overall external radiation and vehicle exhaust emissions by about 30%. However, no adverse health effects would be expected among workers and the public during normal transportation activities when shipment of both DOE- and USEC-generated cylinders is considered.

Although the total number of shipments would increase by about 30%, the estimated number of fatalities from transportation accidents (not involving releases of radioactive or hazardous materials) would be the same as that for DOE-generated cylinders reported on in Section 5.2.2. (The estimated number of traffic fatalities would not change because of rounding effects and the fact that estimates are presented as a single whole number.) Thus, the total estimated number of traffic accident fatalities under the long-term storage as UF_6 alternative (including both DOE- and USEC-generated cylinders) would remain 2 for truck transport and 1 for rail transport.

The consequences of severe traffic accidents involving releases of radiation or chemicals would be the same as those for the shipment of DOE-generated cylinders described in Section 5.2.2, because the shipment sizes would not change. The annual probability of severe accidents occurring would be the same as that discussed for DOE-generated cylinders, although the total probability of a severe accident would increase by about 30% as shipments continued for an additional 6 years.

6.3.2.3 Air Quality

The continued storage of additional USEC cylinders at the Paducah and Portsmouth sites through the year 2034 would not result in significant impacts to air quality. The estimated concentrations of criteria pollutants at the current storage sites would remain approximately the same as those for the long-term storage as UF_6 alternative, when only DOE-generated cylinders are considered, as described in Section 5.2.3. The estimated maximum 24-hour average HF concentrations at the Paducah and Portsmouth sites would increase from about 0.22 $\mu g/m^3$ and 0.14 $\mu g/m^3$ to about 1.2 $\mu g/m^3$ and 0.44 $\mu g/m^3$, respectively. The overall concentration for the Paducah site would still be well below the Kentucky primary 24-hour standard for HF of 800 $\mu g/m^3$. The State of Ohio does not have air standards for HF.

At a consolidated long-term storage facility, impacts on criteria pollutant emissions from construction and operation would be the same as those for DOE-generated cylinders discussed in Section 5.2.3. The air quality impacts would be the same because, although the size of the long-term storage facility would increase by about 30% as a result of the addition of the USEC-generated

cylinders, the annual level of operations (and emissions) would remain unchanged. No emission of uranium compounds was predicted in association with consolidated storage as UF_6.

6.3.2.4 Water and Soil

At the current storage sites, additional water use for continued storage of USEC-generated cylinders was roughly estimated to be 0.8 million gal for construction at the Paducah site, 67,000 gal/yr for operations at the Paducah site, and 13,000 gal/yr for operations at the Portsmouth site. The estimated total water use would be about 3 million gal for construction, 230,000 gal/yr during operations at Paducah, and 73,000 gal/yr for operations at Portsmouth.

The annual water requirements for a cylinder transfer facility would not change from those presented in Section 5.2.4 (i.e., between 6 and 9 million gal/yr), because the size of the facility would not change. However, the facility would be operated for an additional 6 years.

Because the duration of construction and operational activities at a long-term storage facility would be increased by 6 years, from 3.0 to 38 million gal of additional water would be required for construction, and about 7 million gal of additional water would be required for operations. About 6.6 million gal of additional wastewater would be generated. The total amount of water required during construction would be about 13 to 170 million gal; the total amount of water used during operations would be about 31 million gal; the total wastewater generated would be about 29 million gal.

As discussed in Section 6.3.1.4, the overall impacts to surface water, groundwater, and soil from the continued storage of USEC cylinders under this alternative would be the same as those estimated for the DOE-generated cylinders in Section 5.2.4. The estimated maximum groundwater uranium concentrations from continued storage at the Paducah and Portsmouth sites (i.e., 20 µg/L and 4 µg/L, respectively) would not change as a result of considering the USEC cylinders. Potential groundwater impacts would be mitigated by collecting and treating runoff from the cylinder yards and by identifying and repairing breached cylinders as soon as possible. The estimated maximum soil uranium concentration would remain 7 µg/g, well within the 230-µg/g guideline used for comparison.

Because total overall discharges would be extremely small, no impacts to groundwater quality would be expected from cylinder preparation activities or at a consolidated long-term storage facility.

The addition of USEC-generated cylinders would increase requirements for excavating a mine for a long-term storage facility. The additional excavation volume would be about 300,000 yd^3 (230,000 m^3). The total required excavation volume for the mine would be about 2.1 million yd^3 (1.6 million m^3).

6.3.2.5 Socioeconomics

Under the long-term storage as UF_6 alternative, continued storage of the additional USEC-generated cylinders would result in about 8 additional direct construction jobs and about 34 additional total jobs at the Paducah site. Operational activities at both the Paducah and Portsmouth sites would create 29 additional direct jobs and 45 additional total jobs per year. Additional direct and total income from construction at the Paducah site in the peak year would be $0.42 million and $0.84 million, respectively. During operations, additional direct and total income at both the Paducah and Portsmouth sites would be $0.8 million/yr and $1 million/yr, respectively.

The total socioeconomic impacts for continued cylinder storage under the long-term storage as UF_6 alternative (including both DOE- and USEC-generated cylinders) would be 38 direct jobs and 174 total jobs in the peak construction year, 150 direct jobs and 275 total jobs per year during operations, $1.8 million direct income and $4.3 million total income from construction, and $6.8 million/yr direct income and $8.9 million/yr total income during operations.

The annual socioeconomic impacts from cylinder preparation activities would be the same as those for the DOE-generated cylinders only estimated in Section 5.2.5, but the period of operation would be extended by 6 years. Construction impacts would not change for the cylinder preparation options because facility sizes would remain the same.

Construction and operation of a long-term storage facility would be extended by 6 years as a result of the addition of the USEC-generated cylinders. The peak year construction costs would not change. For operations, the emplacement period, originally assumed to extend from the year 2009 through 2028, would be extended through 2034, with the surveillance and maintenance period being reduced to the years 2035 through 2039. The average annual income and number of jobs estimated for the surveillance and maintenance period would increase by about 30% as a result of the addition of the USEC-generated cylinders. To estimate the change in socioeconomic impacts associated with the additional USEC cylinders, 30% of the average annual number of jobs and income during the surveillance and maintenance period for each option were added to the average annual number of jobs and income during the emplacement period from 2009 through 2028 (Allison and Folga 1997). Adding this increased the range for the number of annual jobs by 11–14 for the long-term storage as UF_6 options, resulting in a total range of 60 to 70 jobs when both DOE- and USEC-generated cylinders are considered. Correspondingly, annual income would increase by about $1 million, to a total of $4 million.

6.3.2.6 Ecology

The continued storage and preparation of the USEC-generated cylinders at the current storage sites would not result in additional impacts to ecological resources. Concentrations of uranium in soil, groundwater, and surface water would remain well below benchmark values for

toxic and radiological effects (see Section C.3.3). In addition, construction activities would take place on previously disturbed areas (i.e., existing yards) and would have no ecological impacts.

The storage of the USEC-generated cylinders at consolidated long-term storage facilities would increase land use requirements by 11 to 26 acres (4 to 10 ha), which would result in additional habitat loss. The total land required would range from 107 to 170 acres (43 to 68 ha), which could have a large impact on vegetation and wildlife.

6.3.2.7 Waste Management

Continued storage of USEC-generated cylinders under the long-term storage as UF_6 alternative would increase waste impacts at the current storage sites. The maximum additional impacts from management of the USEC-generated cylinders at the Paducah site would be the same as those under the no action alternative discussed in Section 6.3.1.7. Because the annual treatment volumes would not change, operational impacts related to waste handling would not be impacted (see Section 5.2.7). However, the timeframe of operations would increase by 6 years, and the total amount of waste generated would increase by about 30%.

For the operation and construction of a consolidated long-term storage facility, the addition of the USEC cylinders would generate an additional 900 yd^3 (690 m^3) of LLW and 240 yd^3 (180 m^3) of LLMW for storage in yards and about 25 yd^3 (19 m^3) of LLW for storage in buildings or a mine. The total waste generated would be about 3,700 yd^3 (2,800 m^3) of LLW and 970 yd^3 (740 m^3) of LLMW for storage in yards and 100 yd^3 (80 m^3) of LLW for storage in buildings or a mine.

The generation of waste under the long-term storage as UF_6 alternative (when both DOE- and USEC-generated cylinders are considered) would have a negligible to low impact when considered in terms of national and regional waste management capabilities. That is, the required increase in capacity at the regional and national level would be less than 10%.

6.3.2.8 Resource Requirements

In general, the addition of the USEC cylinders would not change the assessment of impacts on resource requirements for DOE-generated cylinders presented in Chapter 5 (i.e., no significant impacts would result because construction and operational requirements would not be resource intensive, and the resources required would not be rare or unique). The electrical requirement for mine construction would increase by about 130 MW-yr to a total of 970 MW-yr. The impact of this high electrical requirement on use of local energy resources would depend on the location of the facility and the existing infrastructure.

6.3.2.9 Land Use

At the current storage sites, the impacts to land use from the addition of USEC-generated cylinders would be the same as that for management of DOE-generated cylinders described in Section 5.2.9. Storage space for the USEC cylinders is already present at the sites. If transfer facilities were built for cylinder preparation, the land use requirements would be the same as those for the DOE-generated cylinders only described in Section 5.2.9, because the facility operational period would increase, not the facility size.

The increase in land use requirements at long-term storage facilities to accommodate the USEC-generated cylinders would range from 11 to 26 acres (4 to 10 ha). The total land use requirement for long-term storage of DOE- and USEC-generated cylinders would range from 107 to 170 acres (43 to 68 ha), constituting a moderate potential land use impact.

6.3.2.10 Cultural Resources

The potential impacts to cultural resources would be the same as those for the DOE-generated cylinders under the long-term storage as UF_6 alternative discussed in Section 5.2.10: impacts to cultural resources would be unlikely at the current storage sites because all activities would take place on previously developed land, and cultural impacts at a long-term storage facility would depend on the location of the facility.

6.3.2.11 Environmental Justice

The impacts to environmental justice would be the same as those for the DOE-generated cylinders under the long-term storage as UF_6 alternative discussed in Section 5.2.11. No disproportionately high and adverse effects to minority or low-income populations would be expected in the vicinity of the Paducah and Portsmouth sites in association with the continued cylinder storage and/or cylinder preparation under the long-term storage as UF_6 alternative.

6.3.3 Long-Term Storage as Uranium Oxide

Under the long-term storage as oxide alternative, the inclusion of USEC-generated cylinders would increase the number of cylinders managed by DOE at the Paducah site by 42% and at the Portsmouth site by 22%. Activities occurring at the K-25 site would be unaffected. Consequently, the duration of continued cylinder storage at the Paducah and Portsmouth sites would be extended by about 6 years, from 2028 to 2034. In addition, the total number of shipments of cylinders, uranium oxide, HF, and associated materials would increase by about 30%, although the annual number of shipments would be unchanged. The operational period for a conversion facility would be extended from 20 to 26 years to accommodate the additional processing of USEC-generated

cylinders. Similarly, the operational and construction (or emplacement) period for a long-term storage facility would also be increased from 20 to 26 years, with approximately 30% more land area being required for storage at the facility. At a long-term storage facility, surveillance and maintenance requirements would increase during the additional 6 years of emplacement, for a total increase of 30% for the surveillance and maintenance period of 2035 through 2039.

6.3.3.1 Human Health and Safety

6.3.3.1.1 Normal Facility Operations

For the long-term storage as oxide alternative, the management of USEC-generated cylinders would increase the level of exposure of workers and members of the public to radiation and chemicals, when compared with the management of DOE-generated cylinders only as presented in Chapter 5. For involved workers, the increased radiation exposure could result in a maximum of 1 LCF in addition to the potential 1 to 2 LCFs estimated for the management of DOE-generated cylinders. (The estimated total, when both DOE- and USEC-generated cylinders are considered, would be 1 to 3 LCFs.) For noninvolved workers and members of the public, the increased levels of exposure would not be large enough to cause appreciable increases in the potential health impacts over those under the long-term storage as oxide alternative discussed in Chapter 5.

Workers. Under the long-term storage as oxide alternative, the management of the additional USEC cylinders (including continued cylinder storage, cylinder preparation, conversion, empty cylinder treatment, and consolidated storage of oxide) was estimated to increase the total dose to involved workers by about 30%, resulting in a maximum of 1 additional LCF under each of the three long-term storage options (buildings, vaults, and mines). The total number of health effects among involved workers (when both DOE- and USEC-generated cylinders are considered) would range from 1 to 3 LCFs over the duration of the program. (The dose to noninvolved workers would remain negligible when compared with the involved worker dose.)

In general, the average annual radiation dose to individual workers associated with management of the additional USEC cylinders would be the same as that for DOE-generated cylinders reported on in Chapter 5 (i.e., well within applicable standards) because (1) at the current storage sites and a long-term storage facility, additional workers would be used instead of having the same individuals conduct extra activities, and (2) at conversion facilities, the annual worker activities would be the same, but the facilities would operate over a longer period of time.

Increased exposure to chemicals would not be expected to increase health impacts on involved or noninvolved workers; the total estimated hazard indices (when both DOE- and USEC-generated cylinders are considered) would be less than 0.002 for noninvolved workers at all three current storage sites, a conversion facility, or a consolidated long-term storage facility.

General Public. The overall potential impacts to members of the general public during normal operations would be the same as those for the management of DOE-generated cylinders described in Section 5.3.1.1.2: all exposures would be within applicable public health standards, and no LCFs from radiation exposures and no adverse effects from chemical exposures would be expected to occur among members of the general public near the three current storage sites, a conversion facility, or a consolidated long-term storage facility, when the management of additional USEC cylinders is considered.

At the current storage sites, potential public exposure to radiation and chemicals released from the sites would be exactly the same as that under the long-term storage as UF_6 alternative described in Section 6.3.2.1.1.

At conversion and long-term storage facilities, the annual impacts to members of the public would be the same as those for management of DOE-generated cylinders described in Section 5.3.1.1.2, because the annual operations would be the same. The total exposure of the public in the vicinity of these facilities to airborne radiation and chemicals would increase by approximately 30% as a result of the processing of USEC-generated cylinders. However, total exposure levels would remain well within standards and below levels expected to cause any adverse health effects among the public for all storage options.

6.3.3.1.2 Facility Accidents

Physical Hazards (On-the Job Injuries and Fatalities). For the long-term storage as oxide alternative, it was estimated that 1 additional worker fatality and up to 460 additional worker injuries could occur in association with management of the USEC-generated cylinders (including continued storage, cylinder preparation, empty cylinder treatment, conversion to oxide, and long-term storage as oxide activities). The total physical hazards associated with management of the DOE- and USEC-generated cylinders would range from about 1 to 3 worker fatalities and about 900 to 2,100 worker injuries.

Accidents Involving Releases of Radiation or Chemicals. For accident consequences, impacts would be the same as those for the DOE-generated cylinders under the long-term storage as oxide alternative discussed in Section 5.3.1.2.2. Although the estimated frequencies of some accidents would increase somewhat in association with the management of the additional USEC cylinders, this increase would not be expected to be enough to change the overall expected frequency of specific accidents from the broad ranges used for this PEIS.

6.3.3.2 Transportation

The management of the USEC-generated cylinders would result in an increase of approximately 30% in the total number of shipments of UF_6 cylinders, uranium oxide, ammonia,

anhydrous HF (if produced), CaF_2 (if produced), and waste materials. (The annual number of shipments would be the same as that for DOE-generated cylinders described in Section 5.3.2 and Appendix J.) For normal (incident-free) transportation operations, these additional shipments would increase exposure to overall external radiation and vehicle exhaust emissions by about 30%. However, no adverse health effects would be expected among workers and the public during normal transportation activities when shipment of both DOE- and USEC-generated cylinders and associated materials is considered.

Although the total number of shipments would increase by about 30%, the estimated number of fatalities from transportation accidents (not involving releases of radioactive or hazardous materials) would be the same as that for DOE-generated cylinders described in Section 5.3.2. As described under the long-term storage as UF_6 alternative in Section 6.3.2.2, the estimated number of traffic fatalities would not change because of rounding effects and the fact that estimates are presented as a single whole number. Thus, the total estimated number of traffic accident fatalities under the long-term storage as oxide alternative (when both DOE- and USEC-generated cylinders are considered) would remain 4 for truck transport and 2 for rail transport.

The consequences of severe traffic accidents involving releases of radiation or chemicals would be the same as those for the shipment of DOE-generated cylinders and associated materials described in Section 5.3.2, because the shipment sizes would not change. The annual probability of severe accidents occurring also would be the same as that discussed in Section 5.3.2, although the total probability of a severe accident would increase by about 30% as shipments continued for an additional 6 years.

6.3.3.3 Air Quality

At the current storage sites, air quality impacts would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.3.

At a conversion to oxide facility, annual criteria pollutant emissions from construction and operation would be identical to those discussed for DOE-generated cylinders in Section 5.3.3, because conversion facilities would not increase in size, only in duration of operations. During an additional 6 years of operation, an additional 12 to 66 lb (5 to 30 kg) of uranium (as U_3O_8 or UO_2) would be emitted. The total uranium emissions that would result from conversion of both the DOE- and USEC-generated inventory could range from about 52 to 290 lb (24 to 132 kg). No air quality standards exist for uranium compounds. However, the potential health impacts from these emissions were evaluated in Section 6.3.3.1.1.

At a long-term storage facility, although the size of the facility would increase, annual average air concentrations of criteria pollutants and other emissions would remain the same as those predicted for the DOE-generated cylinders only in Section 5.3.3. No emission of uranium compounds is predicted in association with the long-term storage as oxide facility.

6.3.3.4 Water and Soil

At the current storage sites, impacts to surface water, groundwater, and soil would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.4.

The amount of water used to construct a conversion facility would be the same as that for DOE-generated cylinders described in Section 5.3.4. The duration of operational activities at a conversion facility would increase by 6 years, resulting in an additional water requirement of about 200 to 1,700 million gal. From about 90 to 840 million gal of additional wastewater would be generated over the additional 6 years of operation. The total water requirement at a conversion facility would range from about 880 to 7,400 million gal; the total wastewater generated would range from about 390 to 3,600 million gal.

The duration of both construction and operational activities at a long-term storage facility would increase by 6 years, so about 2 to 8 million gal of additional water would be required for construction, and about 8 million gal of additional water would be required for operations. Additional wastewater generation would range from about 0.6 to 8 million gal. The total water requirement for construction would range from 8 to 34 million gal; the total water requirement for operations would be about 36 million gal. Total wastewater generation would range from about 3 to 36 million gal.

Impacts to surface water and groundwater from an oxide conversion facility or a long-term storage facility would depend on the actual location of the facility. On the basis of an assessment of representative settings considered for this PEIS, impacts from the DOE cylinders only were expected to be negligible, as described in Section 5.3.4.1. Additional impacts to surface water and groundwater as a result of the additional USEC-generated cylinders during conversion to oxide and long-term storage would also probably be negligible because annual emissions would not change.

The conversion and storage of USEC-generated cylinders would increase requirements for excavating a mine for a long-term storage facility. The additional excavation volume would be about 400,000 yd^3 (306,000 m^3) for storage as U_3O_8 in a mine and 200,000 yd^3 (150,000 m^3) for storage as UO_2 in a mine. The maximum total required excavation volume for a mine would be about 2.6 million yd^3 (2.0 million m^3).

6.3.3.5 Socioeconomics

At the current storage sites, socioeconomic impacts would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.5.

The annual socioeconomic impacts from operating a conversion to oxide facility would be the same as those estimated for the DOE-generated cylinders in Section 5.3.5, but the period of operation would be extended by 6 years. Annual socioeconomic impacts during construction would

also be the same as those for managing DOE-generated cylinders, but the period of construction activities for the long-term storage facility would also be extended by 6 years.

Construction and operation of a long-term storage as oxide facility would be extended by 6 years as a result of the addition of the USEC-generated cylinders. The peak year construction costs would not change. For operations, the emplacement period, originally assumed to extend from the year 2009 through 2028, would be extended through 2034, with the surveillance and maintenance period being reduced to the years 2035 through 2039. The average annual income and number of jobs estimated for the surveillance and maintenance period would increase by about 30% as a result of the addition of the USEC-generated cylinders. To estimate the change in socioeconomic impacts associated with the additional USEC cylinders, 30% of the average annual number of jobs and income during the surveillance and maintenance period for each option were added to the average annual number of jobs and income during the emplacement period from 2009 through 2028 (Allison and Folga 1997). Adding this increased the range for the number of annual jobs by 12–15 for the long-term storage as oxide options, resulting in a total range of 70 to 80 jobs when both DOE- and USEC-generated cylinders are considered. Correspondingly, annual income would increase by about $1 million, to a range of $4–5 million.

6.3.3.6 Ecology

The continued cylinder storage and preparation activities associated with management of the USEC-generated cylinders at the current storage sites would not result in additional impacts to ecological resources. Concentrations of uranium in soil, groundwater, and surface water would remain well below benchmark values for toxic and radiological effects (see Section C.3.3). In addition, construction activities would take place on previously disturbed areas (i.e., existing yards) and would have no ecological impacts.

At a conversion facility, treatment of USEC-generated cylinders would not result in any additional land use requirements or habitat loss, because the size of the conversion facility would not change. At a long-term storage facility, storage as U_3O_8 would increase land use from 14 to 52 acres (6 to 21 ha). Storage as UO_2 would increase land use from 7 to 22 acres (3 to 9 ha). These increases would result in additional habitat loss. The total land required for long-term storage would range from 135 to 264 acres (54 to 106 ha) for storage as U_3O_8, and from 81 to 135 acres (32 to 54 ha) for storage as UO_2. These total land requirements would have a moderate to large potential impact on vegetation and wildlife.

6.3.3.7 Waste Management

At the current storage sites, waste management impacts would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.7.

The duration of operational activities at a U_3O_8 conversion facility would be increased by 6 years, resulting in the generation of about 1,100 to 4,700 yd^3 (840 to 3,600 m^3) of additional LLW, 8 yd^3 (6 m^3) of additional LLMW, and 55 yd^3 (42 m^3) of additional hazardous waste. For conversion to UO_2, about 1,300 to 5,800 yd^3 (1,000 to 4,400 m^3) of additional LLW, 0 to 1,400 yd^3 (0 to 1,100 m^3) of additional LLMW, and 55 to 130 yd^3 (42 to 100 m^3) of additional hazardous waste would be generated. The construction impacts would be the same as those presented for DOE-generated cylinders. For conversion to U_3O_8, the total waste generated during operations (USEC and DOE-generated material) would be about 4,700 to 21,000 yd^3 (3,600 to 16,000 m^3) of LLW, 34 yd^3 (26 m^3) of LLMW, and 240 yd^3 (180 m^3) of hazardous waste. For conversion to UO_2, the total waste generated during operations (USEC and DOE-generated material) would be about 5,800 to 25,000 yd^3 (4,400 to 19,000 m^3) of LLW, 0 to 620 yd^3 (0 to 470 m^3) of LLMW, and 240 to 580 yd^3 (180 to 440 m^3) of hazardous waste. (The ranges are the result of assessing different conversion technologies.)

If CaF_2 was produced in the conversion process, and if the CaF_2 was disposed of as nonradioactive, nonhazardous solid waste, an additional 3,000 to 87,000 yd^3 (2,300 to 66,000 m^3) of nonradioactive, nonhazardous solid waste would be generated over the additional 6 years of operation. The capacity for managing this annual volume of nonhazardous waste would already be in place. If the CaF_2 was disposed of as LLW, the addition of about 170,000 yd^3 (128,000 m^3) of LLW would be generated over the additional 6 years of operation. (The additional volume would be the result of grouting.) In total, about 720,000 yd^3 (550,000 m^3) of CaF_2 LLW could be generated as a result of conversion to oxide. This quantity would represent about 13% of the projected DOE complexwide disposal volume for approximately the same time period, an amount that would represent a moderate impact on waste management if the LLW was considered to be DOE waste.

The duration of operational activities at a cylinder treatment facility would increase by 6 years, resulting in a total of about 380 yd^3 (290 m^3) of additional LLW, 1.6 yd^3 (1.2 m^3) of additional LLMW, and 16 yd^3 (12 m^3) of additional hazardous waste generated as a result of the inclusion of the USEC-generated cylinders. The construction impacts would be the same as those described for management of DOE-generated material. The total waste generated during treatment operations for both DOE- and USEC-generated cylinders would be about 1,600 yd^3 (1,200 m^3) of LLW, 6.8 yd^3 (5.2 m^3) of LLMW, and 68 yd^3 (52 m^3) of hazardous waste. The crushed cylinders, totaling about 37,000 m^3, would add an additional 1% to the projected DOE complexwide LLW disposal volume (if a decision for disposal was made). The total inventory of crushed cylinders would add an additional 4% to the projected DOE complexwide LLW disposal volume.

For the operation and construction of a consolidated long-term storage facility, the addition of the USEC cylinders would generate a maximum of about 8 yd^3 (6 m^3) of additional LLW from the repackaging of failed storage containers; the maximum total volume of LLW generated as a result of both the DOE- and USEC-generated inventory would be 34 yd^3 (26 m^3).

The generation of waste for all components under the long-term storage as oxide alternative (when both DOE- and USEC-generated cylinders are considered) would have a negligible to moderate impact when considered in terms of national and regional waste management capabilities.

6.3.3.8 Resource Requirements

In general, the addition of the USEC cylinders under the long-term storage as oxide alternative would not change the assessment of impacts on resource requirements presented in Section 5.3.8. The electrical requirement for mine construction would increase by up to 150 MW-yr to a total of 1,150 MW-yr. The impact of this high electrical requirement on use of local energy resources would depend on the location of the facility and the existing infrastructure.

6.3.3.9 Land Use

At the current storage sites, the impacts to land use from the addition of USEC-generated cylinders would be the same as that for management of DOE-generated cylinders described in Section 5.2.9. Storage space for the USEC cylinders is already present at the sites. If transfer facilities were built for cylinder preparation, the land use requirements would be the same as those for the DOE-generated cylinders only described in Section 5.2.9, because the facility operational period would increase, not the facility size. The land use required for a conversion facility would be the same as that for management of DOE-generated cylinders described in Section 5.3.9, because the size of the conversion facility would remain the same.

The increase in land use requirements at long-term storage facilities to accommodate the USEC-generated cylinders would range from 7 to 52 acres (3 to 21 ha). The total land use requirement for long-term storage as oxide for DOE- and USEC-generated cylinders combined would range from 81 to 264 acres (32 to 106 ha), constituting a moderate to large potential land use impact.

6.3.3.10 Cultural Resources

Potential impacts to cultural resources would be unlikely at the current storage sites because all activities would take place on previously developed land, and cultural impacts at a conversion or long-term storage facility would depend on the location of the facility.

6.3.3.11 Environmental Justice

No disproportionately high and adverse effects to minority or low-income populations would be expected in the vicinity of the Paducah and Portsmouth sites in association with the addition of the USEC-generated cylinders under the long-term storage as oxide alternative.

6.3.4 Use as Uranium Oxide

Under the use as uranium oxide alternative, the inclusion of USEC-generated cylinders would increase the number of cylinders managed by DOE at the Paducah site by 42% and at the Portsmouth site by 22%. Activities occurring at the K-25 site would be unaffected. Consequently, the duration of continued cylinder storage at the Paducah and Portsmouth sites would be extended by about 6 years, from 2028 to 2034. In addition, the total number of shipments of cylinders, uranium oxide, HF, uranium-oxide-shielded casks, and associated materials would increase by about 30%, although the annual number of shipments would be unchanged. The operational period for conversion and manufacturing facilities would be extended from 20 to 26 years to accommodate the additional processing of USEC-generated cylinders, but the sizes of these facilities would remain unchanged.

6.3.4.1 Human Health and Safety

6.3.4.1.1 Normal Facility Operations

For the use as uranium oxide alternative, the management of USEC-generated cylinders would increase the level of exposure of workers and members of the public to radiation and chemicals when compared with the management of DOE-generated cylinders only as presented in Chapter 5. However, the increased levels of exposure would not be large enough to cause appreciable increases in the potential health impacts over those under the use as uranium oxide alternative discussed in Chapter 5.

Workers. Under the use as uranium oxide alternative, the management of the additional USEC-generated cylinders (including continued cylinder storage, cylinder preparation, conversion, empty cylinder treatment, and manufacture and use) was estimated to increase the total dose to involved workers by about 30%. However, this increase would not result in additional health effects among workers when compared with the management of DOE-generated cylinders only. (The number of LCFs would not change because of rounding effects and the fact that estimates are presented as whole numbers.) The total number of health effects among involved workers (when both DOE- and USEC-generated cylinders are considered) would still range from 1 to 2 LCFs over the duration of the program. (The dose to noninvolved workers would remain negligible when compared with the involved worker dose.)

In general, the average annual radiation dose to individual workers associated with management of the additional USEC cylinders would be the same as that for DOE-generated cylinders reported on in Chapter 5 (i.e., well within applicable standards) because (1) at the current storage sites, additional cylinder yard workers would be used instead of having the same individuals conduct extra activities, and (2) at conversion and manufacturing facilities, the annual worker activities would be the same, but the facilities would operate over a longer period of time.

Increased exposure to chemicals would not be expected to increase health impacts on involved or noninvolved workers; the total estimated hazard indices (when both DOE- and USEC-generated cylinders are considered) would be less than 0.002 for noninvolved workers at all three current storage sites, a conversion facility, or a manufacturing facility.

General Public. The overall potential impacts to members of the general public during normal operations would be the same as those for the management of DOE-generated cylinders described in Section 5.4.1.1.2: all exposures would be within applicable public health standards, and no LCFs from radiation exposures and no adverse effects from chemical exposures would be expected to occur among members of the general public near the three current storage sites, a conversion facility, or a manufacturing facility, when the management of additional USEC cylinders is considered.

At the current storage sites, potential public exposure to radiation and chemicals released from the sites would be exactly the same as that under the long-term storage as UF_6 alternative described in Section 6.3.2.1.1.

At conversion and manufacturing facilities, the annual impacts to members of the public would be the same as those for management of DOE-generated cylinders described in Section 5.4.1.1.2, because the annual operations would be the same. The total exposure of the public in the vicinity of these facilities to airborne radiation and chemicals would increase by approximately 30% as a result of the processing of USEC-generated cylinders. However, total exposure levels would remain well within standards and below levels expected to cause any adverse health effects among the public for all options.

6.3.4.1.2 Facility Accidents

Physical Hazards (On-the Job Injuries and Fatalities). For the use as uranium oxide alternative, it was estimated that no (zero) additional worker fatalities and up to 600 additional worker injuries could occur in association with management of the USEC-generated cylinders (including continued storage, cylinder preparation, cylinder treatment, conversion to oxide, and manufacture of uranium-oxide-shielded casks). The total physical hazards associated with management of the DOE- and USEC-generated cylinders would range from 2 to 3 worker fatalities and 1,600 to 2,600 worker injuries.

Accidents Involving Releases of Radiation or Chemicals. For accident consequences, impacts would be the same as those for the DOE-generated cylinders under the use as uranium oxide alternative discussed in Section 5.4.1.2.2. Although the estimated frequencies of some accidents would increase somewhat in association with the management of the additional USEC cylinders, this increase would not be expected to be enough to change the overall expected frequency of specific accidents from the broad ranges used for this PEIS.

6.3.4.2 Transportation

The management of the USEC-generated cylinders would result in an increase of approximately 30% in the total number of shipments of UF_6 cylinders, uranium oxide, ammonia, anhydrous HF (if produced), CaF_2 (if produced), uranium-oxide-shielded casks, and waste materials. (The annual number of shipments would be the same as that for DOE-generated cylinders described in Section 5.4.2 and Appendix J.) For normal (incident-free) transportation operations, these additional shipments would increase exposure to overall external radiation and vehicle exhaust emissions by about 30%. However, no adverse health effects would be expected among workers and the public during normal transportation activities when shipment of both DOE- and USEC-generated cylinders and associated materials is considered.

The 30% increase in the total number of shipments would not change the estimated number of fatalities from truck accidents (not involving releases of radioactive or hazardous materials) presented in Section 5.4.2: 4 fatalities from truck shipments (because of rounding). However, the estimated number of fatalities from rail shipment accidents would increase by 1, from 2 to 3, over the duration of the program.

The consequences of severe traffic accidents involving releases of radiation or chemicals would be the same as those for the shipment of DOE-generated cylinders and associated materials described in Section 5.4.2, because the shipment sizes would not change. The annual probability of severe accidents occurring also would be the same as that discussed in Section 5.4.2, although the total probability of a severe accident would increase by about 30% as shipments continued for an additional 6 years.

6.3.4.3 Air Quality

At the current storage sites, potential impacts to air quality would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.3. At an oxide conversion facility, the potential air quality impacts would be identical to those under the long-term storage as oxide alternative discussed in Section 6.3.3.3.

At a cask manufacturing facility, impacts on criteria pollutant emissions from construction and operation would be identical to those for DOE-generated cylinders only discussed in

Section 5.4.3, because manufacturing facilities would not increase in size, only in duration of operations. During an additional 6 years of operation, an additional 0.1 lb (0.048 kg) of uranium (as UO_2) would be emitted. The total uranium emissions from oxide cask manufacture of both the DOE- and USEC-generated inventory would be about 0.46 lb (0.21 kg). No air quality standards exist for uranium compounds. However, the additional radiological dose from these emissions was evaluated in Section 6.3.4.1.1.

6.3.4.4 Water and Soil

At the current storage sites, potential impacts to surface water, groundwater, and soil would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.4. At a conversion facility, impacts to water use and surface water, groundwater, and soil quality would be identical to those under the long-term storage as oxide alternative discussed in Section 6.3.3.4.

During construction of an oxide cask manufacturing facility, water use requirements would be the same as those for DOE-generated cylinders described in Section 5.4.4. The duration of operational activities at a cask manufacturing facility would increase by 6 years, so about 45 million gal of additional water would be required for operations. About 30 million gal of additional wastewater would be generated over the additional 6 years of operation. The total water requirement for oxide cask manufacturing facility operations would be about 200 million gal; the total operational wastewater generated would be about 130 million gal.

At a cask manufacturing facility, potential impacts to surface water, groundwater, and soil would depend on the actual location of the facility. Impacts from the DOE cylinders only were expected to be negligible, as discussed in Section 5.4.4. Impacts from the additional USEC-generated cylinders would also likely be negligible.

6.3.4.5 Socioeconomics

At the current storage sites, socioeconomic impacts would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.5.

The annual socioeconomic impacts from operating a conversion to oxide facility and an oxide cask manufacturing facility would be the same as those for the DOE-generated cylinders only presented in Section 5.4.5. However, the period of operation would be extended by 6 years. Socioeconomic impacts during construction would also be the same as those described in Section 5.4.5.

6.3.4.6 Ecology

The continued cylinder storage and preparation activities associated with management of the USEC-generated cylinders at the current storage sites would not result in additional impacts to ecological resources. Concentrations of uranium in soil, groundwater, and surface water would remain well below benchmark values for toxic and radiological effects. In addition, construction activities would take place on previously disturbed areas (i.e., existing yards) and would have no ecological impacts.

At conversion and manufacturing facilities, treatment of USEC-generated cylinders would not result in any additional land use requirements or habitat loss, because the size of the facilities would not change when compared with those described in Section 5.4.6.

6.3.4.7 Waste Management

At the current storage sites, potential impacts to waste management would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.7.

Waste management impacts from conversion activities (including disposal of CaF_2, if necessary, and empty cylinder treatment) would be identical to those under the long-term storage as oxide alternative discussed in Section 6.3.3.7.

Waste generation during construction of a manufacturing facility would be the same as that for DOE-generated cylinders described in Section 5.4.7, because the design and size of the manufacturing facility would not change. During operation of a manufacturing facility, the addition of the USEC-generated cylinders would not change the amount of LLW generated annually; this amount would still be about 0.2% of the projected annual LLW treatment volume for all DOE facilities as described in Section 5.4.7. Operation of the manufacturing facility would generate about 1,000 yd^3 (780 m^3) of additional LLW, 2,200 yd^3 (1,700 m^3) of additional hazardous waste, and 1,500 metric tons of nonradioactive, nonhazardous solid waste. The total volume of LLW generated for processing of both the DOE- and USEC-generated cylinders would be about 4,400 yd^3 (3,400 m^3); the total volume of hazardous waste would be about 9,800 yd^3 (7,500 m^3); and the total volume of nonradioactive, nonhazardous solid waste would be about 6,500 metric tons.

The generation of waste for all components under the use as oxide alternative (when both DOE- and USEC-generated cylinders are considered) would have a low to moderate impact when considered in terms of national and regional waste management capabilities.

6.3.4.8 Resource Requirements

Addition of the USEC-generated cylinders under the use as uranium oxide alternative would not change the assessment of impacts on resource requirements presented in Section 5.4.8: no significant impacts would be expected because construction and operational requirements would not be resource intensive, and the resources required would not be rare or unique.

6.3.4.9 Land Use

At the current storage sites, the impacts to land use from the addition of USEC-generated cylinders would be the same as that for management of DOE-generated cylinders described in Section 5.2.9. Storage space for the USEC cylinders is already present at the sites. If transfer facilities were built for cylinder preparation, the land use requirements would be the same as those for the DOE-generated cylinders only described in Section 5.2.9, because the facility operational period would increase, not the facility size. The land use required for conversion and manufacturing facilities would be the same as that for management of DOE-generated cylinders described in Section 5.4.9, because the facility sizes would remain the same.

6.3.4.10 Cultural Resources

The potential impacts to cultural resources would be the same as those for the DOE-generated cylinders under the use as uranium oxide alternative discussed in Section 5.4.10. Impacts to cultural resources would be unlikely at the current storage sites because all activities would take place on previously developed land, and cultural impacts at a conversion or manufacturing facility would depend on the location of the facility.

6.3.4.11 Environmental Justice

The potential impacts to environmental justice would be the same as those for the DOE-generated cylinders under the long-term storage as oxide alternative discussed in Section 5.4.11.

6.3.5 Use as Uranium Metal

Under the use as uranium metal alternative, the inclusion of USEC-generated cylinders would increase the number of cylinders managed by DOE at the Paducah site by 42% and at the Portsmouth site by 22%. Activities occurring at the K-25 site would be unaffected. Consequently, the duration of continued cylinder storage at the Paducah and Portsmouth sites would be extended by about 6 years, from 2028 to 2034. In addition, the total number of shipments of cylinders, uranium oxide, HF, uranium-metal-shielded casks, and associated materials would increase by about 30%, although

the annual number of shipments would be unchanged. The operational period for conversion and manufacturing facilities would be extended from 20 to 26 years to accommodate the additional processing of USEC-generated cylinders, but the sizes of these facilities would remain unchanged.

6.3.5.1 Human Health and Safety

6.3.5.1.1 Normal Facility Operations

For the use as metal alternative, the management of USEC-generated cylinders would increase the level of exposure of workers and members of the public to radiation and chemicals when compared with the management of DOE-generated cylinders only as presented in Chapter 5. However, the increased levels of exposure would not be large enough to cause appreciable increases in the potential health impacts over those under the use as metal alternative discussed in Chapter 5.

Workers. Under the use as metal alternative, the management of the additional USEC-generated cylinders (including continued cylinder storage, cylinder preparation, conversion, empty cylinder treatment, and manufacture and use) was estimated to increase the total dose to involved workers by about 30%. However, this increase would not result in additional health effects among workers when compared with the management of DOE-generated cylinders only. The total number of health effects among involved workers (when both DOE- and USEC-generated cylinders are considered) would still range from 1 to 2 LCFs over the duration of the program. (The dose to noninvolved workers would remain negligible when compared with the involved worker dose.)

In general, the average annual radiation dose to individual workers associated with management of the additional USEC cylinders would be the same as that for DOE-generated cylinders reported on in Chapter 5 (i.e., well within applicable standards) because (1) at the current storage sites, additional cylinder yard workers would be used instead of having the same individuals conduct extra activities, and (2) at conversion and manufacturing facilities, the annual worker activities would be the same, but the facilities would operate over a longer period of time.

Increased exposure to chemicals would not be expected to increase health impacts on involved or noninvolved workers. The total estimated hazard indices (when both DOE- and USEC-generated cylinders are considered) would be less than 0.002 for noninvolved workers at all three current storage sites, a conversion facility, or a manufacturing facility.

General Public. The overall potential impacts to members of the general public during normal operations would be the same as those for the management of DOE-generated cylinders described in Section 5.5.1.1.2: all exposures would be within applicable public health standards, and no LCFs from radiation exposures and no adverse effects from chemical exposures would be expected to occur among members of the general public near the three current storage sites, a

conversion facility, or a manufacturing facility, when the management of additional USEC cylinders is considered.

At the current storage sites, potential public exposure to radiation and chemicals released from the sites would be exactly the same as that for the long-term storage as UF_6 alternative described in Section 6.3.2.1.1.

At conversion and manufacturing facilities, the annual impacts to members of the public would be the same as those for management of DOE-generated cylinders described in Section 5.5.1.1.2, because the annual operations would be the same. The total exposure of the public in the vicinity of these facilities to airborne radiation and chemicals would increase by approximately 30% as a result of the processing of USEC-generated cylinders. However, total exposure levels would remain well within standards and below levels expected to cause any adverse health effects among the public for all options.

6.3.5.1.2 Facility Accidents

Physical Hazards (On-the Job Injuries and Fatalities). For the use as metal alternative, it was estimated that no (zero) additional worker fatalities and up to 600 additional worker injuries could occur in association with the management of the USEC-generated cylinders (including continued storage, cylinder preparation, empty cylinder treatment, conversion to metal, and manufacture of metal casks). The total physical hazards associated with management of the DOE- and USEC-generated cylinders would range from 2 to 3 worker fatalities and 1,700 to 2,700 worker injuries.

Accidents Involving Releases of Radiation or Chemicals. For accident consequences, impacts would be the same as those for the DOE-generated cylinders under the use as metal alternative discussed in Section 5.5.1.2.2. Although the estimated frequencies of some accidents would increase somewhat in association with the management of the additional USEC cylinders, this increase would not be expected to be enough to change the overall expected frequency of specific accidents from the broad ranges used for this PEIS.

6.3.5.2 Transportation

The management of the USEC-generated cylinders would result in an increase of approximately 30% in the total number of shipments of UF_6 cylinders, uranium metal, ammonia, anhydrous HF (if produced), CaF_2 (if produced), MgF_2, uranium-metal-shielded casks, and waste materials. (The annual number of shipments would be the same as that for DOE-generated cylinders described in Section 5.5.2 and Appendix J). For normal (incident-free) transportation operations, these additional shipments would increase exposure to overall external radiation and vehicle exhaust emissions by about 30%. However, no adverse health effects would be expected among workers and

the public during normal transportation activities when shipment of both DOE- and USEC-generated cylinders and associated materials is considered.

The 30% increase in the total number of shipments would increase the estimated number of fatalities from truck and rail accidents (not involving releases of radioactive or hazardous materials) presented in Section 5.5.2. The estimated number of fatalities from truck shipments would increase from 3 to 4. The estimated number of fatalities from rail shipments would increase from 1 to 2 over the duration of the program.

The consequences of severe traffic accidents involving releases of radiation or chemicals would be the same as those for the shipment of DOE-generated cylinders and associated materials described in Section 5.5.2, because the shipment sizes would not change. The annual probability of severe accidents occurring also would be the same as that discussed in Section 5.5.2, although the total probability of a severe accident would increase by about 30% as shipments continued for an additional 6 years.

6.3.5.3 Air Quality

At the current storage sites, potential impacts to air quality would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.3.

At a metal conversion facility, impacts on criteria pollutant emissions from construction and operation would be identical to those for DOE-generated cylinders only under the use as metal alternative discussed in Section 5.5.3, because conversion facilities would not increase in size, only in duration of operations. During an additional 6 years of operation, an additional 24 to 66 lb (11 to 30 kg) of uranium (as U_3O_8 or UF_4) would be emitted. The total uranium emissions from conversion of both the DOE- and USEC-generated inventory would range from about 100 to 290 lb (45 to 130 kg). No air quality standards exist for uranium compounds. However, the potential health impacts from these emissions were evaluated in Section 6.3.5.1.1.

At a cask manufacturing facility, impacts on criteria pollutant emissions from construction and operation would be identical to those for DOE-generated cylinders only discussed in Section 5.5.3, because manufacturing facilities would not increase in size, only in duration of operations. During an additional 6 years of operation, an additional 0.66 lb (0.30 kg) of uranium (as U_3O_8) would be emitted. The total uranium emissions from metal cask manufacture of both the DOE- and USEC-generated inventory would be about 2.9 lb (1.3 kg). No air quality standards exist for uranium compounds. However, the additional radiological dose from these emissions was evaluated in Section 6.3.5.1.1.

6.3.5.4 Water and Soil

At the current storage sites, potential impacts to surface water, groundwater, and soil would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.4.

During construction of a metal conversion facility, water use requirements would be the same as those for DOE-generated cylinders described in Section 5.5.4. The duration of operational activities at a conversion to metal facility would increase by 6 years, so about 330 million gal of additional water would be required for operations. From about 150 to 180 million gal of additional wastewater would be generated over the additional 6 years of operation. The total water requirement for conversion to metal operations would be about 1,400 million gal; the total wastewater generated would range from about 650 to 780 million gal.

During construction of a cask manufacturing facility, water use requirements would be the same as those for DOE-generated cylinders described in Section 5.5.4. The duration of operational activities at a metal cask manufacturing facility would increase by 6 years, so about 42 million gal of additional water would be required for operations. About 30 million gal of additional wastewater would be generated over the additional 6 years of operation. The total water requirement for metal cask manufacturing facility operations would be about 180 million gal; the total operational wastewater generated would be about 130 million gal.

At a metal cask manufacturing facility, potential impacts to surface water, groundwater, and soil would depend on the actual location of the facility. Impacts for the DOE-cylinders only were expected to be negligible, as described in Section 5.5.4. Impacts from the additional USEC-generated cylinders would also likely be negligible.

6.3.5.5 Socioeconomics

At the current storage sites, socioeconomic impacts would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.5.

The annual socioeconomic impacts from operating a conversion to metal facility and metal cask manufacturing facility would be the same as those for the DOE-generated cylinders only presented in Section 5.5.5. However, the period of operations would be extended by 6 years. Socioeconomic impacts during construction would also be the same as those described in Section 5.5.5.

6.3.5.6 Ecology

The continued cylinder storage and preparation activities associated with management of the USEC-generated cylinders at the current storage sites would not result in additional impacts to

ecological resources. Concentrations of uranium in soil, groundwater, and surface water would remain well below benchmark values for toxic and radiological effects. In addition, construction activities would take place on previously disturbed areas (i.e., existing yards) and would have no ecological impacts.

At conversion and manufacturing facilities, treatment of USEC-generated cylinders would not result in any additional land use requirements or habitat loss, because the sizes of the facilities would not change when compared with those described in Section 5.5.6.

6.3.5.7 Waste Management

At the current storage sites, potential impacts to waste management would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.7.

At a metal conversion facility, the impacts during construction would be the same as those for DOE-generated cylinders described in Section 5.5.7. Operation of the metal conversion facility would increase by 6 years, so about 1,400 to 14,000 yd^3 (1,100 to 11,000 m^3) of additional LLW, 8 yd^3 (6 m^3) of additional LLMW, and 55 to 78 yd^3 (42 to 60 m^3) of additional hazardous waste would be generated as a result of including the USEC-generated cylinders. The total waste generated during operations for conversion of both DOE- and USEC-generated cylinders would be about 6,400 to 64,000 yd^3 (4,900 to 49,000 m^3) of LLW, 34 yd^3 (26 m^3) of LLMW, and 230 to 340 yd^3 (180 to 260 m^3) of hazardous waste. (The ranges are the result of assessing different conversion technologies.)

If MgF_2 produced in the conversion process was disposed of as nonradioactive, nonhazardous solid waste, an additional 48,000 yd^3 (37,000 m^3) of nonradioactive, nonhazardous solid waste would be generated. This additional waste would be disposed of annually (about 7,900 yd^3 [6,100 m^3] per year) over the additional 6 years of operation of the conversion facility. The capacity for managing this annual volume of nonhazardous waste would already be in place. If the MgF_2 needed to be disposed of as LLW, an additional 96,000 yd^3 (74,000 m^3) of LLW would be generated over the additional 6 years of operation. This additional volume would be a result of grouting. In total, about 420,000 yd^3 (320,000 m^3) of MgF_2 LLW could be generated through conversion to metal. This amount of LLW would represent less than 8% of the projected DOE complexwide disposal volume for approximately the same time period, which would be considered a low impact for waste management if the LLW was considered DOE waste. If HF was neutralized to produce CaF_2, and if the CaF_2 needed to be disposed of as LLW, an additional 27,000 yd^3 (21,000 m^3) of CaF_2 would be produced, yielding a total of 120,000 yd^3 (91,000 m^3) of grouted CaF_2 LLW. This additional volume of LLW would constitute approximately 4% of the projected DOE complexwide LLW disposal volume.

Waste generation during construction of a metal cask manufacturing facility would be the same as that for DOE-generated cylinders described in Section 5.5.7, because the design and size of

the manufacturing facility would not change. During operation of a manufacturing facility, the addition of the USEC-generated cylinders would not change the amount of LLW generated annually; this amount would still be about 0.3% of the projected annual LLW treatment volume for all DOE facilities, as described in Section 5.4.7. Operation of the manufacturing facility would generate about 5,100 yd^3 (3,900 m^3) of additional LLW, 2,500 yd^3 (1,900 m^3) of additional hazardous waste, and 1,800 metric tons of nonradioactive, nonhazardous solid waste. The total volume of LLW generated for processing of both the DOE- and USEC-generated cylinders would be about 22,000 yd^3 (17,000 m^3); the total volume of hazardous waste would be about 1,100 yd^3 (8,300 m^3); and the total volume of nonradioactive, nonhazardous solid waste would be about 7,800 metric tons.

The generation of waste for all components of the use as metal alternative (when both DOE- and USEC-generated cylinders are considered) would have a low to moderate impact when considered in terms of national and regional waste management capabilities.

6.3.5.8 Resource Requirements

The addition of the USEC-generated cylinders under the use as uranium metal alternative would not change the assessment of impacts on resource requirements presented in Section 5.5.8: no significant impacts would be expected, because construction and operational requirements would not be resource intensive, and the resources required would not be rare or unique.

6.3.5.9 Land Use

At the current storage sites, the impacts to land use from the addition of USEC-generated cylinders would be the same as that for management of DOE-generated cylinders described in Section 5.2.9. Storage space for the USEC cylinders is already present at the sites. If transfer facilities were built for cylinder preparation, the land use requirements would be the same as those given for the DOE-generated cylinders only described in Section 5.2.9, because the facility operational period would increase, not the facility size. The land use required for conversion and manufacturing facilities would be the same as that for management of DOE-generated cylinders described in Section 5.5.9, because the facility sizes would remain the same.

6.3.5.10 Cultural Resources

For the use as uranium metal alternative, impacts to cultural resources would be unlikely at the current storage sites, because all activities would take place on previously developed land, and cultural impacts at a conversion or manufacturing facility would depend on the location of the facility.

6.3.5.11 Environmental Justice

The impacts to environmental justice would be the same as those for the DOE-generated cylinders under the use as metal alternative discussed in Section 5.5.11.

6.3.6 Disposal as Uranium Oxide

Under the disposal as uranium oxide alternative, the inclusion of USEC-generated cylinders would increase the number of cylinders managed by DOE at the Paducah site by 42% and at the Portsmouth site by 22%. Activities occurring at the K-25 site would be unaffected. Consequently, the duration of continued cylinder storage at the Paducah and Portsmouth sites would be extended by about 6 years, from 2028 to 2034. In addition, the total number of shipments of cylinders, uranium oxide, HF, and associated materials would increase by about 30%, although the annual number of shipments would be unchanged. The operational period for a conversion facility would be extended from 20 to 26 years to accommodate the additional processing of USEC-generated cylinders. Similarly, the operational period of a disposal facility would also be increased from 20 to 26 years, with approximately 30% more land area being required for disposal.

6.3.6.1 Human Health and Safety

6.3.6.1.1 Normal Facility Operations

For the disposal as uranium oxide alternative, the management of USEC-generated cylinders would increase the level of exposure of workers and members of the public to radiation and chemicals when compared with the management of DOE-generated cylinders only, as presented in Chapter 5. For involved workers, the increased radiation exposure could result in a maximum of 1 LCF in addition to the potential 1 to 2 LCFs estimated for the management of DOE-generated cylinders. (The estimated total including DOE- and USEC-generated cylinders would be 1 to 3 LCFs.) For noninvolved workers and members of the public, the increased levels of exposure would not appreciably increase the potential health impacts over those under the disposal as oxide alternative discussed in Chapter 5. For a disposal facility in a wet environment, potential long-term exposure of members of the public to radiation and chemicals from groundwater could exceed standards and levels expected to cause adverse health effects. For a disposal facility in a dry environment, no long-term impacts would be expected.

Workers. Under the disposal as oxide alternative, the management of the additional USEC cylinders (including continued cylinder storage, cylinder preparation, conversion, empty cylinder treatment, and disposal of oxide) was estimated to increase the total dose to involved workers by about 30%, resulting in a maximum of 1 additional LCF for each disposal option (shallow-earthen structures, vaults, and mines). The total number of health effects among involved workers (when

both DOE- and USEC-generated cylinders are considered) would range from 1 to 3 LCFs over the duration of the program. (The dose to noninvolved workers would remain negligible when compared with the involved worker dose.)

In general, the average annual radiation dose to individual workers associated with management of the additional USEC cylinders would be the same as that for DOE-generated cylinders reported on in Chapter 5 (i.e., well within applicable standards) because (1) at the current storage sites, additional cylinder yard workers would be used instead of having the same individuals conduct extra activities, and (2) at conversion and disposal facilities, the annual worker activities would be the same, but the facilities would operate over a longer period of time.

Increased exposure to chemicals would not be expected to increase health impacts on involved or noninvolved workers; the total estimated hazard indices (when both DOE- and USEC-generated cylinders are considered) would be less than 0.002 for noninvolved workers at all three current storage sites, a conversion facility, or a disposal facility.

General Public. During the operational phase of the disposal facility, the overall potential impacts to members of the general public during normal operations would be the same as those for the management of DOE-generated cylinders described in Section 5.6.1.1.2: all exposures would be within applicable public health standards, and no LCFs from radiation exposures and no adverse effects from chemical exposures would be expected to occur among members of the general public near the three current storage sites, a conversion facility, or a disposal facility, when the management of additional USEC cylinders is considered.

At the current storage sites, potential public exposure to radiation and chemicals released from the sites would be exactly the same as that for the long-term storage as UF_6 alternative described in Section 6.3.2.1.1.

At a conversion facility or a disposal facility during the operational phase, the annual impacts to members of the public would be the same as those for management of DOE-generated cylinders described in Section 5.6.1.1.2, because the annual operations would be the same. The total exposure of the public to airborne radiation and chemicals in the vicinity of these facilities would increase by approximately 30% as a result of the processing of USEC-generated cylinders. However, total exposure levels during the operational phase would remain well within standards and below levels expected to cause any adverse health effects among the public for all disposal options.

For a disposal facility located in a wet environment, during the postclosure phase (long-term), potential exposures of members of the public to radiation and chemicals in groundwater could increase as a result of the additional management of USEC-generated cylinders. (For a disposal facility in a dry environment, groundwater contamination would not occur until well after the 1,000-year assessment period considered in the PEIS.) As described in the groundwater analysis in Section 6.3.6.4, in a wet environment, the addition of the USEC-generated cylinders would increase the uranium concentration in groundwater by 20% 1,000 years after facility failure (Tomasko 1998).

The potential radiation dose and chemical intakes for a maximally exposed individual would increase proportionally. The maximum radiation dose to an individual assumed to use contaminated groundwater would be expected to increase to about 120 mrem/yr, a level that is greater than the dose limit of 25 mrem/yr specified in 10 CFR Part 61. The chemical hazard indices were calculated to increase to 12, indicating the potential for chemically induced adverse effects.

6.3.6.1.2 Facility Accidents

Physical Hazards (On-the Job Injuries and Fatalities). Under the disposal as uranium oxide alternative, it was estimated that no (zero) additional worker fatalities and up to 600 additional worker injuries could occur in association with the management of the USEC-generated cylinders (including continued cylinder storage, cylinder preparation, cylinder treatment, conversion, and disposal). The total physical hazards associated with management of the DOE- and USEC-generated cylinders would range from 1 to 3 worker fatalities and 900 to 2,400 worker injuries.

Accidents Involving Releases of Radiation or Chemicals. For accident consequences, impacts would be the same as those for the DOE-generated cylinders under the disposal as uranium oxide alternative discussed in Section 5.6.1.2.2. Although the estimated frequencies of some accidents would increase somewhat in association with the management of the additional USEC cylinders, this increase would not be expected to be enough to change the overall expected frequency of specific accidents from the broad ranges used for this PEIS.

6.3.6.2 Transportation

The management of the USEC-generated cylinders would result in an increase of approximately 30% in the total number of shipments of UF_6 cylinders, uranium oxide, ammonia, anhydrous HF (if produced), CaF_2 (if produced), and waste materials. (The annual number of shipments would be the same as that for DOE-generated cylinders described in Section 5.6.2 and Appendix J.) For normal (incident-free) transportation operations, these additional shipments would increase exposure to overall external radiation and vehicle exhaust emissions by about 30%. However, no adverse health effects would be expected among workers and the public during normal transportation activities when shipment of both DOE- and USEC-generated cylinders and associated materials is considered.

Although the total number of shipments would increase by about 30%, the estimated number of fatalities from transportation accidents (not involving releases of radioactive or hazardous materials) would be the same as that for DOE-generated cylinders reported on in Section 5.6.2. The number would be the same because of rounding and the fact that estimates were presented as a single whole number. Thus, the total estimated number of traffic accident fatalities under the disposal as oxide alternative (including both DOE- and USEC-generated cylinders) would remain at 4 for truck transport and 2 for rail transport.

The consequences of severe traffic accidents involving releases of radiation or chemicals would be the same as those for the shipment of DOE-generated cylinders and associated materials described in Section 5.6.2, because the shipment sizes would not change. The annual probability of severe accidents occurring also would be the same as that discussed in Section 5.6.2, although the total probability of a severe accident would increase by about 30% as shipments continued for an additional 6 years.

6.3.6.3 Air Quality

At the current storage sites, potential impacts to air quality would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.3. At a conversion facility, potential impacts to air quality would be identical to those for conversion under the long-term storage as oxide alternative discussed in Section 6.3.3.3.

At a disposal facility, although the size of the facility would increase, annual average air concentrations of criteria pollutants would remain the same as those predicted for the DOE-generated cylinders only in Section 5.6.3, because the annual level of operations would stay the same. For disposal options that involve the grouting of waste, during an additional 6 years of operation, an additional 3.6 to 6.6 lb (1.6 to 3 kg) of uranium (as U_3O_8 or UO_2) would be emitted. The total uranium emissions from disposal of grouted U_3O_8 or UO_2 for both the DOE- and USEC-generated inventory would range from about 16 to 29 lb (7 to 13 kg). No air quality standards exist for uranium compounds. However, the potential health impacts from these emissions were evaluated in Section 6.3.6.1.1.

6.3.6.4 Water and Soil

At the current storage sites, potential impacts to water and soil would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.4. At an oxide conversion facility, potential impacts to water and soil would be identical to those for conversion under the long-term storage as oxide alternative discussed in Section 6.3.3.4.

At a disposal facility, the addition of the USEC-generated cylinders would require that construction and operational activities be increased by 6 years. Therefore, about 1.2 to 17 million gal of additional water would be required for construction, and about 0.6 to 120 million gal of additional water would be required for operations. Additional wastewater generation would range from about 0.6 to 1.2 million gal for construction and 0.6 to 8 million gal for operations. The total water requirement for construction would range from 5 to 73 million gal; the total water requirement for operations would range from about 3 to 520 million gal. Total wastewater generation would range from about 3 to 5 million gal for construction and 3 to 34 million gal for operations.

As stated in Section 5.6.4.1, impacts to surface water from a disposal facility would be negligible, because no process water effluents would be expected and because wastewater generation rates would be half or less than half of those from a conversion facility. Additional impacts of disposal to surface water as a result of the additional USEC-generated cylinders would also be negligible.

Potential impacts to groundwater during the operational phase of disposal when the USEC cylinders are considered would be the same as the impacts for the DOE-generated cylinders only described in Section 5.6.4.2.1.

Potential long-term impacts to groundwater from disposal of DOE-generated cylinders only were discussed in Section 5.6.4.2.2. The addition of the USEC cylinders to the disposal inventory would increase the total subsurface disposal area, which ultimately would increase the estimated concentration of uranium in groundwater by 20% 1,000 years after failure of the facility (Tomasko 1998). This increase would not impact the assessment for disposal in a dry environment (i.e., concentrations greater than the guideline level of 20 µg/L would not occur for at least 1,000 years after failure of the facility). For disposal in a wet environment, the inclusion of the USEC cylinders in the disposal calculations would result in estimated concentrations of uranium in groundwater at 1,000 years after facility failure that would range from about 280 to 510 pCi/L (1,100 to 2,000 µg/L) for disposal of U_3O_8 and about 230 to 380 pCi/L (910 to 1,600 µg/L) for disposal of UO_2.

The additional excavation volume that would result from the addition of the USEC cylinders under the disposal as uranium oxide alternative would range from 70,000 yd^3 (54,000 m^3) for disposal as ungrouted UO_2 in a vault to 1 million yd^3 (770,000 m^3) for disposal as grouted U_3O_8 in a mine. The total required excavation volumes would range from 400,000 yd^3 (310,000 m^3) to 3.6 million yd^3 (230,000 to 2.8 million m^3).

6.3.6.5 Socioeconomics

At the current storage sites, socioeconomic impacts would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.5.

The annual socioeconomic impacts from operating a conversion to oxide facility and a disposal facility would be the same as those for the DOE-generated cylinders only presented in Section 5.6.5. However, the period of operation would be extended by 6 years. Socioeconomic impacts during construction would not change for the conversion facility. However, the period of construction activities for the disposal facility would increase by 6 years.

6.3.6.6 Ecology

The continued cylinder storage and preparation activities associated with management of the USEC-generated cylinders at the current storage sites would not result in additional impacts to ecological resources. Concentrations of uranium in soil, groundwater, and surface water would remain well below benchmark values for toxic and radiological effects. In addition, construction activities would take place on previously disturbed areas (i.e., existing yards) and would have no ecological impacts.

At a conversion facility, treatment of USEC-generated cylinders would not result in any additional land use requirements or habitat loss, because the size of the facilities would not change when compared with those described in Section 5.6.6.

For the operational phase of the disposal facility, addition of the USEC-generated cylinders would increase land use requirements by 8 to 116 acres (3 to 46 ha), which would result in additional habitat loss. The total land required for a disposal facility would range from 36 to 587 acres (14 to 230 ha), which would have a moderate to large potential impact on vegetation and wildlife.

Although the postclosure groundwater uranium concentrations at disposal facilities might increase somewhat (i.e., by about 20%) as a result of the addition of the USEC-generated cylinders, the overall ecological impacts during the postclosure phase would remain the same as those discussed in Section 5.6.6.2.

6.3.6.7 Waste Management

At the current storage sites, potential impacts on waste management would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.7. At an oxide conversion facility, impacts would be identical to those under the long-term storage as oxide alternative discussed in Section 6.3.3.7.

At a disposal facility, the inclusion of the USEC-generated cylinders would increase disposal volumes by approximately 30%. Thus, the maximum volume of grouted U_3O_8 for disposal would increase by approximately 130,000 yd^3 (100,000 m^3), to a total of 540,000 yd^3 (412,000 m^3). This amount would represent approximately 10% of the projected DOE complexwide LLW disposal volume over the same approximate period. If the U_3O_8 was not grouted, an additional 65,000 yd^3 (50,000 m^3) would be disposed of, for a total of about 260,000 yd^3 (200,000 m^3), representing about 5% of the projected DOE disposal volume. The volumes of UO_2 disposed of would increase by approximately 30,000 yd^3 (23,000 m^3) if grouted and 20,000 yd^3 (15,000 m^3) if ungrouted, for totals of about 120,000 yd^3 (95,000 m^3) grouted and 82,000 yd^3 (63,000 m^3) ungrouted. These volumes represent less than about 2.2% of the projected DOE disposal volume. Overall, the additional volumes represent a range of potential waste management impacts from low to moderate.

The generation of waste for all components under the disposal alternative (when both DOE- and USEC-generated cylinders are considered) would have a low to moderate impact when considered in terms of national and regional waste management capabilities.

6.3.6.8 Resource Requirements

In general, addition of the USEC cylinders would not change the assessment of impacts on resource requirements from those under the disposal alternative presented in Section 5.6.8; no significant impacts would be expected because construction and operational requirements would not be resource intensive, and the resources required would not be considered rare or unique. The maximum electrical requirement for mine construction would increase by approximately 200 MW-yr, to a total of 1,300 MW-yr. The impact of this high electrical requirement on use of local energy resources would depend on the location of the facility and the existing infrastructure.

6.3.6.9 Land Use

At the current storage sites, the impacts to land use from the addition of USEC-generated cylinders would be the same as that for management of DOE-generated cylinders described in Section 5.2.9. Storage space for the USEC cylinders is already present at the sites. If transfer facilities were built for cylinder preparation, the land use requirements would be the same as those for the DOE-generated cylinders only described in Section 5.2.9, because the facility operational period would increase, not the facility size. The land use required for a conversion facility would be the same as that for management of DOE-generated cylinders described in Section 5.6.9, because the facility size would remain the same.

The increase in land use requirements for disposal facilities to accommodate the USEC-generated cylinders would range from 8 to 116 acres (3 to 46 ha). The total land use requirement for disposal of DOE- and USEC-generated cylinders combined would range from 36 to 587 acres (14 to 230 ha), constituting a moderate to large potential land use impact.

6.3.6.10 Cultural Resources

For the disposal alternative, impacts to cultural resources would be unlikely at the current storage sites, because all activities would take place on previously developed land, and cultural impacts at a conversion or disposal facility would depend on the location of the facility.

6.3.6.11 Environmental Justice

The impacts to environmental justice would be the same as those for the DOE-generated cylinders only under the disposal alternative discussed in Section 5.6.11.

6.3.7 Preferred Alternative

DOE's preferred alternative is to begin conversion of the depleted UF_6 inventory, including USEC-generated cylinders, as soon as possible, either to uranium oxide, uranium metal, or a combination of both, while allowing for use of as much of this inventory as possible. As explained in Section 5.7, some portion of the inventory would probably require long-term storage as oxide, and for use, it could be in the form of either uranium oxide or uranium metal. To analyze the impacts of the preferred alternative as detailed in Section 5.7, a representative combination strategy involving 25% use as oxide, 25% use as metal, and 50% long-term storage as oxide was evaluated. Estimates of the impacts taken from parametric analyses of facilities with capacities ranging from 25% to 100% (presented in Appendix K) were added as appropriate to estimate the total impacts.

In practice, the addition of the USEC cylinders could be managed in a variety of ways. For example, facilities could be increased in size or operated longer to accommodate the additional inventory (as was assumed for the assessment of the potential impacts from the management of USEC-generated cylinders detailed in Sections 6.3.1 through 6.3.6). To remain consistent with the assumptions for the USEC-generated cylinders used in Sections 6.3.1 through 6.3.6, the analysis conducted for this section assumed that the facilities would operate longer to process the additional inventory. (For example, a 75%-capacity conversion to oxide facility would operate about 6 years longer, for a total of 26 years, to process 75% of the USEC-generated cylinders; a 25%-capacity conversion to metal facility would operate about 6 years longer, to process 25% of the USEC-generated cylinders.) The results of the analyses detailed in Sections 6.3.1 through 6.3.6 were incorporated and modified when possible to estimate the combined impacts when both the DOE- and USEC-generated cylinders are considered under the preferred alternative. For example, the impacts that would result from continued storage would be the same as those presented under the long-term storage as UF_6 alternative that considers USEC cylinders (Section 6.3.2).

6.3.7.1 Human Health and Safety

6.3.7.1.1 Normal Facility Operations

Under the preferred alternative, the management of USEC-generated cylinders would increase the levels of exposure of workers and members of the public to radiation and chemicals when compared with the management of DOE-generated cylinders only presented in Chapter 5. For involved workers, the increased radiation exposure could result in a maximum of 1 LCF in addition

to the potential 1 to 2 LCFs estimated for the management of DOE-generated cylinders. Thus, the estimated total, when both DOE- and USEC-generated cylinders are considered, would range from 2 to 3 LCFs. For noninvolved workers and members of the public, the increased levels of exposure would not be large enough to cause appreciable increases in the potential health impacts under the preferred alternative discussed in Chapter 5.

Workers. Under the preferred alternative, the management of the additional USEC cylinders (including continued cylinder storage, cylinder preparation, conversion to both uranium oxide and uranium metal, empty cylinder treatment, manufacture of oxide- and metal-shielded casks, and long-term storage of oxide) was estimated to increase the total dose to involved workers by about 30%, resulting in a maximum of 1 additional LCF. The total number of health effects among involved workers (when both DOE- and USEC-generated cylinders are considered) would range from 2 to 3 LCFs over the duration of the program. (The dose to noninvolved workers would remain negligible when compared with the involved worker dose.)

In general, the average annual radiation dose to individual workers associated with management of the additional USEC cylinders would be the same or less than that for DOE-generated cylinders reported on in Chapter 5 (i.e., well within applicable standards) because (1) at the current storage sites and a long-term storage facility, additional cylinder yard workers would be used instead of having the same individuals conduct extra activities and (2) conversion and manufacturing facilities would be smaller than the full-scale facilities and would thus require fewer worker activities.

Increased exposure to chemicals would not be expected to increase health impacts on involved or noninvolved workers; the total estimated hazard indices (when both DOE- and USEC-generated cylinders are considered) would be less than 0.002 for noninvolved workers at all three current storage sites, a conversion facility, a manufacturing facility, or a consolidated storage facility.

General Public. Although the exposure of the public to radiation and chemicals would increase by about 30%, the overall potential impacts to members of the general public during normal operations would be the same as those for the management of DOE-generated cylinders only described in Section 5.7.1.1: all exposures would be within applicable public health standards, and no LCFs from radiation exposures and no adverse effects from chemical exposures would be expected to occur among members of the general public near the three current storage sites, a conversion facility, a manufacturing facility, or a consolidated long-term storage facility, when the management of additional USEC cylinders is considered.

At the current storage sites, potential public exposure to radiation and chemicals released from the sites would be exactly the same as that under the long-term storage as UF_6 alternative described in Section 6.3.2.1.1.

At conversion, manufacturing, and long-term storage facilities, the total exposure of the public in the vicinity of these facilities to airborne radiation and chemicals would increase by

approximately 30% as a result of the processing of USEC-generated cylinders. However, total exposure levels would remain well within standards and below levels expected to cause any adverse health effects among the public.

6.3.7.1.2 Facility Accidents

Physical Hazards (On-the Job Injuries and Fatalities). Overall, on-the-job injuries and fatalities under the preferred alternative as presented in Section 5.7.2.2 and Table 5.11 would be expected to increase by about 30%. This percentage would represent an increase of about 700 to 990 injuries, for a total range of 2,900 to 4,100 injuries under the preferred alternative. The estimated fatalities would increase by about 1, to a total range of 4 to 5.

Accidents Involving Releases of Radiation or Chemicals. The assessment of impacts from these accidents would remain the same as previously that under the preferred alternative discussed in Section 5.7.2.1.

6.3.7.2 Transportation

The management of the USEC-generated cylinders would result in an increase of approximately 30% in the total number of shipments of UF_6 cylinders, uranium oxide, uranium metal, ammonia, anhydrous HF (if produced), CaF_2 (if produced), oxide- and metal-shielded casks, and waste materials. For normal (incident-free) transportation operations, these additional shipments would increase exposure to overall external radiation and vehicle exhaust emissions by about 30%. However, no additional adverse health effects would be expected among workers and the public during normal transportation activities when shipment of both DOE- and USEC-generated cylinders and associated materials is considered.

The 30% increase in the total number of shipments would increase the estimated numbers of fatalities due to truck and rail accidents (not involving releases of radioactive or hazardous materials) from the numbers presented in Section 5.7.3. The estimated number of fatalities from truck shipments would increase from 4 to 5. The estimated number of fatalities from rail shipments would increase from 1 to 2 over the duration of the program.

The consequences of severe traffic accidents involving releases of radiation or chemicals would be the same as those for the shipment of DOE-generated cylinders and associated materials described in Section 5.7.3, because the shipment sizes would not change. The annual probability of severe accidents occurring also would be the same as that discussed in Section 5.7.3, although the total probability of a severe accident would increase by about 30% as shipments continued for an additional 6 years.

6.3.7.3 Air Quality

At the current storage sites, potential impacts to air quality would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.3.

As stated in Section 5.7.4, under the preferred alternative, during the construction and operation of conversion, long-term storage, and manufacturing facilities designed to handle less than 100% of the inventory, pollutant emissions would remain within standards.

6.3.7.4 Water and Soil

At the current storage sites, potential impacts to water and soil would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.4.

Potential surface water, groundwater, and soil quality impacts at conversion, long-term storage, and manufacturing facilities would be site-dependent. On the basis of an evaluation of representative and generic sites, contaminant concentrations would be expected to remain within guideline levels.

The consideration of long-term storage of USEC-generated cylinders would result in increased excavation requirements. Additional excavation volumes would range from 10,000 to 200,000 yd^3 (7,600 to 150,000 m^3). The total required excavation volume would range from 51,000 to 1.3 million yd^3 (39,000 to 1.0 million m^3).

6.3.7.5 Socioeconomics

At the current storage sites, socioeconomic impacts would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.5.

The annual socioeconomic impacts from operating conversion to oxide and conversion to metal facilities under the preferred alternative would be the same as those estimated for the DOE-generated cylinders only in Section 5.7.5, but the period of operation would be extended by about 6 years. Socioeconomic impacts during construction would not change for the conversion facilities.

For the long-term storage as oxide component of the preferred alternative, construction and operations would be extended by 6 years as a result of the addition of the USEC-generated cylinders. The peak year construction jobs and income would not change from those stated in Table 2.4 for the preferred alternative (that is, 60–210 direct jobs, $3–10 million direct income). It is estimated that additional operational activities due to the USEC-generated cylinders would create from 9 to 11 direct jobs per year and up to $1 million in additional direct income. Thus, the total operational socioeconomic impacts from the DOE- and USEC-generated cylinders combined would be expected

to range from 39 to 46 direct jobs per year and from $3 to $4 million in direct income per year. The values are in ranges to allow for the form of the oxide and the location used for storage (buildings, vaults, or a mine).

6.3.7.6 Ecology

The continued cylinder storage and preparation activities associated with management of the USEC-generated cylinders at the current storage sites would not result in additional impacts to ecological resources. Concentrations of uranium in soil, groundwater, and surface water would remain well below benchmark values for toxic and radiological effects. In addition, construction activities would take place on previously disturbed areas (i.e., existing yards) and would have no ecological impacts. Habitat losses due to conversion and manufacturing facilities would not change from those presented in Section 5.7.7.

At a long-term storage facility, the addition of the USEC-generated cylinders would increase the land use requirement by up to about 25% (see Section 5.7.7), from about 49 acres (20 ha) to 61 acres (25 ha). The result would be additional habitat loss, but this loss would still represent only a moderate potential impact to vegetation and wildlife.

6.3.7.7 Waste Management

At the current storage sites, potential impacts on waste management would be identical to those under the long-term storage as UF_6 alternative discussed in Section 6.3.2.7.

At uranium oxide and uranium metal conversion facilities, inclusion of the USEC-generated cylinders could increase the amount of CaF_2 and MgF_2 requiring disposal as LLW by about 30%. However, this increase would not change the overall assessment of impacts on waste management; disposal of the LLW would still have a moderate impact on nationwide LLW management (assuming these wastes would be considered DOE wastes).

At long-term storage and manufacturing facilities, impacts to waste management would generally be negligible, as described in Section 5.7.8. The operation of these facilities for an additional 6 years to process USEC-generated cylinders would not appreciably change waste management impacts.

The generation of waste for all components under the preferred alternative (when both DOE- and USEC-generated cylinders are considered) would have negligible to moderate impacts when considered in terms of national and regional waste management capabilities.

6.3.7.8 Resource Requirements

Under the preferred alternative, when the USEC cylinders are considered, adverse effects on local, regional, or national availability of materials would not be expected.

6.3.7.9 Land Use

No change in land use would occur at the current storage sites under the preferred alternative described in Section 5.7.7 when the USEC cylinders are considered. Storage space for the cylinders is already present at the sites. If transfer facilities were built for cylinder preparation, the land use requirements would be the same as those for the DOE-generated cylinders only described in Section 5.7.7, because the facility operational period would increase, not the facility size.

Land use requirements at conversion and manufacturing facilities would not change from those presented in Section 5.7.6, because the length of operations at these facilities would be increased to accommodate the USEC cylinders; sizes of the facilities would not be increased.

For the long-term storage component of the preferred alternative, the addition of the USEC-generated cylinders would increase the land use requirement by about 25% (Section 5.7.7), from about 49 acres (20 ha) to 61 acres (25 ha). This increase would still represent only a moderate potential land use impact.

6.3.7.10 Cultural Resources

The impacts to cultural resources would be the same as those for the DOE-generated cylinders under the preferred alternative discussed in Section 5.7.11.

6.3.7.11 Environmental Justice

The impacts to environmental justice would be the same as those for the DOE-generated cylinders under the preferred alternative discussed in Section 5.7.11.

6.3.8 Cumulative Impacts

This section addresses whether the consideration of the additional USEC-generated cylinders would increase the impacts of depleted UF_6 management activities sufficiently to change the cumulative impacts evaluation presented in Section 5.8.

Inclusion of the USEC-generated cylinders would increase the number of cylinders managed by DOE at the Paducah site by 42% and at the Portsmouth site by 22%. Activities at the K-25 site would be unaffected. Consequently, the duration of continued cylinder storage and preparation activities at the Paducah and Portsmouth sites would be extended by about 6 years, from 2028 through 2034.

At the Paducah site, the increased inventory would generally result in a 42% increase in the collective population dose to the involved workers and to the public from continued cylinder storage and preparation activities, as reported on in Table 5.12. However, this increase in radiological exposure would not significantly affect the estimated number of cumulative health effects at the Paducah site. The overall cumulative impacts to workers and the public would be unaffected by the increase in the inventory because of rounding effects and the fact that estimated health effects (e.g., LCFs) are presented as whole numbers. Similarly, although transportation requirements and resource and infrastructure requirements would increase, this increase would not significantly change the cumulative impacts from those presented in Table 5.12. Air quality standards at the Paducah site would not be exceeded, nor would groundwater quality impacts change from those estimated for the DOE-generated cylinders alone. (See Sections 6.3.1.3, 6.3.1.4, 6.3.2.3, and 6.3.2.4.)

At the Portsmouth site, the increased inventory would generally result in a 22% increase in the collective population dose to the involved workers and to the public from continued cylinder storage and preparation activities, as reported on in Table 5.13. However, this increase in radiological exposure would not significantly affect the estimated number of cumulative health effects at the Portsmouth site. The overall cumulative impacts to workers and the public would be unaffected by the increase in the inventory because of rounding effects and the fact that estimated health effects (e.g., LCFs) are presented as whole numbers. Although transportation requirements and resource and infrastructure requirements would increase, this increase would not significantly change the cumulative impacts from those presented in Table 5.13. Air quality standards at the Portsmouth site would not be exceeded, nor would groundwater quality impacts change from those estimated for the DOE-generated cylinders alone. (See Sections 6.3.1.3, 6.3.1.4, 6.3.2.3, and 6.3.2.4.)