



California Department of Health Services

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Director

State of California—Health and Human Services Agency  
Department of Health Services



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**MAILED**  
11/14/06

ARNOLD SCHWARZENEGGER  
Governor

**SENT**  
11/14/06 B10

November 8, 2006

Mr. Mike Sedell  
City Manager  
City of Simi Valley  
2929 Tapo Canyon Road  
Simi Valley, CA 93063-2199

Dear Mr. Sedell:

The California Department of Health Services, Radiologic Health Branch (CDHS/RHB), has completed its review of available information concerning the presence of strontium-90 in soil on the Runkle Canyon site. The review evaluated whether such presence constituted a health and safety concern due to strontium-90 that may become airborne during grading or other activities associated with the site development.

Mr. Robert Greger, a Certified Health Physicist on my staff coordinated the preparation of the attached report. The report addresses radiological impacts on nearby residents and site workers from site development activities at Runkle Canyon that are expected to cause strontium-90 in the soil at the site to become airborne. The report concludes that the planned Runkle Canyon site development activities do not pose significant health and safety concerns to nearby residents or to site workers from strontium-90 that has been reported to exist in the soil at the site.

Please refer to the attached report for our detailed findings and direct any questions concerning the report to Mr. Greger at (714) 270-0368. Please do not hesitate to contact me if you require additional assistance from CDHS/RHB on this matter.

Sincerely,

Gary Butner  
Acting Chief  
Radiologic Health Branch

Attachment

cc: See next page

Mr. Mike Sedell  
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# AIRBORNE Sr-90 HAZARD AT RUNKLE CANYON SITE

## Introduction

In a September 27, 2006 letter, the City of Simi Valley requested assistance from the California Department of Health Services (CDHS) to provide a technical assessment of the potential radiological health and safety impact from strontium-90 reported in the soil at the Runkle Canyon site. This report assesses that impact on nearby residents and onsite workers from dust-generating site development activities.

Runkle Canyon is an approximate 1600-acre site in the City of Simi Valley that is scheduled for development. Approximately 150 acres of the site is scheduled for mixed-use residential development, with the remaining acreage designated for open space/recreational use, including a proposed golf course. The site partially abuts the Santa Susana Field Laboratory (SSFL) site, although the Brandeis-Bardin site lies between the portion of the Runkle Canyon site that is scheduled for residential development and the SSFL site.

## Background

Several radiological surveys were conducted at the Runkle Canyon property between 1999 and 2003, including soil surveys. The soil surveys are of particular interest because they identified strontium-90 concentrations in the soil that exceed the expected background from nuclear weapons testing. These soil surveys include a QST survey in 1999, a Foster Wheeler survey in 1999, a Harding ESE survey in 2000, and a Miller Brooks survey in 2003.<sup>1</sup> The radiological surveys were undertaken by a previous site developer, and CDHS was not involved in the conduct of the surveys.

The Miller Brooks survey is not considered useful due to its high minimum detectable activity, which ranged from 2.0 to 2.8 pCi/g. The remaining surveys determined the following average strontium-90 soil concentrations: QST: 0.59 pCi/g (4 sample locations); Foster Wheeler: 1.40 pCi/g (58 sample locations); and Harding ESE: 0.865 pCi/g (17 sample locations). Additionally, CDHS collected and analyzed five soil samples in 2005 from the locations of the five highest previously identified strontium-90 locations.<sup>2</sup> The CDHS samples were split with the Runkle Canyon site developer at the time (GreenPark) for analysis, and the following average strontium-90 soil concentrations were determined: CDHS: 0.050 pCi/g; GreenPark: 0.22 pCi/g.<sup>3</sup> The average from all of the above strontium-90 soil surveys, except for Miller Brooks, is 1.12 pCi/g.

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<sup>1</sup> QST Environmental, Inc., Peoria, IL; Foster Wheeler Environmental Corporation, Costa Mesa, CA; Harding ESE, Phoenix, AZ; Miller Brooks Environmental, Inc., Huntington Beach, CA

<sup>2</sup> The CDHS survey locations were based on GPS or recorded survey map locations, and therefore could not precisely match the previous sample locations. The CDHS sampling was prompted, in part, because unusually low Cs-137 soil concentrations from the previous surveys challenged the validity of the reported Sr-90 soil concentrations.

<sup>3</sup> The five locations sampled by CDHS in 2005 had significantly lower strontium-90 results than the previous sampling results for these locations. The reason for these lower results is not known. The previous results averaged 6.45 pCi/g for the five locations; the CDHS results were approximately 1/100 of those previous sampling results; the GreenPark analyses for the CDHS split-samples were approximately 1/30 of those previous sampling results.

Strontium-90 is present in surface soil around the world as a result of fallout from past atmospheric nuclear weapons tests at approximately 0.1 pCi/g.<sup>4</sup> The results from the five samples collected by CDHS and split with GreenPark appear to be reasonably consistent with world background levels of strontium-90 (with the CDHS results on the lower side of this background and the GreenPark results on the higher side). The average of all the soil sampling (1.12 pCi/g) is approximately 10 times the reported world background levels from atmospheric weapons testing.

It is not known why the strontium-90 soil concentrations were determined to be significantly higher in the 1999-2003 sampling than in the 2005 CDHS sampling, particularly considering the 2005 CDHS samples were collected near the five highest strontium-90 results from the earlier sampling. However, because the 1999-2003 sampling results are low from a health and safety perspective, there does not appear to be sufficient justification at this time to attempt to resolve the reason for the differences between the 1999-2003 and the CDHS 2005 sampling results. The average of 1.12 pCi/g is assumed to be representative of current strontium-90 soil concentrations for purposes of the assessment performed in this report. If the 2005 CDHS sampling, and the analyses performed by the CDHS laboratory and the laboratory utilized by GreenPark, are representative of current strontium-90 soil concentrations at the Runkle Canyon site, use of 1.12 pCi/g in this report's assessment will overestimate the health and safety significance of the soil strontium-90 by approximately a factor of ten.

### General Methodology

In order to determine the significance of the potential radiological risks from airborne strontium-90 during site development activities, airborne nuisance dust concentrations have been calculated based on site grading activities in order to predict off-site impact, and the Cal/OSHA regulatory criterion limiting workplace dust concentration (PEL) was used to predict on-site impact. These conditions provide upper bounds on the non-radioactive airborne dust concentrations, resulting in conservative impact calculations for both off-site and on-site individuals since neither limiting condition could reasonably be expected to exist consistently over the year as assumed in the calculations. The radioactive airborne dust concentrations were derived by assuming these nuisance dust concentrations were comprised of airborne soil at the average soil strontium-90 concentration of 1.12 pCi/g. These airborne strontium-90 concentrations were then compared to CDHS regulatory standards or other safety criteria, as noted in the remainder of this report.<sup>5</sup> The numerical data associated with the calculations are shown in the attached table (Airborne Sr-90 at Runkle Canyon from Development Activities).

### Off-Site Impact Determination

We received assistance from the Ventura County Air Pollution Control District (VCAPCD) in calculating the respirable airborne dust (PM<sub>10</sub>) concentrations that are expected to be generated from the site development activities. The VCAPCD reviewed the Runkle Canyon Final Environmental Impact Report (EIR) dust generation data and utilized that data with the EPA SCREEN 3 computer code to determine the PM<sub>10</sub> airborne concentrations off the Runkle Canyon

<sup>4</sup> Argonne National Laboratory, Human Health Fact Sheet, August 2005

<sup>5</sup> CDHS radiological regulatory standards are not applicable to DOE or DOE contractor activities.

site. The airborne strontium-90 concentrations were then calculated using the 1.12 pCi/g average of all the Runkle Canyon strontium-90 soil sampling, and these airborne strontium-90 concentrations were compared with regulatory radiological criteria for members of the public.

California regulations basically require that doses to members of the public not exceed 100 mrem per year above dose contributions from background radiation and medical radiation.<sup>6</sup> Similar regulations exist in all other states, either based on state regulations or federal Nuclear Regulatory Commission regulations. Public dose is further restricted in some situations, in part so as not to exceed the 100 mrem per year regulatory limit due to dose contributions from multiple sources. One such restriction is on airborne concentrations of radioactive materials from licensed facilities; the restriction used in this situation is 10 mrem per year as an ALARA (As Low As Reasonably Achievable) goal.<sup>7</sup>

In lieu of actually calculating dose to individuals from airborne effluents, which entails determining occupancy-times for individuals at various locations throughout the year and determining actual airborne concentrations at these locations, CDHS regulations allow licensees to control their airborne effluents based on the concentrations of such effluents at the licensee's restricted area boundaries (site boundary in the case of the Runkle Canyon site).<sup>8</sup> The dose to an individual actually residing 24 hours per day, 365 days per year, at the allowed airborne effluent regulatory limit, would be 50 mrem for the year.<sup>9</sup>

While the Runkle Canyon site is not a "licensee", it is appropriate for purposes of determining health and safety to use the CDHS regulatory criteria. The attached table, "Airborne Sr-90 at Runkle Canyon from Development Activities", shows parameters utilized and the resultant determinations of the "Fraction of 10CFR20 Appendix B" values in determining the health and safety of the airborne strontium-90 concentrations. Also shown are the expected doses to offsite individuals and the cancer incidence risks associated with such doses. It should be noted that a number of simplifying assumptions were made in the calculations. The simplifying assumptions were conservative (i.e., they overestimated the health and safety effects). The simplifying assumptions are noted in the footnotes to the attached table.

### Off-Site Impact Conclusions

As shown in the attached table (assuming implementation of dust mitigation measures):

- The strontium-90 concentrations off-site will be less than 1/100,000 of the allowable regulatory airborne effluent concentrations.<sup>10</sup>

<sup>6</sup> Title 10, Code of Federal Regulations, Section 20.1301(a)(1), which is adopted into CDHS regulations by Title 17 of the California Code of Regulations, Section 30253(a).

<sup>7</sup> Title 10, Code of Federal Regulations, Section 20.1101(d), which is adopted into CDHS regulations by Title 17 of the California Code of Regulations, Section 30253(a).

<sup>8</sup> Title 10, Code of Federal Regulations, Section 20.1302(b)(2), which is adopted into CDHS regulations by Title 17 of the California Code of Regulations, Section 30253(a).

<sup>9</sup> Title 10, Code of Federal Regulations, Appendix B to Part 20, which is adopted into CDHS regulations by Title 17 of the California Code of Regulations, Section 30253(a).

<sup>10</sup> Without dust mitigation the off-site concentrations will be less than 4/100,000 of the regulatory concentration.

- The dose to an individual who is continuously located in the maximum off-site airborne concentration would be less than 1/100,000 of the 100 mrem per year public dose regulatory limit, and less than 1/10,000 of the 10 mrem per year ALARA criterion.<sup>11</sup>
- The cancer morbidity risk for an individual continuously located in the maximum off-site airborne concentration would be less than 1E-9/y.<sup>12</sup>

Based on this conservative analysis, the CDHS has no reason to believe that the strontium-90 reported in the soil presents a health and safety concern to persons living in the vicinity of the Runkle Canyon development site from site development activities.<sup>13</sup>

### On-Site Impact Determination

We also examined the hazard to site workers at the Runkle Canyon site from airborne strontium-90. Cal OSHA regulations limit the nuisance dust ("particulates not otherwise regulated") concentrations at work sites to 10 mg/m<sup>3</sup> for total particulates and 5 mg/m<sup>3</sup> for respirable particulates (eight-hour time-weighted average).<sup>14</sup> Dust mitigation measures are required at construction sites to maintain nuisance dust concentrations under these Permissible Exposure Limit (PEL) concentrations. As noted in the attached table, "Airborne Sr-90 at Runkle Canyon from Development Activities", the maximum annual radiation dose was calculated to site workers based on working at the respirable nuisance dust limit for 50 hours per week and 50 weeks per year at the average soil Sr-90 concentration of 1.12 pCi/g.<sup>15</sup> Also shown in the table is the cancer incidence risk associated with the maximum annual dose.

### On-Site Impact Conclusions

As shown in the attached table:

- The dose to an individual working at the PEL concentration 2500 hours per year would be less than 2/10,000 of the 100 mrem per year public dose regulatory limit, and less than 2/1000 of the 10 mrem per year ALARA criterion.
- The cancer morbidity risk for a site-development worker will be less than 2E-8/y.<sup>16</sup>

Based on this conservative analysis, the CDHS has no reason to believe that the strontium-90 reported in the soil presents a health and safety concern to Runkle Canyon site workers from site development activities.

<sup>11</sup> Without dust mitigation the site boundary dose would be less than 2/100,000 of the 100-mrem/y limit and less than 2/10,000 of the 10-mrem/y ALARA criterion.

<sup>12</sup> National Academy of Sciences, BEIR VII report indicates a lifetime cancer morbidity risk of approximately 1E-6 per mrem. Without dust mitigation the off-site cancer morbidity risk would be less than 2E-9.

<sup>13</sup> This CDHS conclusion remains the same whether or not dust mitigation measures are implemented onsite.

<sup>14</sup> California Code of Regulations, Title 8, Section 5155, Table AC-1

<sup>15</sup> Radiation dose was based on the relationship noted in 10 CFR 20, Appendix B, that occupational exposure to 2000 DAC-hours is the equivalent of 5000 mrem.

<sup>16</sup> National Academy of Sciences, BEIR VII report indicates a lifetime cancer morbidity risk of approximately 1E-6 per mrem.

# Airborne Sr-90 at Runkle Canyon from Development Activity

Grading Impact	Dust Control Measures	Scheduled Grading Duration <sup>1,2</sup>	Affected Area <sup>2</sup> (acres)	PM <sub>10</sub> Dust Generated <sup>2</sup> (lb/d)	Distance to Site Boundary <sup>2</sup> (meters)	Average PM <sub>10</sub> Conc. <sup>3</sup> (ug/m <sup>3</sup> )	Average Sr-90 Conc. <sup>4</sup> (pCi/g)	Fraction of 10CFR20 App. B <sup>5</sup>	Dose <sup>6</sup> (mrem/yr)	Cancer Morbidity Risk <sup>7</sup> (y <sup>-1</sup> )
Offsite from Planning Areas 1-4,8,11,12,14	Unmitigated	9 Mo.	142.8	1995	380	98.3	1.12	1.8E-05	9.2E-04	9.2E-10
Offsite from Planning Areas 5,6,7,14	Mitigated	9 Mo.	142.8	250	380	22.9	1.12	4.3E-06	2.1E-04	2.1E-10
Offsite from Planning Areas 9,10	Unmitigated	4.5 Mo.	78.4	386	1100	54.6	1.12	1.0E-05	5.1E-04	5.1E-10
Offsite from Planning Areas 9,10	Mitigated	4.5 Mo.	78.4	88	1100	11.5	1.12	2.1E-06	1.1E-04	1.1E-10
Offsite from All Planning Areas Combined <sup>8</sup>	Unmitigated	1 Mo.	12.4	114	112	61.5	1.12	1.1E-05	5.7E-04	5.7E-10
Offsite from All Planning Areas Combined <sup>8</sup>	Mitigated	1 Mo.	12.4	26	112	13.7	1.12	2.6E-06	1.3E-04	1.3E-10
Onsite Worker <sup>9</sup>	Unmitigated					214.4	1.12	4.0E-05	2.0E-03	2.0E-09
Onsite Worker <sup>9</sup>	Mitigated					48.1	1.12	9.0E-06	4.5E-04	4.5E-10
Onsite Worker <sup>9</sup>						5000	1.12	2.8E-06	1.8E-02	1.8E-08

**Footnotes:**

- 1 Conservatively assumes grading continues 7 days per week for entire year even though grading duration per Planning Area < 1 year
- 2 From Final EIR (provided and/or confirmed by VCAPCD)
- 3 Conservatively determine average PM<sub>10</sub> concentration based on default meteorology utilizing EPA SCREEN 3 (data from VCAPCD) or OSHA PEL
- 4 Conservatively because highest Sr-90 conc. are outside areas to be graded; also CDHS soil sampling showed <5% of 1.12 pCi/g Sr-90 conc. used in
- 5 Conservatively used most restrictive 10 CFR 20, App. B Sr-90 airborne concentration of 6E-12 uCi/ml for offsite calc. and 2E-9 uCi/g for onsite calc.
- 6 Conservatively assumes occupancy at point of maximum airborne concentration off the Runkle Canyon site for entire year (see 9 for onsite dose)
- 7 Utilizes 1E-6 cancer morbidity risk per mrem dose (based on National Academy of Sciences, BEIR VII Report)
- 8 Conservatively assumes all Planning Areas are graded simultaneously (and per Footnote 1, grading continues for entire year for all areas)
- 9 Conservatively assumes working 50 hr/week for 50 weeks (2500 hr/yr) in respirable dust levels at the Cal OSHA Permissible Exposure Limit (PEL)