# 4.0 COMPLIANCE ASSESSMENT

This section describes the compliance assessment performed for the Site for the 2002 calendar year.

## 4.1 Compliance Demonstration Based on Environmental Measurements

Historically, the Site demonstrated compliance with the annual 10-mrem public dose standard in 40 CFR 61, Subpart H, through measurement and dispersion modeling of measured point source emissions, and emission estimation and dispersion modeling of nonpoint and calculated point source emissions, to determine the dose to the most impacted off-Site resident. Beginning with calendar year 1998, the Site transitioned to an alternative compliance demonstration method based on environmental measurements, as allowed by 40 CFR 61.93(b)(5). The calendar year 2002 compliance assessment is based on the alternative method, which is described below.

### 4.1.1 Description of Compliance Sampling Network

The Site operates a network of high-volume, size-fractionating ambient air samplers located on and around the Site, and in nearby communities (the RAAMP network). The compliance sampling network consists of 14 of these samplers located along the Site perimeter. Eleven of these samplers have operated for several years in their current locations. A 12$^{th}$ sampler located at the intersection of Highway 72 and Indiana Street ceased operation and a new sampler began operation to the north along Indiana Street during 1999. In addition, two new samplers were installed during 1999 to complete the compliance sampling network, one at the northeast corner of the Site fenceline near the intersection of Highway 128 and Indiana Street and the other due north of the center of the Site, on South 66$^{th}$ Street. The compliance sampling network is shown in Figure 4-1, along with nearby businesses or residences (receptors).

The ambient air samplers continuously collect both fine and coarse particulate matter fractions on filters and removable impactor surfaces that are exchanged and analyzed on a monthly schedule. The samples are analyzed for the plutonium, americium, and uranium isotopes that represent most of the radioactive materials handled at or residing on the Site. These isotopes account for all materials that have the potential to contribute 10% or more of the dose to the public.

Residential and commercial development on and around the Site is reviewed on a quarterly basis. If new development or privatization projects warrant additional or revised sampler locations, EPA and CDPHE will be notified. Sampler installation will be scheduled so that samplers will be operational when the new residence or business is occupied. No development that warranted additional or revised sampler location occurred in calendar year 2002.

Following the transition to the alternative compliance demonstration method, effluent collection and measurement were discontinued for insignificant release points on Site and

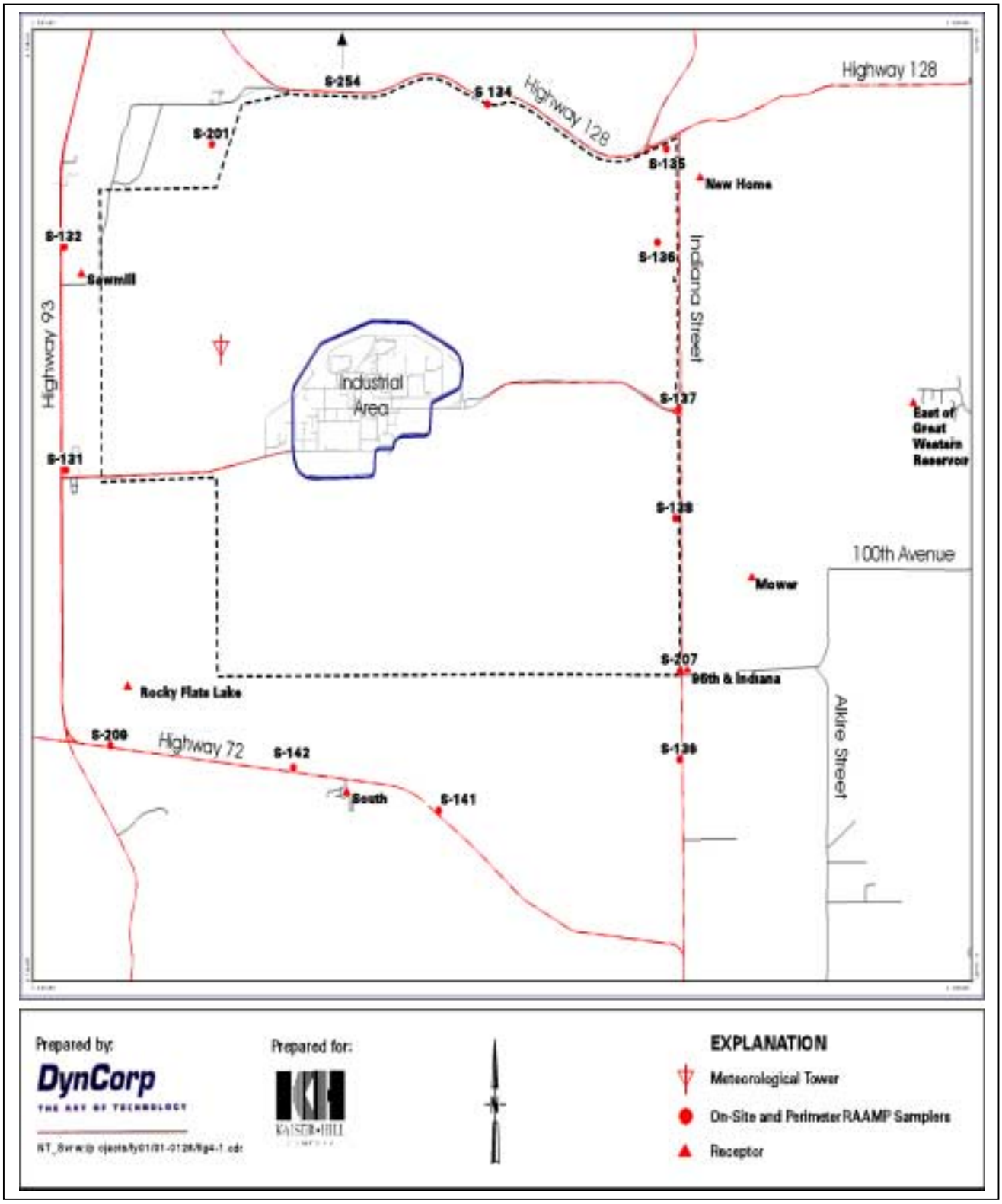


**Figure 4-1. Receptor Locations and Nearby Samplers**

the ambient network is now used to verify low emissions from these locations, as required by Section 61.93(b)(4). Emissions from significant release points will continue to be measured with the existing effluent sampling systems until the buildings are actively being decommissioned or until the operations that exceeded the 0.1 mrem trigger have ceased.

### 4.1.2 Compliance Sampling Network Measurements for 2002

Filters from the compliance sampling network were exchanged monthly during 2002, then analyzed for Pu-239/240, Am-241, U-233/234, U-235, and U-238. These isotopes accounted for all materials that had the potential to contribute 10% or more of the dose to the public. Annual average isotopic concentrations were calculated at each sampler from monthly isotopic concentration and sample volume data. The annual average isotopic concentrations for each compliance demonstration sampler are shown in Table 4-1.

A *fractional sum* was calculated for each sampler location by dividing each annual isotopic concentration by that isotope's corresponding *compliance level* as listed in Table 2 of Appendix E to 40 CFR 61, then summing the fractions. The fractional sums are also shown in Table 4-1.

## 4.2 Compliance Assessment Results

This section discusses the results of the compliance assessment for calendar year 2002.

### 4.2.1 Compliance Demonstration

As reported in Section 4.1 of this report, the maximum annual concentrations of Pu-239/240, Am-241, U-233/234, U-235, and U-238 measured at the compliance sampling network were compared to the compliance levels listed in Table 2 of Appendix E to 40 CFR 61. In each case, the maximum measured concentration of each isotope, as shown in Table 4-1, was less than 1% of the corresponding compliance level. In addition, the fractional sum of all isotopes at the *critical receptor* location (the sampler showing the highest concentrations in 2002) was determined to be 0.0156. The facility is in compliance when the annual concentration of each isotope is less than its corresponding Table 2 compliance level and when the fractional sum of all isotopes is less than 1.

Figure 4-2 shows data from the 2002 compliance sampling network at all locations. The data are presented as percentages of the compliance level for each isotope; the total height of each bar in Figure 4-2 represents the fractional sum expressed as a percent of the allowable sum (percent of 1). Data are presented for each sampler, beginning with S-131 at the west gate of the Site, and continuing around the Site perimeter in a clockwise direction. Sampler locations are shown in Figure 4-1.

The maximum measured radionuclide levels occurred to the northwest of the Site, at sampler S-132. This location also showed the highest radionuclide levels measured at the perimeter samplers during calendar years 1997, 1998, 1999, 2000, and 2001.

## Table 4-1. Annual Average Isotopic Concentrations at Compliance Sampling Network Locations

| Sampler | Pu-239/240 ($Ci/m^3$) | Am-241 ($Ci/m^3$) | U-233/234 ($Ci/m^3$) | U-235 ($Ci/m^3$) | U-238 ($Ci/m^3$) | Fractional Sum |
|---|---|---|---|---|---|---|
| S-131 | 8.75E-19 | 4.03E-19 | 3.85E-17 | 1.80E-18 | 3.69E-17 | 0.0108 |
| S-132 | 8.56E-19 | 5.68E-19 | 5.51E-17 | 3.22E-18 | 5.55E-17 | **0.0156** |
| S-134 | 3.17E-19 | 3.39E-19 | 2.82E-17 | 1.42E-18 | 2.88E-17 | 0.0080 |
| S-135 | 7.98E-19 | 3.07E-19 | 3.03E-17 | 1.91E-18 | 3.12E-17 | 0.0089 |
| S-136 | 1.41E-18 | 2.73E-19 | 2.55E-17 | 1.39E-18 | 2.62E-17 | 0.0078 |
| S-137 | 2.54E-18 | 3.15E-19 | 2.84E-17 | 1.59E-18 | 2.84E-17 | 0.0091 |
| S-138 | 3.08E-18 | 4.45E-19 | 2.79E-17 | 1.52E-18 | 2.89E-17 | 0.0094 |
| S-139 | 7.43E-19 | 1.11E-19 | 3.97E-17 | 2.15E-18 | 4.01E-17 | 0.0112 |
| S-141 | 4.92E-19 | 1.71E-19 | 3.35E-17 | 2.08E-18 | 3.17E-17 | 0.0092 |
| S-142 | 5.05E-19 | 6.79E-20 | 3.06E-17 | 2.06E-18 | 3.18E-17 | 0.0087 |
| S-201 | 4.59E-19 | 1.93E-19 | 4.01E-17 | 1.66E-18 | 3.82E-17 | 0.0108 |
| S-207 | 3.69E-18 | 6.01E-19 | 3.76E-17 | 1.96E-18 | 3.61E-17 | 0.0121 |
| S-209 | 6.66E-19 | 1.61E-19 | 3.34E-17 | 1.71E-18 | 3.40E-17 | 0.0095 |
| S-254 | 8.29E-19 | 3.60E-19 | 4.51E-17 | 2.27E-18 | 4.62E-17 | 0.0128 |
| **Compliance Level ($Ci/m^3$)[a]** | **2.0E-15** | **1.9E-15** | **7.1/7.7E-15** | **7.1E-15** | **8.3E-15** | **1** |

[a] Compliance levels are listed for each isotope in Table 2 of Appendix E to 40 CFR 61.

Notes:

Am = Americium
$Ci/m^3$ = Curies per cubic meter; 1 Ci = $3.7 \times 10^{10}$ Becquere1 (Bq)
E# = $\times 10^{\#}$
Pu = Plutonium
U = Uranium

Examination of the isotopic data presented in Table 4-1 and Figure 4-2 shows that the higher overall radionuclide level (fractional sum) at S-132, relative to other samplers in the compliance sampling network, was primarily due to higher levels of U-233/234 and U-238. The ratio of U-233/234 to U-238 activities at S-132 (and at other compliance samplers as well) was close to 1:1, which is characteristic of naturally occurring uranium. (In contrast, depleted or enriched uranium that might be emitted from on-Site sources would show different isotopic ratios.) S-132 is located in an area that has elevated dust levels due to quarrying activities, sand and gravel removal, and turbulence caused by nearby traffic, and 2002 was a particularly dry year, which may have enhanced dust emissions. The soils surrounding Rocky Flats contain naturally occurring uranium, which may explain the elevated activities at this sampler. Figure 4-3 shows the isotopic breakdown at S-132 as a percentage of the total fractional sum at that location; over 92% of the fractional sum is due to U-233/234 and U-238.

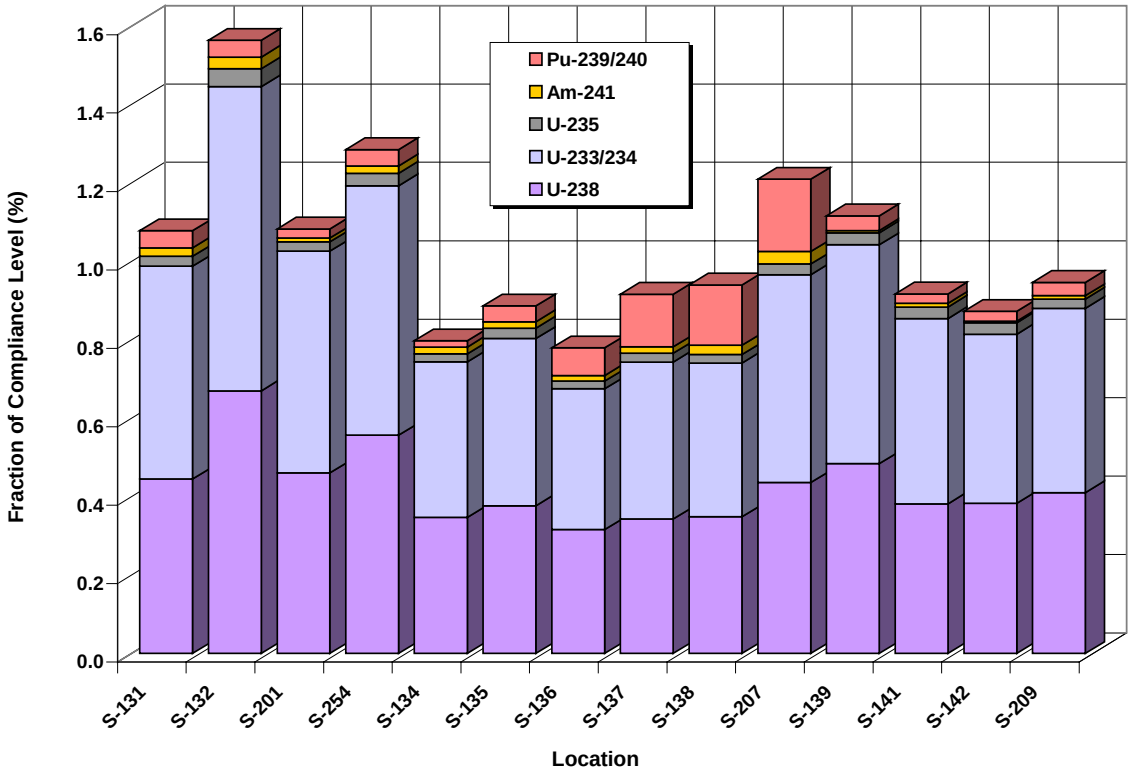


**Figure 4-2. Environmental Measurements of Airborne Radionuclides in 2002**

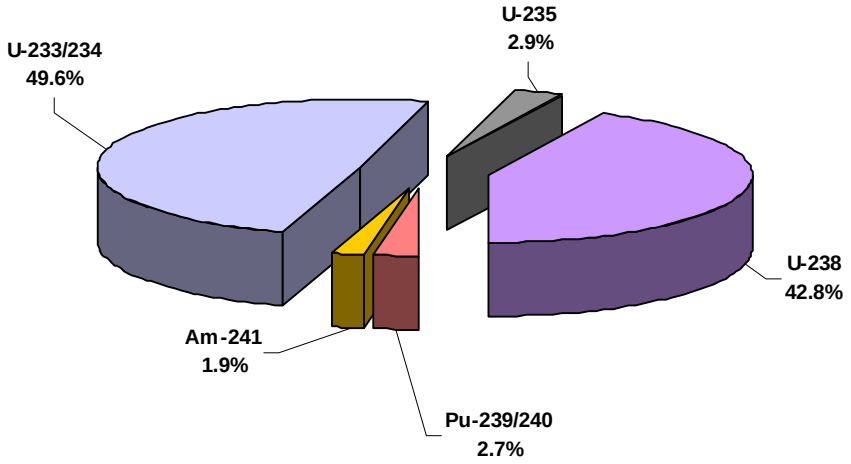


**Figure 4-3. Isotopic Contribution to the Fractional Sum at the Critical Receptor**

Naturally occurring uranium isotopes appear to have dominated the airborne radionuclide levels at all the compliance samplers in 2002. The sum of U-233/234 and U-238 activity represented between 79% and 95% of the fractional sum at the compliance demonstration samplers in 2002.

Uranium concentrations peaked at most of the compliance network samplers in June 2002. June continued a very dry period in the Denver area. In addition, the Denver area was impacted by smoke from a number of regional wildfires during much of June. Wildfires can liberate uranium bound to vegetation, leading to elevated airborne concentrations.

Figure 4-4 shows the measured levels of Pu-239/240 and Am-241 at the compliance sampling network locations, also presented as percentages of the compliance level for each isotope. These two isotopes are characteristic of the weapons-grade plutonium that was used at the Site.

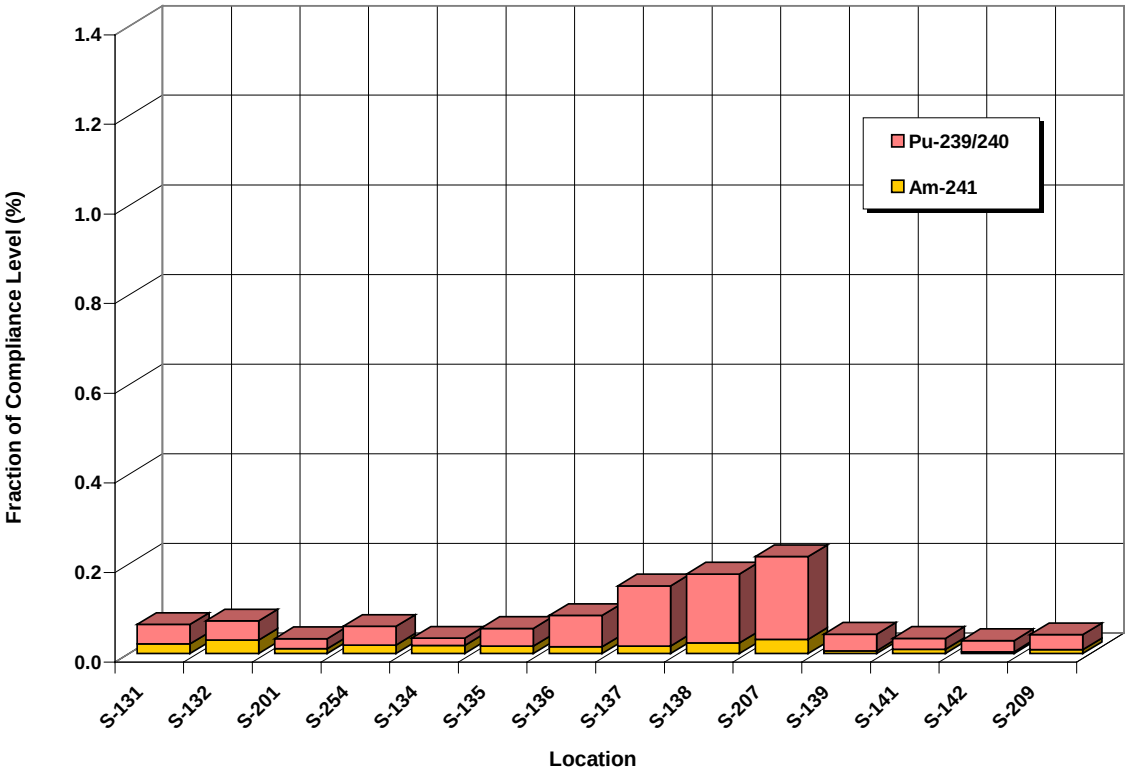


**Figure 4-4. Environmental Measurements of Pu-239/240 and Am-241 in 2002**

As has been seen in past years, Pu-239/240 and Am-241 present a different pattern than U-233/234 and U-238. An increase in concentrations is apparent at several of the samplers located along the eastern boundary of the Site relative to the other compliance network samplers. Based on annual average wind patterns (see Appendix E), these samplers are generally downwind of Site activities, including wind-blown dust from the 903 Pad, decommissioning and demolition activities in the industrial area, and other soil disturbance activities in the Buffer Zone.

Most of the increased Pu-239/240 and Am-241 activity measured along the eastern fenceline occurred in March, May, and June 2002. A number of demolition and slab removal projects occurred in the industrial area during this period, which may have disturbed contaminated dust. Also, between March and May, installation of a power line in the eastern Buffer Zone may have disturbed the slightly contaminated soils west of these fenceline samplers. Note that although the Pu-239/240 and Am-241 activity levels recorded at the eastern compliance network samplers were higher than those seen at most other samplers during 2002, they still represent an annual dose rate two orders of magnitude below the 10 mrem standard.

The fractional sum information for calendar year 2002 for the critical receptor can be compared with the 10-mrem dose limit and with data from prior years. As noted previously, the fractional sum at the critical receptor location in 2002 was 0.0156, which is nearly two orders of magnitude below the allowable level (fractional sum of 1). The fractional sum can be directly related to the allowable dose limit of 10 mrem in 40 CFR 61, Subpart H. As a result, the maximum dose recorded at the compliance sampling network in 2002 was nearly two orders of magnitude below the 10-mrem limit and more than 92% of the dose was due to uranium isotopes that are largely naturally occurring in the Site environment. For comparison, the fractional sum at the critical receptor was 0.0128 in 2001, 0.0130 in 2000, 0.0145 in 1999, 0.0141 in 1998, and 0.0128 in 1997.

### 4.2.2 Statement of Compliance Status

Compliance with the 10-mrem standard has been determined by comparing environmental radionuclide air concentration measurements at the critical receptor location with the “Concentration Levels for Environmental Compliance” listed in Table 2 of Appendix E to 40 CFR 61. Compliance is demonstrated when each measured radionuclide air concentration is less than its corresponding compliance level in Table 2 and when the fractional sum of all radionuclides is less than 1. For 2002, each measured radionuclide air concentration was less than 1% of its corresponding compliance level and the fractional sum of all radionuclides was less than 2% of the allowable level at the critical receptor (the sampler with the highest fractional sum). The Site was in compliance with the 10-mrem standard during 2002.

## 4.3 Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. (See 18 USC 1001.)

| | |
|---|---|
| Joseph A. Legare<br>Assistant Manager<br>of Environment and<br>Infrastructure<br>Department of Energy | David C. Shelton<br>Vice President<br>of Environmental Systems and<br>Stewardship<br>Kaiser-Hill Company, L.L.C. |
| _____ | _____ |
| Signature Date | Signature Date |