LMS/S11921

Elimination Report and Determination of LTS&M Authority for the Burris Park Field Station, Kings County, California

Formerly Utilized Sites Remedial Action Program

June 2014

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Abbreviations

AEC	U.S. Atomic Energy Commission
DOE	U.S. Department of Energy
FUSRAP	Formerly Utilized Sites Remedial Action Program
LM	Office of Legacy Management
LTS&M	long-term surveillance and maintenance
mCi	millicuries
MED	Manhattan Engineer District
NRC	U.S. Nuclear Regulatory Commission
RHB	Radiological Health Branch
Sr	strontium
UC-B	University of California Berkley

1.0 Introduction

In 1987 the U.S. Department of Energy (DOE) reviewed the past activities conducted by the University of California Berkley (UC-B) under contract to the U.S. Atomic Energy Commission (AEC) at the Burris Park Field Station in Kings County, California. Based on the review of remediation activities conducted by UC-B, DOE determined that no further remedial action was required and that the Burris Park Field Station would not be included in the Formerly Utilized Sites Remedial Action Program (FUSRAP; see DOE 1987).

UC-B and Kings County staffs have been maintaining the site, with the involvement of California Department of Public Health officials, since its closure in 1963. Maintenance is needed at the site and UC-B personnel requested that DOE provide assistance in addressing maintenance needs. This report reevaluates the site for eligibility for remediation under FUSRAP and considers whether DOE is required to maintain the remedy at the site.

The DOE Office of Legacy Management (LM) reviewed records available in the Considered Sites Library and provided by UC-B. LM also acquired deeds for Burris Park from the Kings County, California, assessor's office, and reviewed the State of California Hazardous Material Registry. LM staff contacted the National Archives and Records Administration and Lawrence Berkeley National Laboratory to search for the AEC contract, which was not found. On the basis of available documentation, LM has determined that DOE is authorized to conduct additional remediation, if needed, but no additional remediation is needed. Therefore, the site is not eligible for remediation under FUSRAP.

This eligibility evaluation departs from guidance in the FUSRAP Program Plan (DOE 2014a). The Burris Park Field Station is not eligible for remediation under FUSRAP because no additional remediation is required. However, post closure maintenance is needed, and the site should be monitored to ensure it remains protective. An authority review was conducted to determine if DOE is authorized to perform long-term surveillance and maintenance (LTS&M) under another authority, and concluded that DOE has the authority to conduct LTS&M.

2.0 Background and Description

Burris Park is located at 6500 Clinton Avenue, in Kings County, California (Figure 1). The 57-acre park is owned by Kings County, which is in the Central Valley south of Fresno. The park is surrounded by agricultural areas in the north portion of Kings County (Figure 2).

The former AEC/UC-B research area (Burris Park Field Station) consisted of 6-foot by 6-foot soil plots laid out in a square grid of 49 plots and separated by concrete barriers extending 30 inches into the soil. Sr-90 was added to the soil in seven plots to study the effectiveness of decontaminating the soil using displacement by electrolytes and leaching and physical immobilization using asphalt preparations (UC-B date unknown and Schulz et al. 1959). The site was decommissioned in 1963 by placing a concrete cap over the test plots and installing a fence, signage, and a permanent plaque (CDPH 1963).

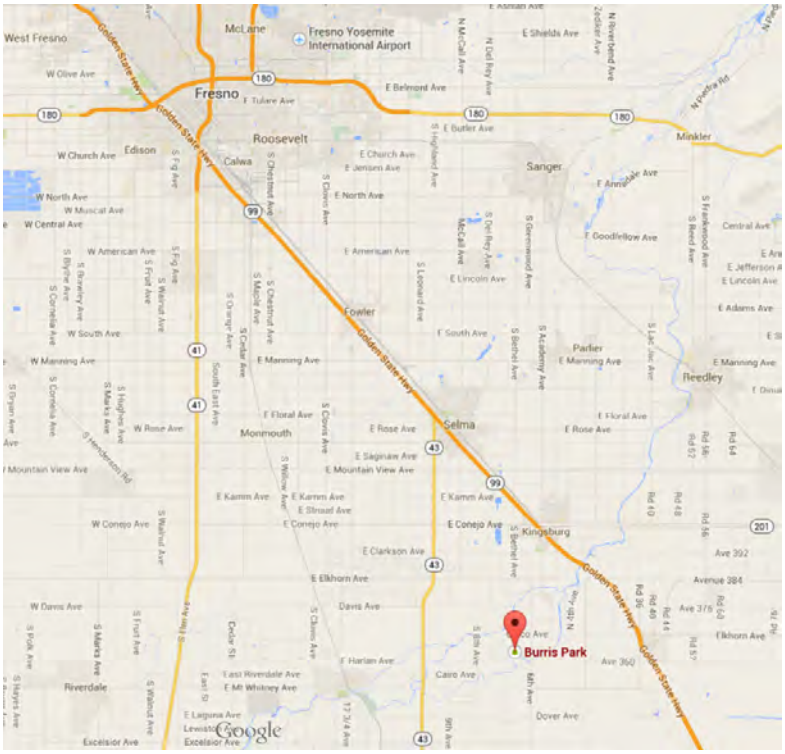


Figure 1. Location of Burris Park

Figure 2. Aerial Photograph of Burris Park and Surrounding Region

Currently, the site consists of a 50-foot by 50-foot fenced area with a 42-foot by 42-foot concrete slab covering the former Sr-90 research plots. The fence needs maintenance, two dead trees are inside the fenced area, and the slab is littered with tree limbs and has a display of old farm equipment. More information is provided in the trip report for the January 2014 site visit (DOE 2014b, see Attachment 2).

3.0 Contract and License Information

AEC entered into contract AT (11-1)-34 Project #23 with UC-B to construct test plots at the site and introduce Sr-90 into the soil. DOE has not located the AEC contract.

The site is not currently covered under a radioactive materials license. Burris Park was not included on the UC-B radioactive materials license because the work was completed in 1963 before UC-B had a broad scope license (UC-B 2013b).

4.0 Radiological Conditions

1956–1957: The research at Burris Park under contract AT (11-1)-34 Project #23 was described in the annual report of the Division of Radiation Safety (UC date unknown). The principal investigator was Dr. Robert K Schulz, Dept. of Plant and Soil Biology. Seventy-two millicuries (mCi) of Sr-90 was applied to soil.

1963: Work was stopped at Burris Park. The soil plots were capped with concrete, a plaque applied, and the area fenced (CDPH 1963).

1981: Burris Park was surveyed by the UC-B Radiation Safety Officer. No readings above background were obtained. Calculations determined that radioactive decay had reduced the amount of Sr-90 to less than 41 mCi (UC-B 1981).

1987: DOE evaluated the Burris Park Field Station and eliminated it from consideration under FUSRAP because no additional remediation was required (DOE 1987).

1995: Kings County requested that the California Department of Health Services Radiological Health Branch (RHB) investigate Burris Park. RHB personnel requested information from the U.S. Nuclear Regulatory Commission (NRC) and UC-B, performed a dose assessment for park workers, and surveyed the test area and determined there was not an “external radiation hazard.” RHB requested that the fencing be repaired and maintained (CDHS 1995).

2004: Kings County retained a subcontractor to sample the drinking water well and irrigation well at the park; no contamination was detected (KCDPW 2005).

2005: Kings Country requested site files from UC-B. Soil and water monitoring was conducted by the county and reported in a May 2005 newspaper article. A 2005 Kings County memorandum reported that the County’s results did not exceed background levels and that UC-B tests demonstrated the same conditions (KCDPW 2005).

2013: UC-B Radiation safety staff visited the site and collected soil, water, and vegetation samples for analysis (Figure 3). The soil sample results were comparable to the background control sample with the exception of one soil sample. Additional analysis and sampling was recommended to better identify the possible presence of Sr-90. The water samples did not show detectable levels of radioactive strontium. The vegetation samples from the live trees did not show activity significantly above the minimum detectable activities. The dead tree sample results suggested the need for additional sampling and analysis to identify the possible presence of Sr-90 (UC-B 2013a).

2014: UC-B provided core sample results for two dead trees inside the fenced test plot area at Burris Park. One sample contained Sr-90 at a level exceeding background (UC-B 2014).

5.0 Risk

The remediation activities conducted in 1963 by UC-B were adequate and no further remediation is needed. Multiple radiological surveys have been conducted over the last 35 years. Sr-90 concentrations in accessible areas outside the containment structure had been at background levels but a 2013 survey indicates a slightly above-background concentration in one soil sample (UC-B 2013a). Kings County and UC-B officials agree that the site does not pose an unacceptable risk to the public in its present configuration (KCDPW 2005). Approximately 20 mCi of Sr-90 remain within the containment structure, and should decay to background levels in about 200 years.

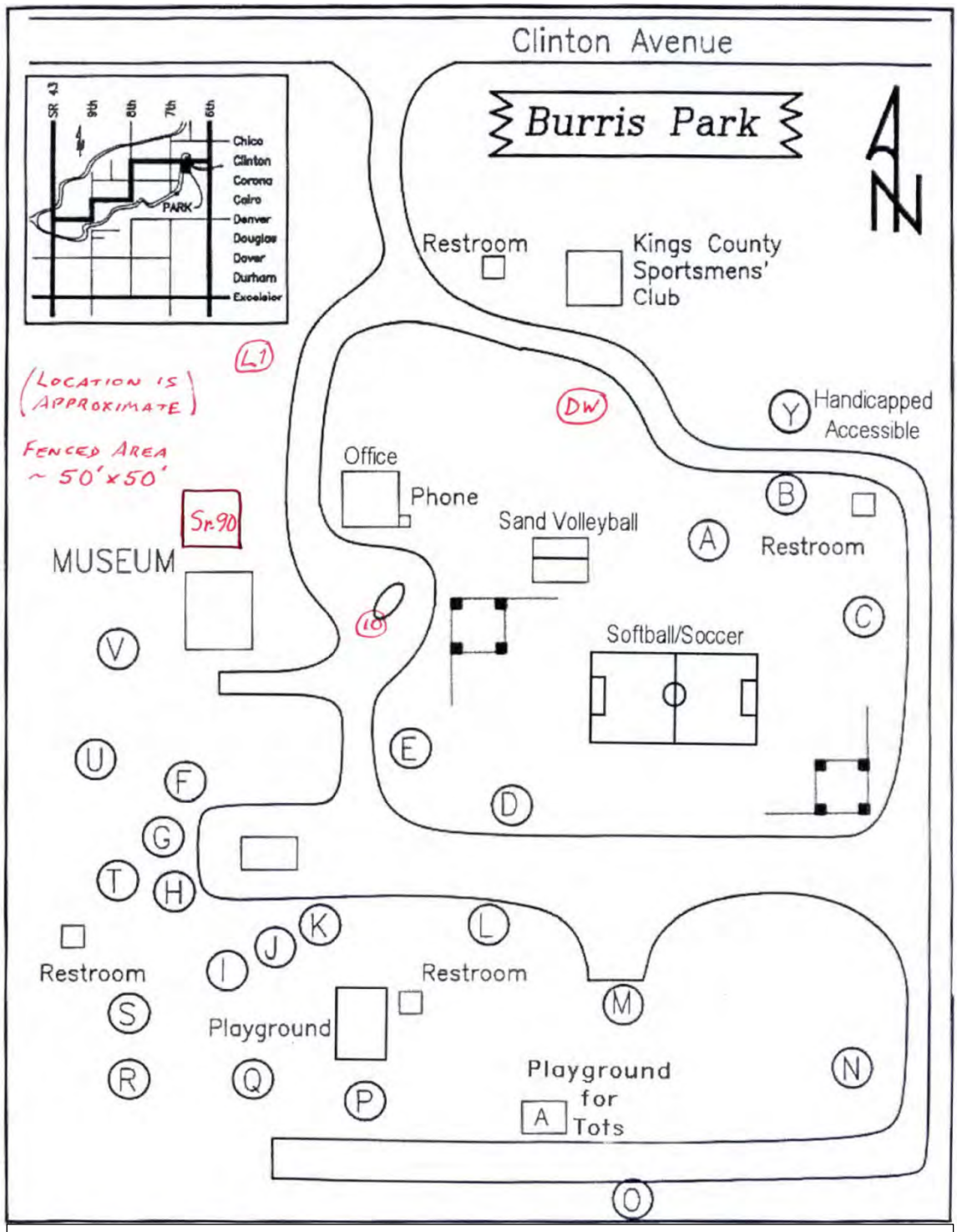
DOE found no evidence of formal institutional controls applied to the Burris Park test plots (CDTSC undated).

6.0 Elimination Analysis

The Burris Park Field Station is hereby re-evaluated for FUSRAP eligibility. In accordance with Section 3.1.3.1 of the FUSRAP Program Plan (DOE 2014a), eligibility criteria are

1. Work was conducted in support of Manhattan Engineer District and/or AEC activities (typically during the 1940s to early 1960s timeframe).
2. The activities resulted in residual radioactive contamination (primarily uranium, radium, and thorium and their daughter elements) that exceed current cleanup criteria.
3. The authority to request appropriations to perform remedial action activities at the site is prescribed within existing legislation and guidelines.
4. The site is not subject to remedial action under any other remedial action program nor is residual radioactive contamination addressed under an NRC or state license.

In 1987, on the basis of the documented remediation activities conducted by UC-B, DOE determined that no further remedial action was required and that the Burris Park Field Station would not be included in FUSRAP (DOE 1987). The site was eliminated from consideration, and this determination is documented on the LM website at http://www.lm.doe.gov/Considered_Sites/Burris_Park_Field_Station_-_CA_10.aspx.



Location # 10 - Soil Sample - Field Control
Location # 11 - Direct Measurement - Background
Location # L1 - Landscape Irrigation Well
Location # DW - Drinking Water Well
Location Sr-90 - Strontium-90 Research Site

Figure 3. Burris Park Field Station Map (from UC-B 2013a)

This determination is still valid, on the basis of radiological conditions, because no additional remediation is required for the Burris Park Field Station. Although a site-specific cleanup guideline has not been derived, the site is protective in its current configuration because exposure pathways are not complete. Furthermore, Sr-90, a product of uranium fission, is not a typical FUSRAP waste. Therefore, Criterion 2 is not met and the site is not eligible for remediation under FUSRAP.

7.0 LTS&M Authority Determination

DOE recognizes that post closure maintenance is needed at the site. Therefore, DOE reviewed its authority to conduct LTS&M under another (i.e., non-FUSRAP) authority using the authority determination guidance in Section 3.1.3.1 of the FUSRAP Program Plan. Following are responses to the authority review questions:

1. Was the site/operation owned by a DOE predecessor, or did a DOE predecessor agency have significant control over the operations at a site?

   Response: No. AEC did not own the site; the site was conveyed to Kings County in 1924, before the AEC-sponsored work was conducted (Kings County 1924). There is no documentation that AEC had significant control over the operations at the site, and there is documentation that the University of California State-Wide Division of Radiation Safety provided radiological monitoring during application of Sr-90 at the site (UC date unknown).

2. Was a DOE predecessor agency responsible for maintaining or ensuring the health, safety, and environment of the site—that is, were they responsible for cleanup?

   Response: Unknown. There is no documentation that AEC was responsible for maintaining site health or safety. The site closure plan was submitted by UC-B to the California Department of Public Health for approval, and a University of California representative oversaw the closure work (CDPH 1963). Contractual provisions for oversight and closure cannot be determined because the contract has not been found. It is reasonable to assume that UC-B expended AEC funds to close the site.

3. Does residual radioactive contamination remain on the site as the result of DOE predecessor-related operations?

   Response: Not yet determined. Above-background Sr-90 was detected in one soil sample collected between the concrete slab and the fence, and one tree core sample contained above-background Sr-90 (UC-B 2013a and UC-B 2014). A site-specific release criterion for Sr-90 must be derived in order to determine if the above background soil result must be addressed as contamination or if permitted disposal is required for the tree. Sr-90 within the test plots may require management until it decays to levels that allow unrestricted use.

4. Is the site in need of further cleanup and was the site left in an unacceptable condition as a result of DOE-predecessor-related activities?

   Response: The concrete cap appears to be intact and additional remediation is not required. The site is protective in its current configuration as long as the access controls (i.e., the fence and signage) are maintained. The fence is in poor condition and maintenance is needed. Additional monitoring is required to confirm the above-background Sr-90 activity in soil and determine the extent of elevated concentrations of Sr-90. The tree with the above-background Sr-90 may require permitted disposal.

5. Did the present owner accept responsibility for the site knowing of its contaminated condition, and knowing that additional remedial measures are necessary before the site is acceptable for unrestricted use by the general public?

   Response: No documentation was found that neither UC-B nor Kings County accepted responsibility for the closed test plots. Since site closure in 1963, Kings County and UC-B have maintained the site, and the State of California Department of Public Health has investigated the site and confirmed there is no unacceptable risk. No additional remediation is required. Contractual provisions cannot be established because the contract has not been found.

On the basis of the above responses, AEC authorized the work at Burris Park and no other party assumed responsibility for post closure care. "Unacceptable condition," as referred to in question 4 above, includes LTS&M needed to maintain a remedy. Therefore, DOE is authorized to conduct additional work needed to maintain site protectiveness.

8.0 References

CDHS (California Department of Health Services), 1995. G. Wong, CDHS, letter to G. Curtis, Kings County, "Concrete Capped Radioactivity in Burris Park," June 2. [References dose modeling conducted by CDHS]

CDPH (California Department of Public Health), 1963. I. Tarbeshaw, CDPH, letter to J. Heslep, DCPH, "Sr-90 Plots, Burris Park, California," March 26.

CDTSC (California Department of Toxic Substances Control, undated. Envirostor website,)http://www.envirostor.dtsc.ca.gov/public/deed_restrictions.asp?orderby=county https://dtsc.ca.gov/database/LUC/county_list.cfm.

DOE (U.S. Department of Energy), 1987. D. Levine, DOE, Memorandum/Checklist to the file, "Elimination Recommendation," May 7.

DOE (U.S. Department of Energy), 2014a. *Formerly Utilized Sites Remedial Action Program, Program Plan* LMS/S09273, (in revision).

DOE (U.S. Department of Energy), 2014b. *Burris Park, California, Site: Summary of Site Conditions and Recommendations for Post-Closure Care*, Document Number S11927, April 30, 2014

KCDPW (Kings County Department of Public Works), 2005. H. Verheul, Kings County Department of Public Works, memorandum to Kings County Board of Supervisors, “Report of Results on Testing for Radiation at Burris Park;” August 9.

Kings County, 1924. Deed conveying 57 acres owned by J.B. Burris, H.C. Burris, and E. W. Burris, grantors, to Kings County, grantee, as recorded in Book *, page 57, records of Kings County, State of California.

Schulz, R.K., J.P. Moberg, and R. Overstreet, 1959. “Some Experiments on the Decontamination of Soils Containing Strontium-90,” *Hilgardia*, Volume 28, Number 17, University of California, Berkeley, May. [Includes photographs of test plots before they were capped]

UC (University of California), date unknown. *Annual Report, 1955-1956, State-Wide Division of Radiation Safety*.

UC-B (University of California-Berkeley), 1981. A. Peterson, Radiation Safety Officer, letter to C. Jackson, Director, Environment, Safety, and Program Support Division, includes report, “Survey of the Burris Park Site,” March 2.

UC-B (University of California-Berkeley), 2013a. *Radiation Safety Survey Report*, July 5.

UC-B (University of California-Berkeley), 2013b. C. Mac Kenzie, UC-B, letter to C. Rexroth, California Department of Public Health, “DOCKET NUMBER 082013-1333- Response to CDPH's November 6, 2013 Letter,” December 5. [Contains dose estimate for child ingesting soil]

UC-B (University of California-Berkeley), 2014. C. Mac Kenzie, UC-B, e-mail to C. Clayton, DOE, “Sr90 results - UC Berkeley samples - Eberline 14-02125,” March 25 [tree core results].

Attachment 1

Burris Park Deeds

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J.S.BURRIS et al
to
KINGS COUNTY No. 2160

THIS INDENTURE, made the 15th day of March, 1924, between J. S. BURRIS, H. C. BURRIS, and E. W. BURRIS, all of the County of Kings, State of California, and F. M. BURRIS, of the County of Sonoma, State of California, parties of the first part, and THE COUNTY OF KINGS, STATE OF CALIFORNIA, party of the second part,

WITNESSETH: that the said party of the first part have given, granted, dedicated and conveyed, and by these presents do give, grant, dedicate and convey unto the County of KINGS, State of California, the following described parcels of land situated in the said County of Kings, State of California, to wit:

Commencing at a point in Kings River, which is 350.5 feet North of Witness Post on Bank of Kings River, and 5709.6 feet north of the Center of Section Twenty two (22), Township Seventeen (17) South, Range Twenty two (22) East, M.D.B. & M., then along the following described courses and distances:-

Course No. 1: S. 75° E. distance 267 ft: Course No. 2 S. 31° 30' E., distance 517.4 ft: Course No. 3, S. 18° W distance 466 ft: Course No. 4, S. 4° W distance 198 ft: Course No. 5 S. 9° E., distance 426.4 ft: Course No. 6 S. 35° 30' E. Distance 510 ft: Course No. 7 S. 83° 50' W. Distance 1027 ft: Course No. 8 N. 76° 12' W. Distance 714 ft: Course No. 9, N. 10° 30' E. distance 87 ft: Course No. 10, N. 7° W Distance 264 ft: Course No. 11, N. 14° W distance 411.8 ft: Course No. 12, N. 10° 30' E. distance 528 ft: Course No. 13, N. 34° E. distance 334.6 ft: Course No. 14 N. 49° E., distance 363.0 ft: Course No. 15, N. 75° E. distance 558.4 ft: to point of beginning, containing fifty seven (57) acres, more or less.

To have and to hold, the same unto the said County of Kings, for the uses and purposes of a public Recreation Park and Play Ground, subject to the following conditions to wit:

(a) That said lands shall be perpetually maintained as a Public Recreation Park and Play Ground, and that the same shall always be hereafter, known as, and called the Burris Park.

(b) That no live trees of any kind shall be cut down, taken out or destroyed on said premises.

In Case said lands shall cease to be used as a Public Recreation Park and Play Ground for a period of five consecutive years, the same shall revert to the parties of the first part their heirs, executors, administrators and assigns.

In Witness Whereof, the said parties of the first part have hereunto set their hands and seals the day and year first above written.

J. S. BURRIS
E. E. BURRIS
H. C. BURRIS
FRANK M. BURRIS

State of California }
County of Kings. } ss.

On this 16th day of June in the year one thousand nine hundred and twenty four before me, J. L.C.IRWIN, a Notary Public in and for the County of Kings, personally appeared J.S. BURRIS, E. E. BURRIS and H. C. BURRIS, known to me to be the same persons whose names are subscribed to the within instrument and they duly acknowledged to me that they executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, at my office in the County of Kings the day and year in this Certificate first above written.

(SEAL) J. L. C. IRWIN Notary Public in and for the County of Kings, State of California.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, at my office in the County of Sonoma, the day and year in this Certificate first above written.

(SEAL) W. W. CARTER Notary Public In and for the County of Sonoma, State of California.
My Commission expires May 22, 1926.

Recorded at the Request of County Clerk, JUL' 9 1924, at 40 min. past 9 o'clock A. M. in Vol. 86 of Deeds Page 57 Kings County Records.

Jos M. Bowman Recorder Fee #
Copied B. C mpared B. Indexed B.

J.S. BURRIS et al
to
Kings County

No. 2161

KNOW ALL MEN BY THESE PRESENTS, that we, J. S. BURRIS, E. E. BURRIS and H. C. BURRIS, all of the County of Kings, State of California, and F. M. BURRIS, of the County of SONOMA, State of California, have given, granted, dedicated and conveyed and by these presents do give grant, dedicate and convey unto the COUNTY OF KINGS, STATE OF CALIFORNIA, the following described parcel of land, situated in the County of Kings, State of California,, and bounded and described as follows, to wit:

A strip of land 50 ft wide, 25 ft, on each side of the following described center-line. Commencing at a point 1727,ft.North and 1319 ft. West of the East ¼ corner of Section 22, Township 17 South, Range 22 East, M.D.B. & M. Thence. N.62° 46' W. 328 ft. S° 82° 40' W. 278 Feet N. 2° 15' W.126.4 Feet,N. 33° 28½'E 121.3 ft. N. 8° 15½' E. 134.4 ft. N.11° 17' W. 97 ft: N. 22° 33½' W. 146 Ft,No.0° 2½' W. 88.1 Ft, N. 14° 42½ E. 350.7 Ft. N. 17° 2' E. 254 Ft. N. 5° ½' W. 86.4 Ft N. 23° 55' W. 102.5 Ft No. 47° 39' W. 243.1 Ft. N. 45° 25½' W. 293.8 Ft to the South line of what is known as the Burris Park

To Have and To Hold the same unto the County of Kings, for the use and purpose of a public highway.

The Grant is made on the expressed condition that said County of Kings will not cut down, dig up or destroy any living oak trees on said right of way.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this 25th day of April, 1924.

J. S. Burris
E. E. Burris
H. C. Burris
Frank M. Burris
Frank M. Burris

State of California,)
) ss,
County of Kings,)

On this 16th day of June in the year one thousand nine hundred and twenty four, before me J. L.C. Irwin a Notary Public in and for the County of Kings,,personally appeared J. S. BURRIS, E. E. BURRIS and H. C. BURRIS known to me to be the same persons whose names are subscribed to the within instrument, and they duly acknowledged to me that they executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal at my office in the County of Kings, the day and year in this certificate first above written

(SEAL) J. L. C. IRWIN Notary Public in and for the County of Kings, State of California.

Stateof California,)
) ss.
County of Sonoma)

On this 20th day of June in the year One thousand nine hundred and twenty four (1924),before me, R.J. Pagani, a Notary Public in and for said County of Sonoma, State of California,personally appeared FRANK M. BURRIS, known to me to be the person whose name is subscribed to the withinInstrument, and he acknowledged to me that he executed the same

A. M. in Vol. 86 of Deeds Page 57 Kings County Records.

Jos M. Bowman Recorder Fee #
Copied B. Compared B. Indexed B.

J.S. BURRIS et al
to
Kings County

No. 2161

KNOW ALL MEN BY THESE PRESENTS, that we, J. S. BURRIS, E. E. BURRIS and H. C. BURRIS, all of the County of Kings, State of California, and F. M. BURRIS, of the County of SONOMA, State of California, have given, granted, dedicated and conveyed and by these presents do give grant, dedicate and convey unto the COUNTY OF KINGS, STATE OF CALIFORNIA, the following described parcel of land, situated in the County of Kings, State of California,, and bounded and described as follows, to wit:

A strip of land 50 ft wide, 25 ft, on each side of the following described center line. Commencing at a point 1727,ft.North and 1319 ft. West of the East ¼ corner of Section 22, Township 17 South, Range 22 East, M.D.B. & M. Thence. N.62° 46' W. 328 ft. S° 82° 40' W. 278 Feet N. 2° 15' W.126.4 Feet,N. 33° 28½' E 121.3 ft. N. 8° 15½' E. 134.4 ft. N.11° 17' W. 97 ft: N. 22° 33½' W. 146 Ft,No.0° 2½' W. 88.1 Ft, N. 14° 42½ E. 350.7 Ft. N. 17° 2' E. 254 Ft. N. 5° ½' W. 86.4 Ft N. 23° 55' W. 102.5 Ft No. 47° 39' W. 243.1 Ft. N. 45° 25½' W. 293.8 Ft to the South line of what is known as the Burris Park

To Have and To Hold the same unto the County of Kings, for the use and purpose of a public highway.

The Grant is made on the expressed condition that said County of Kings will not cut down, dig up or destroy any living oak trees on said right of way.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this 25th day of April, 1924.

J. S. Burris
E. E. Burris
H. C. Burris
Frank M. Burris
Frank M. Burris

State of California,)
County of Kings,) ss,

On this 16th day of June in the year one thousand nine hundred and twenty four, before me J. L.C. Irwin a Notary Public in and for the County of Kings,,personally appeared J. S. BURRIS, E. E. BURRIS and H. C. BURRIS known to me to be the same persons whose names are subscribed to the within instrument, and they duly acknowledged to me that they executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal at my office in the County of Kings, the day and year in this certificate first above written

(SEAL) J. L. C. IRWIN Notary Public in and for the County of Kings, State of California.

Stateof California,)
County of Sonoma) ss.

On this 20th day of June in the year One thousand nine hundred and twenty four (1924),before me, R.J. Pagani, a Notary Public in and for said County of Sonoma, State of California,personally appeared FRANK M. BURRIS, known to me to be the person whose name is subscribed to the withinInstrument, and he acknowledged to me that he executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal,the day and year in this Certificat first above written.

(SEAL) R. J. PAGANI Notary Public in and for the County of Sonoma, State of California.

Recorded at the Request of Co. Clerk, JUL. 9 1924, at 41 min. past 9 o'clock A. M. in Vol. 86 of Deeds Page 58 KINGS COUNTY RECORDS

Jos M. Bowman Recorder Fee ###
Copied B. COmpared B. Indexed B.

Geo.A.Smith
to
Pac S.W.Tr & Sav Bk

No. 2168

INTERNAL REVENUE $7.00 CANCELLED

THIS INDENTURE, Made this Seventh day of July, 1924.

BETWEEN, GEORGE A. SMITH, a single man, the party of the first part and PACIFIC SOUTHWEST TRUST & SAVINGS BANK, a corporation, duly organized and existist under and by virtue of the laws of the State of California, and having its principal place of business in the City of Los Angeles, County of Los Angeles, State of California, the party of the second part.

X WITNESSETH: That the said party of the first part, for and in consideration of the forbearance by the PACIFICSSOUTHWEST TRUST & SAVINGS BANK, a corporation of Los Angeles California, from bringing foreclosure proceedings because of my default on my certain mortgage note for the principal sum of $7000.00 dated December 22, 1920, bearing interest at the rate of 8 per cent per annum, mortgage securing same recorded Jan. 5, 1921, in Book 44 of Mortgages at page 209, Kings County, California, records, and being released from the liability for any possible deficiency judgement to be rendered against me in connection with such foreclosure proceedings andfor the cancellation and surrender to me of the said note(receipt of which said note is hereby acknowledged) and my release from any and all obligations under said note both as to payment of principal and of interest now due and owing according to the terms of thereof, I, George A. Smith, of the City of Hanford, County of Kings, State of California, do hereby grant, bargain, sell, convey and confirm unto the said party of the second part and to its succession and assigns forever, all that certain lot, piece or parcel of land situate, lying and being in the County of Kings, State of California, and bounded and particularly described as follows to wit:

The North half of the South west quarter of Section Twenty one (21) Township Nineteen (19) South, Range 21 East, Mount Diablo Base and Meridian, containing 80 acres more or less.

This deed is given for the consideration hereinbefore set forth and is not intended as and is not in fact a mortgage or other form of security but is a deed of conveyance absolute by the grantor named herein to the grantee named herein.

Together with all and singular the tenements, hereditaments and appurtenances thereunto belonging, or in anywise appertaining, and the reversion and reversions: remainder and remainders, rents, issues and profits thereof. X

TO HAVE AND TO HOLD all and singular the premises, together with the appurtenances unto the said party of the second part, and to its heirs and assigns forever.

IN WITNESS WHEREOF, the said party of the first part has hereunto set his hand and seal, the day and year first above written.

Signed, Sealed and Delivered
in the Presence of Fay G.Horton
Mrs A. Washburn

George A. Smith

Attachment 2

Cited Documents

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CDHS (California Department of Health Services), 1995. G. Wong, CDHS, letter to G. Curtis, Kings County, “Concrete Capped Radioactivity in Burris Park,” June 2. [References dose modeling conducted by CDHS]

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY PETE WILSON, Governor

DEPARTMENT OF HEALTH SERVICES
714/744 P STREET
P.O. BOX 942732
SACRAMENTO, CA 94234-7320
(916) 323-2759

June 2, 1995

Mr. Gary Curtis
County Government Center
1400 W. Lacey Blvd.
Hanford, CA 93230

SUBJECT: Concrete Capped Radioactivity in Burris Park

Dear Mr. Curtis:

This letter refers to the experimental study using Sr-90 by University of California, Berkeley (UCB) in 1956 through 1957. At the end of the study, the study site was surrounded by a fence and capped with a concrete slab. An informational plaque was placed on the concrete by UCB.

Upon receipt of the inquiry by Mr. Doyle Davis of the Kings County Office of Emergency Services (OES) via Mr. Allen Remick of U.S. Department of Energy on January 20, 1994, Radiologic Health Branch (RHB) staff requested information from both the U.S. Nuclear Regulatory Commission (NRC) and UCB concerning the subject matter. Due to an arduous retrieval process, RHB staff was finally able to review the archived files provided by NRC and UCB.

Based on the review of the archived files, the RHB dose assessment using RESRAD computer code and the site survey results, it appears that the site does not pose a significant health and safety hazard to the park workers and the general public. However, this assessment relies on the information provided by the NRC and UCB archived records without direct soil sampling. Soil sampling was not performed to avoid breaching the integrity of the concrete cap which can lead to potential contamination of the surrounding areas.

Mr. Roger Lupo, a RHB staff member, performed a survey of the experiment site on May 19, 1995. The concrete slab was found to be intact and the plaque on it was still legible. Radiation surveys were performed using an Eberline ESP-2 meter with a Ludlum Model 44-9 pancake probe. There was no contamination found on the surface of the concrete slab or soil/dirt surrounding the edges of the slab.

JUN 1995

However, the fence is in marginal condition and service is needed to maintain the fence. This issue needs to be resolved even though the Sr-90 under the concrete slab does not pose an external radiation hazard.

Please feel free to contact me at (916) 323-2759 or Mr. Steve Hsu of this office at (916) 322-4797 if you have any further questions concerning this matter.

Sincerely,

Gerard Wong

Gerard Wong, Ph.D., Chief
Radioactive Material Licensing Section
Radiologic Health Branch

cc: Mr. Allen Remick
U.S. Department of Energy
P.O. Box 808, M/S L-573
Livermore, CA 94550

U.S. NRC Region IV Walnut Creek Field Office
Attn: H. Dean Chaney, C.H.P.
Sr. Radiation Specialist
Radioactive Material Branch
1450 Maria Lane, Suite 210
Walnut Creek, California 94596

Mr. Rod Warren
Acting Radiation Safety Officer
Office of Radiation Safety
University of California, Berkeley
University Hall, 3rd Floor # 1154
Berkeley, CA 94720-1154

Mr. Tim Goodman, Director
Burris Park
County Government Center
1400 W. Lacey Blvd.
Hanford CA 93230

CDPH (California Department of Public Health), 1963. I. Tarbeshaw, CDPH, letter to J. Heslep, DCPH, “Sr-90 Plots, Burris Park, California,” March 26.

STATE OF CALIFORNIA

DEPARTMENT OF PUBLIC HEALTH

MALCOLM H. MERRILL, M.D.
DIRECTOR OF PUBLIC HEALTH

EDMUND G. BROWN
GOVERNOR

2151 BERKELEY WAY
BERKELEY 4, CALIFORNIA

April 4, 1963

Irving R. Tabershaw, M.D.
Environmental Health and Safety
University of California
The Ernest V. Cowell Memorial Hospital
Berkeley 4, California

Dear Dr. Tabershaw:

I refer to your letter of March 26, 1963, concerning the University's Sr-90 plots at Burris Park. The proposed measures for capping the test plots appear satisfactory to us.

We feel that one additional safeguard is necessary; namely, that the fence around the area be maintained. The locked gate should also have a notice to keep out, together with an indication of who should be contacted for additional information or if entrance is desired.

Sincerely yours,

John M. Heslep

John M. Heslep, Chief
Bureau of Radiological Health

JMH:lew

March 26, 1963

John M. Healey, Ph.D., Chief
Bureau of Radiological Health
State Department of Public Health
2151 Berkeley Way
Berkeley 4, California

RE: Sr-90 plots, Burris Park, California

Dear Dr. Healey:

We have been informed by Mr. Robert K. Schulz, Department of Soils and Plant Nutrition, that the project involving the use of Sr-90 at the Burris Park site has been completed. This is to inform you, of the measures to be taken to seal the plots containing Sr-90 and to get your approval of the specifications.

The following specifications for concrete capping of the test plots were developed by Mr. Schulz, and have been submitted to several contractors for bid: (Quoted in part from Bid)

<u>Radioactive plots - 6' 0" square</u>

1. 2" layer sand
2. 6 mil thick polyethylene
3. 4" of concrete reinforced with 6" x 6" gauge mesh

This will bring level to top of curb

<u>Other plots 6' 0" square</u>

Fill to top of curb with crushed rock.
Put footing around entire area on 3 sides as shown by dashed lines.
Approx. 48" on each side.
Pave (with concrete) over entire area as shown in print.

The 44 radioactive plots must not be stepped into until after the sand layer has been applied.

A University representative will be present during the construction.

In addition, 2 bronze plaques will be embedded into the concrete over the contaminated plots, and will include the wording: "Caution Radioactive Material: Sr-90: date of application: amount applied:"

In order to complete the necessary documentation to consider this work, we would appreciate a written approval in confirmation of your verbal approval already granted.

Very truly yours,

Irving R. Tabershaw, M.D. - Head
Environmental Health and Safety

IRT:fo

PURCHASE ORDER

UNIVERSITY OF CALIFORNIA
PURCHASING DEPARTMENT

ORDER NO. G 821260

R

X RPT:

DATE: 3/29/63

J. E. CASTRO CONSTRUCTION
9717 HOME AVENUE
HANFORD,
CALIFORNIA

1. Above Order No. must be marked on each package, shipping receipt & invoice.
2. Address all correspondence and acknowledgements pertaining this order to

   UNIVERSITY OF CALIFORNIA
   PURCHASING DEPARTMENT
   318 Sproul Hall
   BERKELEY 4, California

3. Please note conditions on reverse side which are part of this order.
4. No price increases will be recognized by the University of California without written notice and acceptance thereof prior to shipment.
5. Please itemize all charges.
6. Show Permit Number when billing California USE Tax.
7. Mail invoice in TRIPLICATE quoting this order number to the

   UNIVERSITY OF CALIFORNIA
   ACCOUNTING OFFICE
   400 Sproul Hall
   BERKELEY 4, California

PLEASE SHIP TO UNIVERSITY OF CALIFORNIA
GENERAL CONTRACT CONDITIONS,
INSURANCE & LIABILITY CLAUSES
ATTACHED....

Extra Copy

F.O.B.	PRICE BY	TERMS - From Receipt of Goods or Invoice Whichever is Later	SHIP BY
UC SITE	SB 615/JH	NET	

		UNIT PRICE	TOTAL PRICE	PROMISED DELIVERY
	FURNISH ALL NECESSARY LABOR AND MATERIALS TO CAP 49 PLOTS WITH CONCRETE, AT BURRIS PARK, KINGS COUNTY & UNIVERSITY OF CALIFORNIA AS FOLLOWS.:			
14	RADIOACTIVE PLOTS - 6'-0" SQUARE			
	1. 2" LAYER SAND 2. 6 MIL THICK POLYETHYLENE 3. 4" OF CONCRETE REINFORCED WITH 6"X6"-10 GAUGE MESH			
	THIS WILL BRING LEVEL TO TOP OF CURB.			
35	OTHER PLOTS 6'-0" SQUARE			
	NOT TO EXCEED . . . $ 1,750.00			
	FILL TO TOP OF CURB WITH CRUSHED ROCK.			
	PUT FOOTING AROUND AREA ON 3 SIDES AS SHOWN BY DASHED LINE. APPROX. 48" ON EACH SIDE.			
	PAVE(WITH CONCRETE) OVER ENTIRE AREA AS SHOWN IN PRINT.			
	THE 14 RADIOACTIVE PLOTS MUST NOT BE STEPPED INTO UNTIL AFTER THE SAND LAYER HAS BEEN APPLIED.			
	A UNIVERSITY REPRESENTATIVE WILL BE PRESENT DURING THE CONSTRUCTION.			
	CONTINUED ON PAGE 2.....			

INFORMATIONAL COPY

UNIVERSITY OF CALIFORNIA
F. S. HARTER, Purchasing Agent

BY _____

.SE ORDER

UNIVERSITY OF CALIFORNIA
PURCHASING DEPARTMENT

ORDER NO. G 821260

R P

DATE: 3/29/63

J. E. CASTRO CONSTRUCTION

PAGE 2.

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   UNIVERSITY OF CALIFORNIA
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   400 Sproul Hall
   BERKELEY 4, California

PLEASE SHIP TO UNIVERSITY OF CALIFORNIA

F.O.B.	PRICE BY	TERMS - From Receipt of Goods or Invoice Whichever is Later	SHIP BY

	UNIT PRICE	TOTAL PRICE	PROMISED DELIVE
FOR INFORMATION, DIRECTION OR OTHER ADVICE, CONTACT MR.O.D. MCCUTCHEON, UNIVERSITY OF CALIFORNIA FARM ADVISOR, 310-11½ AVENUE, HANFORD, CALIFORNIA, LU-4-3331.			
STATE CONTRACTOR'S LICENSE NUMBER: 164030			
WORKMEN'S COMPENSATION INSURANCE: CALIFORNIA UNION INSURANCE COMPANY POLICY NO. V 156311 EXPIRING 10/ 1/63			
COMPREHENSIVE PUBLIC LIABILITY & PROPERTY DAMAGE INSURANCE: LONDON GUARANTEE & ACCIDENT CO. POLICY NO. C E D 028537 EXPIRING: 2/19/64			
100,000/300,000. 25,000.			

INFORMATIONAL COPY

UNIVERSITY OF CALIFORNIA
F. S. HARTER, Purchasing Agent

BY _____

DOE (U.S. Department of Energy), 1987. D. Levine, DOE, Memorandum/Checklist to the file, “Elimination Recommendation,” May 7.

3511A CA.10-2

~~1.21~~
CA.10

MEMORANDUM

TO: FILE

DATE 5/7/87

FROM: D. Levine

SUBJECT: Elimination recommendation

SITE NAME: Burris Park Field Station

ALTERNATE NAME:

CITY: Kingsburg STATE: CA (CA.10)

OWNER(S)
Past: Kings County, CA Current:
Owner contacted ☐ yes ☒ no; if yes, date contacted

TYPE OF OPERATION

☒ Research & Development

- ☐ Production scale testing
- ☐ Pilot Scale
- ☐ Bench Scale Process
- ☒ Theoretical Studies
- ☐ Sample & Analysis

☒ Facility Type

- ☐ Manufacturing
- ☒ University
- ☐ Research Organization
- ☐ Government Sponsored Facility
- ☐ Other

☐ Production
☐ Disposal/Storage

TYPE OF CONTRACT

☒ Prime AEC – U. California
☐ Subcontractor
☐ Purchase Order

☐ Other information (i.e., cost + fixed fee, unit price, time & material, etc)
$ 24,739 (10/1/62 – 9/30/63) requested
23,952 requested for 10/1/63 – 9/30/64

Contract/Purchase Order # AT(11-1)-34, Project No. 23

CONTRACTING PERIOD: 1956-63

OWNERSHIP:

	AEC/MED OWNED	AEC/MED LEASED	GOVT OWNED	GOVT LEASED	CONTRACTOR OWNED	CONTRACTOR LEASED
LANDS	☐	☐	☐	☐	☐	☒
BUILDINGS none	☐	☐	☐	☐	☐	☐
EQUIPMENT	☐	☐	☐	☐	☐	☐
ORE OR RAW MATL	☐	☐	☐	☐	☐	☐
FINAL PRODUCT	☐	☐	☐	☐	☐	☐
WASTE & RESIDUE	☐	☐	☐	☐	☐	☐

AEC/MED INVOLVEMENT AT SITE

Control
- ☐ AEC/MED managed operations
- ☐ AEC/MED responsible for accountability
- ☐ AEC/MED overviewed operations
- ☒ Contractor had total control
- ☐ unknown

☐ Health Physics Protection
- ☐ Little or None
- ☐ AEC/MED responsibility
- ☒ Contractor responsibility

MATERIALS HANDLED:

Type (on basis of records reviewed)

- ☐ No Radioactive
- ☐ Natural Radioactive from Feed Materials Production
  - ☐ Ore
  - ☐ Refined Source Material
  - ☐ Residue
- ☒ Natural Radioactive Material: ~~from Non-Nuclear Activities~~ Strontium 90
- ☐ Man-Made
- ☐ Other_____

Comment_____

Quantities (on the basis of records reviewed)

- ☐ None
- ☐ Production Quantities
- ☒ Small Amounts

Comment total of 72 mCi of ^{90}Sr was placed on the site; calculations show that this had decayed to less than 41 mCi by March, 1981

OTHER PERTINENT FACTS:

☐ Facility was Licensed
- ☐ During AEC/MED-Related Operations
- ☐ For Similar Activities
- ☐ For Other Activities

Comment_____

☐ Commercial Production Involving Radioactive Material during AEC/MED Operations

☒ Facility was Decontaminated and Released -- area capped with reinforced concrete -- area enclosed with chain link fence

☒ Availability of Close Out Records
- ☐ None
- ☐ Some
- ☒ Sufficient

☒ Radioactive Status:

	YES	MAYBE	PROBABLY NOT	NOT
Contaminated (soil)	X			
Potential for Exposure (accessible)				X (without removing the concrete slab)

radiation survey showed no readings above background

QUANTITY OF RECORDS AVAILABLE:

☐ Very Little ☐ Some ☒ Sufficient

PROBABILITY OF FINDING ADDITIONAL RECORDS:

☒ Low ☐ Possible ☐ High

RECOMMENDATIONS:

☒ Eliminate
☐ Consider for Remedial Action
☐ Collect More Data

Comment

REFERENCES: Peterson, Andris (Radiation Safety Officer, University of California, Berkeley); letter to Calvin A. Jackson, U.S. Department of Energy (March 4, 1981). Enclosures include March 2, 1981, radiation survey report.

(no references in database system, 4/87)

SUMMARY This site was used in a research project to determine means of decontaminating soils containing radioactive strontium. The site was ~~decontaminated~~ remediated by placing a reinforced concrete cap over the entire contaminated area, effectively eliminating the potential for exposure if the cap was not disturbed. Radiation surveys showed no readings ~~contamination~~ above background. Because the site appears to have been adequately covered such that there is no potential for exposure under reasonable circumstances, it is recommended that the site be eliminated. The site is fenced and marked and is under the jurisdiction of the University of California

Excerpt from DOE (U.S. Department of Energy), 2014a. *Formerly Utilized Sites Remedial Action Program, Program Plan* LMS/S09273, (in revision).

LMS/S09273
Revision 1

This is an excerpt presenting the guidance for conducting and reporting eligibility determinations

Formerly Utilized Sites Remedial Action Program

Program Plan

June 2014

INTERNAL USE ONLY—NOTE DRAFT OVERLAY

HIGHLIGHTED TEXT REFERS TO COMMENTS THAT DOE GC HAS INDICATED NEED TO BE REVIEWED WITH USACE GC

Draft-Internal Use Only

U.S. DEPARTMENT OF ENERGY | Legacy Management

The following sections provide more details about the current site review process for FUSRAP. Sections 3.1.3.1 through 3.1.3.3 describe the DOE eligibility review process, and Section 3.1.3.4 describes the USACE designation review process.

3.1.3.1 DOE Eligibility Review

The DOE eligibility review process typically begins with a review of the operating history of the site, including consideration of the type of operation, the length of time the facility operated under MED or AEC contract, the quantity of material processed and the methods used for waste disposal, the point of possession, and radiological data representing site conditions when the site was released. During early FUSRAP reviews, staff found that sites at which little work was performed or small quantities of material were handled had fewer records available, whereas the facilities that handled greater amounts of radioactive material have better documented evidence of activities. Therefore, the frequency of references in the records is a useful indicator for determining if operations could have resulted in contamination. Approximately 80 candidate sites were found to be ineligible because there was no record of activities conducted for MED or AEC that involved significant quantities of radioactive materials.

The eligibility review considers the contractual agreements and termination information, the DOE predecessor agency's involvement in the facility and its operation, and documented health and safety responsibilities. Other important factors include the license status of the site, the types and amounts of commercial or other governmental work conducted at the site, and activities conducted at the site after termination of the DOE predecessor contract. Figure 3 outlines the types of records and information used in the site eligibility review.

To determine eligibility, DOE must first establish that there is authority for remedial action using a series of questions developed by GC. The answers to the following five questions (and the supporting documentation) are the basis for the determination of DOE's authority to include a site under FUSRAP:

1. Was the site/operation owned by a DOE predecessor, or did a DOE predecessor agency have significant control over the operations at a site?
2. Was a DOE predecessor agency responsible for maintaining or ensuring the health, safety, and environment of the site—that is, were they responsible for cleanup?
3. Does residual radioactive contamination remain on the site as the result of DOE-predecessor-related operations?[4]
4. Is the site in need of further cleanup and was the site left in an unacceptable condition as a result of DOE-predecessor-related activities?
5. Did the present owner accept responsibility for the site knowing of its contaminated condition, and knowing that additional remedial measures are necessary before the site is acceptable for unrestricted use by the general public?[5]

[4] DOE will confirm that radioactive contamination exists at a candidate site before referring the site to USACE. DOE will not conduct a complete characterization; typically, a DOE radiological survey will be halted when radiological contamination is identified that exceeds typical standards or poses an unacceptable risk of release for UU/UE.

[5] DOE found that some sites where MED or AEC activities were conducted were ineligible for remediation under FUSRAP because specific language in the contract authorizing the work indemnified the U.S. Government from liability for site cleanup or cleanup had already occurred under another program.

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Information Needed for DOE Eligibility Determination

Site Description

- Location (address and maps)
- Facility size
  - Entire site
  - MED/AEC portion
  - Area around the site (population and environs)

- Contractual information (MED/AEC)
  - Size of contract
  - Length of contract
  - Type of contract
  - Products
  - Areas utilized for contractual activities
  - Health and safety provisions
  - Closeout provisions
  - Special provisions
  - Contracting Divisions or organization
- Contractual information (non-DOE predecessors)
  - Same as above including estimates of fraction of facility and work that was not MED/AEC related
- License information
  - Type of license
  - Length of license
  - Areas of work not covered under license
  - Violations
  - Current status
- History of MED/AEC operations
  - Type of operation (materials processed, quantities, waste disposal practices, and so forth)
  - DOE predecessor control and involvement at the site
    - Ownership of lands, buildings, or equipment
    - Personnel stationed at the site
    - Frequency of visits to monitor or manage operations
    - Health and safety inspections and so forth
  - Periods of operations and standby status
  - Size of staff (production, research, engineering, health and safety, and so forth) and portion of time spent on non-MED/AEC operations
  - Final closeout
    - Surveys
    - Property transfer
    - Status and final releases
- Current status of site
  - Radiological status
  - Current and planned or future uses
  - Proximity of active areas and summary of operations
- Typical References
  - Contracts
  - Processing records
  - Surveys and health and safety reports
  - Correspondence with MED/AEC managers on pertinent issues
  - Closeout records
  - Licenses and inspections
  - Interviews

Figure 3. Information Collected and Utilized in the DOE Eligibility Review Process

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The first two questions are generally answered solely on the basis of the review of historical information. The review of the radiological conditions must be completed before the final responses to the authority questions can be determined and the final eligibility decision can be made. If the review of radiological contamination is not complete, the last three questions are answered tentatively, under the assumption that the site was contaminated with materials associated with DOE predecessor agency operations. A preliminary authority determination can be made with the condition that the decision will be finalized if it can be shown that radiological contamination remains onsite that was potentially the result of DOE predecessor agency activities. A negative authority determination at the initial stage usually results in a determination that the site is ineligible for remediation under FUSRAP.

The authority determination review is an iterative process. As soon as there is sufficient data to answer the five questions and make a preliminary determination, DOE prepares a draft authority determination review package and submits the package to GC for review. The draft authority determination review package contains the following:

- A summary of the site's operation.
- Available information on the current condition at the site, which summarizes findings based on the five questions.
- Copies of the specific documents that provide answers to the five questions and documents that support the decision making process.

If GC concurs that the review package provides sufficient information to make a determination, DOE finalizes the eligibility review, makes the appropriate authority determination, and transmits the eligibility determination package to USACE, in accordance with Article III, Section D.1.b, of the DOE/USACE MOU.

If GC concurs that there is insufficient data to make an authority determination, DOE will renew its efforts to identify and collect additional information. However, if the additional efforts are not successful and it seems unlikely that any additional useful information will be derived from future records searches, the authority determination review is made on the basis of what was presented. Typically, insufficient data will result in a no-authority determination.

If GC concurs with a no-authority determination and there is still a potential for contamination at the site, DOE issues an elimination report. The site owner, USACE, EPA, and appropriate federal and state agencies are notified that there is a potential for contamination at the site and that DOE has no authority for remedial action, should further cleanup be necessary. The elimination report is made available to the site owner and the general public (generally posted on the DOE-LM public website), and it is archived as part of the permanent FUSRAP records collection.

DOE authorization is not required in situations where the potential for contamination is low or non-existent, and sites can be eliminated from the Program on that basis alone. If the authority determination issue has not been resolved by the time that the determination of no, or low contamination is made, the authority determination review is terminated.

A site cannot be included in FUSRAP if it is already included under another remedial action program or is under an NRC or state license.

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3.1.3.2 Eligibility Report

The eligibility report documents a referral of a site to USACE for a designation review or elimination of a site from the Program. The report contains an analysis of the documentation found and a summary of available data used to make the determination. In order for a site to be eligible for inclusion in FUSRAP, the report must clearly indicate the following:

- The site has radioactive contamination.
- The radioactivity resulted from DOE predecessor agency operations.
- The federal government has the authority to remediate the radiological contamination under FUSRAP.
- The site is not subject to remedial action under any other remedial action program, and the FUSRAP-related contamination is not under an NRC or state license.

The contents of the eligibility report will vary from site to site and may include the following information:

- A summary discussing past site operations, disposal practices, and radiological history.
- A description of historical site location and size, the current site location and size, and the current site status.
- A summary of the authority determination review for the site.
- An analysis of potential radiological doses and risk that might be received by occupants and members of the general public resulting from site contamination.
- A comparison of the levels of residual radioactive contamination on the site and potential doses to guidelines and standards.
- Supporting data and references.

Elimination reports can contain similar information to justify the non-eligibility determination, but they are typically briefer. The elimination may be based on a finding from historical records of little potential for contamination, or a determination that the site is covered under another remedial action program. In cases where the authority determination review is completed first and the finding is that DOE has no authority, the authority determination review may be used as the elimination report.

3.1.3.3 Referral to USACE

If DOE determines that a site is eligible for remediation under FUSRAP, DOE refers the site to USACE to determine if remediation is required under their designation process. DOE conveys the eligibility, elimination or authority determination report to the USACE Director of Civil Works, Environmental Programs, along with supporting documentation.

3.1.3.4 USACE Designation Review Process

USACE is responsible for conducting characterization activities to determine if a site contains FUSRAP-eligible contamination (DOE/USACE MOU, Article III, Section D.2). This may entail

Draft-Internal Use Only

DOE (U.S. Department of Energy), 2014b. *Burris Park, California, Site: Summary of Site Conditions and Recommendations for Post-Closure Care*, Document Number S11927, April 30, 2014

Burris Park, California, Site:
Summary of Site Conditions and Recommendations for Post-Closure Care
January 23, 2014

Introduction

Representatives of the U.S. Department of Energy (DOE) Office of Legacy Management (LM) visited the Burris Park site near Kingsburg, California, on January 22, 2014. The site, located in a county park, consists of a concrete slab covering plots where strontium-90 (Sr-90) was introduced into soil under a U.S. Atomic Energy Commission (AEC) contract. The slab is surrounded by a chain-link fence. The fences needs repair, and the plot is covered with fallen tree limbs, old farm equipment (associated with a museum at the park) and the remains of a farm building exhibit.

Multiple radiological surveys have been conducted over the last 35 years. Sr-90 concentrations in accessible areas outside the containment structure had been at background levels but a 2013 survey indicates a slightly above-background concentration in one soil sample. Still, Kings County and University of California-Berkeley (UC-B) officials state that the site does not pose an unacceptable risk to the public. Sr-90 concentrations within the containment structure should decay to background levels in about 200 years.

Maintenance is needed at this location. The fence should be repaired and the slab should be cleared to allow inspection to confirm its integrity. Currently, the site is not managed under a radioactive materials license and neither Kings County nor UC-B is required to maintain the site. If DOE is responsible for the residual Sr-90 at the site, it should be brought under the DOE-LM program to ensure that the remedy remains protective and site knowledge is preserved.

Similar experiments were conducted at the Hopland Field Station in Mendocino County, California.

Background

Burris Park is located at 6500 Clinton Avenue, Kingsburg, in Kings County, California. Kingsburg is in the Central Valley south of Fresno.

AEC entered into contract AT (11-1)-34 Project #23 with UC-B to construct the site and introduce 72 millicuries (mCi) of Sr-90 into the soil to study the effectiveness of decontaminating the soil using displacement by electrolytes and leaching, and physical immobilization using asphalt preparations. The work was managed by Dr. Robert K Schult of the Department of Plant and Soil Biology.

The site was constructed in 1956. It consists of 49 6-foot by 6-foot plots separated by concrete barriers. The barriers extended 30 inches into the soil. Sr-90 was introduced in 14 of the plots laid out “in checkerboard fashion.”

AEC terminated the study in 1963. UC-B placed a reinforced concrete slab over the test area, overlapping the sides, and surrounded it with a fence. A plaque is affixed to the plot, presenting the following information:

A total of 72 mCi of Strontium-90 was placed on this area
during 1956-1957. This work was done under contract
AT (11-1) - 34 Project 23 between the University of
California and the U.S. Atomic Energy Commission
Roy Overstreet R. K. Schulz
University of California, Berkeley

DOE considered the site for designation under FUSRAP and determined the site was ineligible because it had been remediated by AEC and no further work was required.

A chain-link fence encloses an approximately 56 foot by 56 foot area and restricts public access. The fence has deteriorated and Carolyn Mac Kenzie, the Radiation Safety Officer for UC-B, asked DOE-LM to address the needed maintenance.

History

1956-57: The research at Burris Park under contract AT (11-1)-34 Project #23 was described in the annual report of the Division of Radiation Safety. The principal investigator was Dr. Robert K Schultz, Dept. of Plant and Soil Biology. 72 mCi of Sr-90 was applied to soil.

1963: Work stopped at Burris Park. In a March letter to the California State Department of Public Health (CDPH), UC-B provided closure specifications and requested State approval. CDPH responded in April that the closure plan "appear[ed] satisfactory," fence maintenance was necessary, the gate should be kept locked, and a notice should be posted to inform the public to keep out of the fenced area and provide contact information." Records do not indicate that arrangements were made or responsibilities assigned for surveillance and maintenance after the test plots facility was capped and fenced.

1981: The UC-B Radiation Safety Officer performed a radiological survey of Burris Park. No activity above background was detected.

1987: DOE Office of Environmental Management (EM) FUSRAP program staff evaluated the Burris Park site and recommended eliminating the site from FUSRAP because AEC had previously remediated it.

1995: Kings County requested that the California Department of Health Services (CDHS) investigate Burris Park. The State requested files from UC-B and the U.S. Nuclear Regulatory Commission (NRC). CDHS conducted a radiological survey and modeled dose, and concluded "the site does not pose a significant health and safety hazard to the park workers and the general public." The State noted the fence needed maintenance.

2004: Kings County retained a subcontractor to sample a drinking water well and an irrigation well at the park; no contamination was detected.

2005: Kings Country requested files from UC-B. Soil and water monitoring was conducted by the county and reported in a May 2005 newspaper article. A 2005 Kings County memorandum reports that the County's results did not exceed background levels, and that UC-B tests demonstrated the same conditions.

2013: UC-B received an inquiry from the Wall Street Journal about "the status of the Burris Park contamination with Sr-90." This was explained to FUSRAP staff in a subsequent discussion, which led to the site visit described in this report. UC-B conducted a radiological survey of the site, which included a beta-gamma scan and soil, groundwater, and vegetation sampling and analysis. One soil sample exceeded background levels.

2014: FUSRAP staff visited the site on January 22, 2014 and discussed long-term surveillance and maintenance needs with UC-B staff on January 23, 2014. The attendance roster is attached. UC-B provided analytical results of tree cores in April.

Site Physical Conditions

Chris Clayton, FUSRAP Program Manager, and Michael Widdop with the LM technical support contractor visited the site on January 22, 2013. They met Jeff Tabor and Troy Hommerding of the Kings County Department of Public Health, Division of Environmental Health Services. The parks superintendent had arranged for the on-site maintenance worker to leave the entrance gate unlocked. Mr. Tabor was aware of the radiological conditions and indicated that the county had no concerns about exposure or risk. The park is used as an outdoor education facility for school children and is generally not open to the public, so exposure is limited. Mr. Tabor offered to provide completion diagrams and lithology logs for two wells at the park. The wells have been sampled and no Sr-90 has been detected. Previously, UC-B (Carolyn Mac Kenzie) advised Mr. Clayton that the California Department of Public Health, Radiologic Health Branch, has expressed an interest in reviewing the hydrology to determine where groundwater beneath the test plot would flow.

The FUSRAP representatives assessed site conditions by visual inspection. The 8-foot-high chain link fence requires maintenance services provided by a professional subcontractor to inspect and replace damaged posts, top rails, and fabric. Angle brackets and three strands of barbed wire were installed with the brackets sloping inward. Many of the brackets are broken.

The site appeared neglected. Several pieces of old farming equipment are on the cap, along with the debris from a collapsed shed. The area inside the fence is covered with the limbs of two dead trees that have fallen over. Much of the cap was inaccessible and could not be observed. The accessible portions of the cap appeared to be free of cracks and other defects.

A plaque is affixed to the northeast corner of the slab and is in good condition. Two signs are posted on each side of the fence, stating,

A total of 72 millicuries of Strontium-90
was placed in this area during 1956 and 1957
The work was performed under contract AT (11-1)-34
Project 23 between the University of California and
the United States Atomic Energy Commission
Roy Overstreet R.K. Schulz
University of California, Berkeley

Pipe and other supplies are stacked against the fence along the north side of the site. East of the test plot is another concrete slab used to display farming equipment. The county has offices and a museum in a building south of the test plot.

Site photographs taken during the January 22, 2014 visit and the UC-B 2013 radiological survey report, which contains additional site photographs, are attached at the end of this report.

Site Radiological Conditions and Risk

Sr-90 has a half-life of 28.8 years. Approximately 20 mCi of Sr-90 from the original activity (72 mCi) is left as of 2013.

Beta-gamma activities on the slab and within the fence are slightly above background levels, ranging from 100 to 125 counts per second; background activity was 105 counts per second. Sr-90 is a beta emitter.

Multiple surveys of gamma and beta activity and radionuclide concentrations in soil, groundwater, and vegetation have been conducted since 1981. Before 2013, all results were at background levels. In 2013, the Sr-90 concentration in one sample of accessible soil was 1.91 picocuries per gram (pCi/g), which exceeds the background value of 0.67 pCi/g. Sr-90 concentrations in groundwater and vegetation grab samples do not exceed background values. Subsequent to this trip, DOE received tree core analysis results that indicate about 3.0 pCi/g of Sr-90 in one core.

The California Department of Health Services modeled site dose in 1995 and concluded that the site poses no unacceptable risk to site workers or the public (attached). Ms. Mac Kenzie of UC-B estimated in 2013 that a child ingesting 500 milligrams of soil per day would receive an annual dose of 0.1 millirem (this scenario would seem to be implausible).

Neither a benchmark remediation guideline for Sr-90 nor the specific activity of soils within the plot has been calculated.

Sr-90 contamination has not been detected in the water samples from the two wells near the test plot.

Summary

- Approximately 20 mCi of Sr-90 remain within the plot.
- The site poses no unacceptable risk in its current configuration.

- Maintenance is needed at the site.
- This site was excluded from FUSRAP because it was remediated previously by AEC.
- The site is not included under the UC-B California radioactive materials license.
- The site is not addressed through a structured long-term surveillance and maintenance program.

Recommendations for Addressing Post-Closure Needs

- DOE-LM should consult with Steve Miller of the DOE Office of General Counsel to determine if DOE is responsible for managing residual radioactive material and the containment system at the site; and advise UC-B, Kings County, and the State of California of the opinion.

If DOE is responsible for managing the radioactive materials at the site, conduct the following activities:

- Formally include the site in LM scope and add to the technical, scope, and cost baselines.
- Repair the fence, first determining if barbed wire is needed on top of the fence. Prior to the January 22 visit, Mr. Clayton discussed the site with Barry Gaffney, Director of the Office of Strategic Planning, DOE-EM. Mr. Gaffney indicated that if DOE is responsible for LTS&M at the Burris Park site, his organization may be able to have the fence repaired. DOE-LM will follow up with this recommendation.
- Remove vegetation debris (leaves, tree limbs, and trunks). Determine how to safely dispose of the tree material with the elevated Sr-90 concentration.
- Identify the point of contact and update signage.
- Add the site to the LM program following the transition process defined in the FUSRAP Program Plan.
- Request documentation from DOE-Livermore, UC-B, Kings County, the State of California, and NRC. Search other DOE collections and assemble available records.
- Review hydrology and determine if nearby water supplies could be impacted.by site contaminants.
- Determine how long LTS&M is required until the Sr-90 decays to levels that allow release of the site without use restrictions. The anticipated time period is 200 to 300 years from when the Sr-90 was introduced into the soil.
- Confirm that current conditions are protective.
- Develop an LTS&M plan. Coordinate plans to conduct LTS&M with the State of California, Kings County, and possibly Lawrence Berkeley National Laboratory for support.
- Determine if the Sr-90 test plot at the UC Hopland Field Station requires LTS&M under LM oversight.

Contacts

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Kevin.loewen@co.kings.ca.us

References (in chronological order)

UC (University of California), 1956. *Annual Report, 1955 – 1956, State-Wide Division of Radiation Safety*.

R. K. Schulz, J. P. Moberg, and Roy Overstreet, 1959. "Some Experiments on the Decontamination of Soils Containing Strintium-90," *Hilgardia*, Volume 28, Number 17, University of California, Berkeley, May. [Includes photographs of test plots before they were capped]

UC-B (University of California-Berkeley), 1963. Letter, I. Tabershaw, UC-B, to J. Heslep, CSDPH, March 26. [Provides closure plan and requests approval]

CDPH (California Department of Public Health), 1963. Letter, J. Heslep, CSDPH, to I. Tabershaw UC-B, April 4. [Approves closure plan and requires fence maintenance and posting of contact information]

UC-B (University of California-Berkeley), 1981. Letter, A. Peterson, Radiation Safety Officer, to C. Jackson, Director, Environment, Safety, and Program Support Division, includes report, "Survey of the Burris Park Site," March 2.

DOE (U.S. Department opf Energy), 1987. Memorandum/Checklist, D. Levine, DOE, to the File, Elimination Recommendation, May 7.

CDHS (California Department of Health Services), 1995. Letter, G. Wong, CDHS, to G. Curtis, Kings County, "Concrete Capped Radioactivity in Burris Park," June 2. [References dose modeling conducted by CDHS]

UC-B (University of California-Berkeley), 2005. Letter, P. Goff, UC-B Hazardous Materials and Radiation Safety, to H. Verheul, Kings County Department of Public Works, "^{90}Sr Test Plot at Burris Park," includes documentation, May 19. [Lists DOE-Livermore on distribution]

Kings County Department of Public Works, 2005. Memorandum, H. Verheul, Kings County Department of Public Works, to Kings County Board of Supervisors, "Report of Results on Testing for Radiation at Burris Park;" August 9.

UC-B (University of California-Berkeley), 2013. Radiation Safety Survey Report, July 5. [Attached]

UC-B (University of California-Berkeley), 2013. Letter, C. Mac Kenzie, UC-B, to C. Rexroth, California Department of Public Health, "DOCKET NUMBER 082013-1333- Response to CDPH's November 6, 2013 Letter," December 5. [Contains dose estimate for child ingesting soil]

STATE OF CALIFORNIA - HEALTH AND WELFARE AGENCY PETE WILSON, Governor

DEPARTMENT OF HEALTH SERVICES
714/744 P STREET
P.O. BOX 942732
SACRAMENTO, CA 94234-7320
(916) 323-2759

June 2, 1995

Mr. Gary Curtis
County Government Center
1400 W. Lacey Blvd.
Hanford, CA 93230

SUBJECT: Concrete Capped Radioactivity in Burris Park

Dear Mr. Curtis:

This letter refers to the experimental study using Sr-90 by University of California, Berkeley (UCB) in 1956 through 1957. At the end of the study, the study site was surrounded by a fence and capped with a concrete slab. An informational plaque was placed on the concrete by UCB.

Upon receipt of the inquiry by Mr. Doyle Davis of the Kings County Office of Emergency Services (OES) via Mr. Allen Remick of U.S. Department of Energy on January 20, 1994, Radiologic Health Branch (RHB) staff requested information from both the U.S. Nuclear Regulatory Commission (NRC) and UCB concerning the subject matter. Due to an arduous retrieval process, RHB staff was finally able to review the archived files provided by NRC and UCB.

Based on the review of the archived files, the RHB dose assessment using RESRAD computer code and the site survey results, it appears that the site does not pose a significant health and safety hazard to the park workers and the general public. However, this assessment relies on the information provided by the NRC and UCB archived records without direct soil sampling. Soil sampling was not performed to avoid breaching the integrity of the concrete cap which can lead to potential contamination of the surrounding areas.

Mr. Roger Lupo, a RHB staff member, performed a survey of the experiment site on May 19, 1995. The concrete slab was found to be intact and the plaque on it was still legible. Radiation surveys were performed using an Eberline ESP-2 meter with a Ludlum Model 44-9 pancake probe. There was no contamination found on the surface of the concrete slab or soil/dirt surrounding the edges of the slab.

JUN 2 95

Insert page 2 of CDPH 1995

2013 Radiological Survey of the Burris Park, California, Site

6 August 2013

University of California, Berkeley
Office of Environment, Health, and Safety
RADIATION SAFETY SURVEY REPORT
Date of the survey: 5 July 2013
Location: Burris Park (Kings County, CA)
6500 Clinton Avenue, Kingsburg, CA 93631

Burris Park is a public county park located in Kings County, CA near Hanford, CA. A portion of the park was used as a research field site by University of California Berkley researchers in 1956-1957. The research applied 72 millicuries of strontium-90 to plots of soil at the field site. The research was terminated and the field site was capped with a concrete slab, and surrounded by a fence, in 1963.

A visit to the former research site was conducted on 5 July 2013 to assess the current status of the location. Direct radiation measurements were performed along with collection of soil, water and vegetation samples. The fence surrounding the site is chain link and topped with barbed wire. It is in generally good condition but, portions of the top of the fence have apparently been damaged by falling tree branches. Eight signs identifying the original use of strontium-90 are posted on the site fence – two on each side of the site.

Direct radiation measurements of the concrete slab, and the ground immediately adjacent to the slab, were performed using an open window pancake type Geiger-Mueller detector. The direct measurements of the concrete, and the adjacent ground, were not distinguishable from background measurements of the ground located in other areas of Burris Park.

The soil, water and vegetation samples were sent to a commercial analytical laboratory for analysis of total radioactive strontium content. The soil samples were obtained from locations within the fenced area directly adjacent to the concrete slab. An additional soil sample was collected from adjacent to the park monument located about 200 feet east of the research site for use as a background control sample. The water samples were obtained from two wells located in the park. One well is for landscape irrigation and the other is used for drinking water. The wells are functionally similar. The irrigation well is approximately 200 feet north of the research site and the drinking water well about 300 feet northeast of the research site. Vegetation samples consisted of tree cuttings (leaves and branches) from four trees located just within the fenced research site. Two of the trees were living and two were apparently dead, without leaves.

The soils samples appear to be comparable to the background control sample with the exception of one soil sample. Additional analysis and sampling is recommended to better identify the possible presence of strontium-90.
The water samples do not show detectable levels of radioactive strontium.
The vegetation samples from the live trees do not show activity significantly above the minimum detectable activities. The dead tree samples suggest additional analysis and sampling to identify the possible presence of strontium-90.

Map and analytical reports are attached.

Survey performed by: Jim De Zetter James D De Zetter

Burris Park - Survey – 5 July 2013

Direct Radiation Measurements

Survey measurements: Meter monitoring was performed using a RadEye GX (S/N 10920) with an open window Ludlum model 44-9 (S/N PR059330) pancake G-M probe.

Direct readings were measured at contact with the soil at locations # 1-9 (Map 2) with results indistinguishable from background. Readings ranged from 100-125 cpm. Background was measured at location # 11 (Map 1), approximately 300 feet from the research site, with a reading of 105 cpm.

Environmental Samples

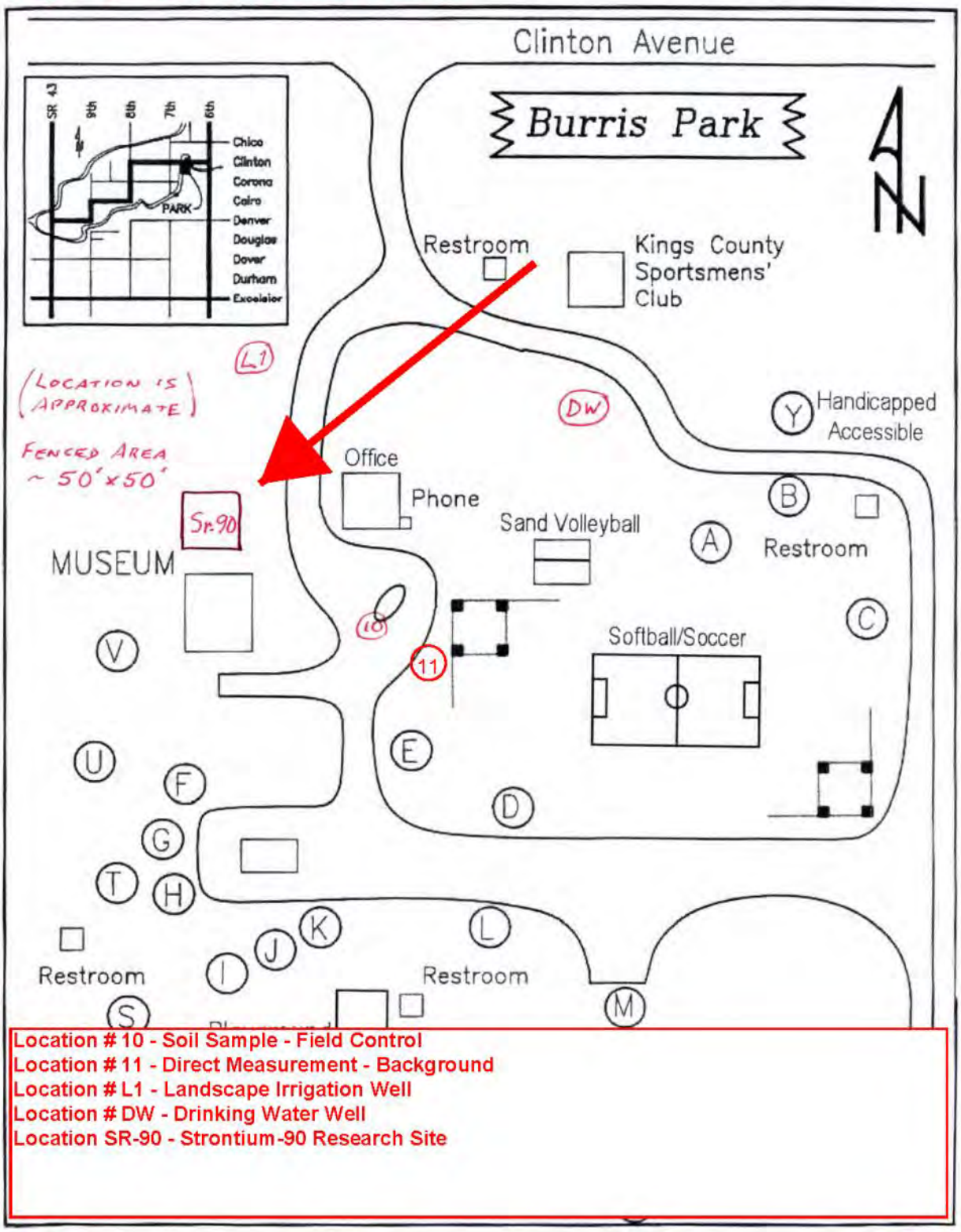
Soil samples: Samples of surface soil were obtained at locations # 1, 3, 5 & 7 (Map 2). A background control soil sample was obtained at location # 10 (Map 1), adjacent to the Burris Park monument. The monument is approximately 200 feet from the research site. Analytical results are attached in report 13-07135.

Water samples: Samples were obtained at location # L1 (Map 1) and location # DW (Map 1). Location # L1 is a landscape irrigation well located about 200 feet from the research site. Location # DW is a drinking water well located about 300 feet from the research site. Analytical results are attached in report 13-07136.

Vegetation samples: Samples were obtained from four trees located within the fenced research site. The trees were at locations # T1, T2, T3 andT4 (Map 2). Trees at locations # T1 and T2 appeared to be living and possessed leaves. Trees at locations # T3 and T4 appeared to be dead, had no leaves, and were surrounded by fallen branches. Samples from trees at locations # T1 and T2 contained branches and leaves. Samples from trees at locations # T3 and T4 contained only branches. Analytical results are attached in report 13-07136.

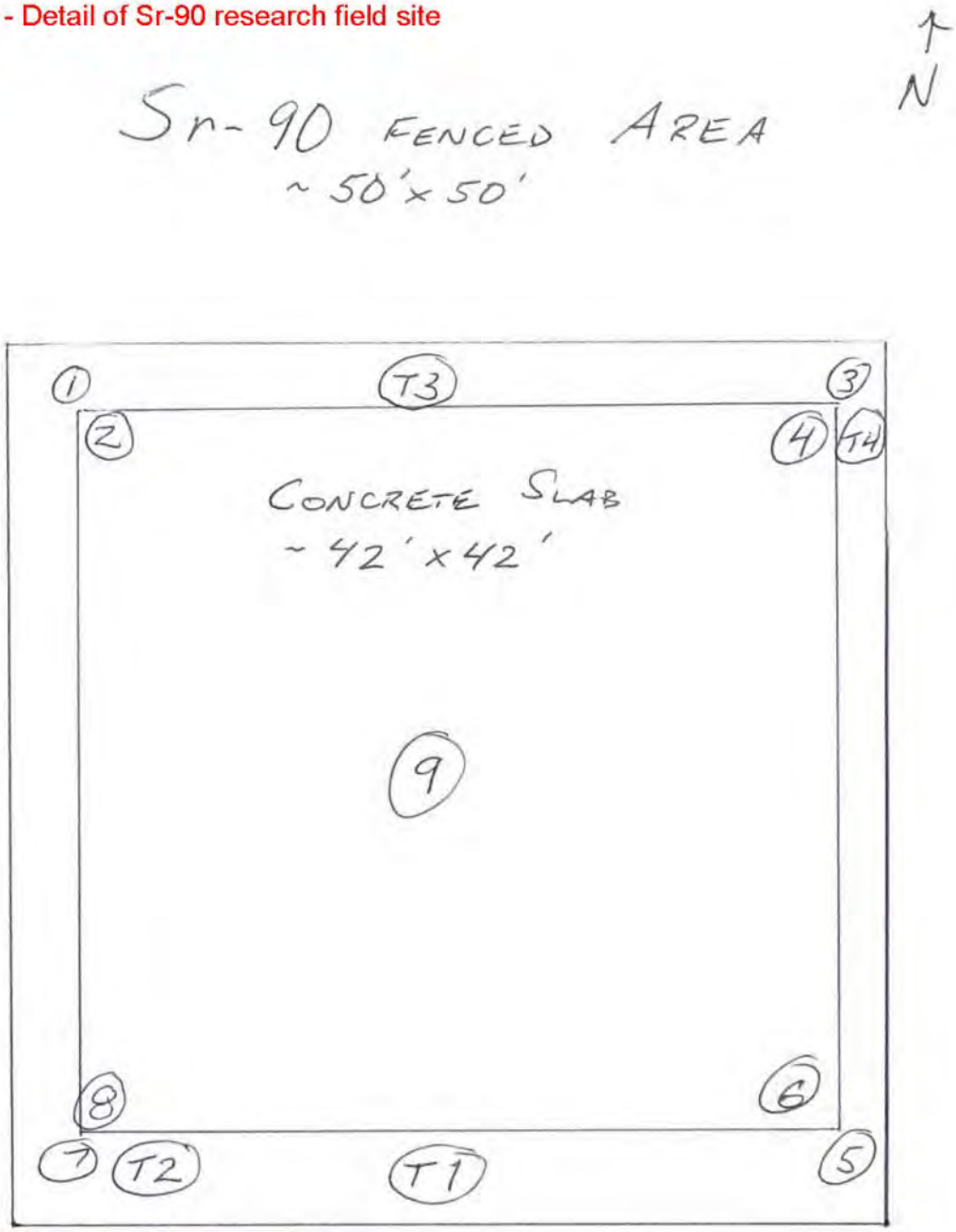
Map 1 - Location of Sr-90 research field site

1 AUG 2013



Field site detail on Map 2

Map 2 - Detail of Sr-90 research field site



Direct Measurements: Locations # 1-9

Soil Sampling: Locations # 1, 3, 5 & 7

Vegetation Sampling: Locations # T1 - T4

LOCATIONS ARE APPROXIMATE
NOT TO SCALE.

Burris Park Historical Museum with fenced research site to the right

Burris Park Monument
Location # 10 (Map 1)

Strontium-90 Research Site
Looking West

A TOTAL OF 72 MILLICURIES OF STRONTIUM 90
WAS PLACED ON THIS AREA DURING 1956 AND 1957.
THIS WORK WAS DONE UNDER CONTRACT AT (11-1)-34.
PROJECT 23 BETWEEN THE UNIVERSITY OF CALIFORNIA AND
THE UNITED STATES ATOMIC ENERGY COMMISSION.
ROY OVERSTREET
R.K. SCHULZ
UNIVERSITY OF CALIFORNIA, BERKELEY

Research Site
Looking South
Trees T4 (left) & T3 (right)

Landscape Irrigation Well at Location # L1 (Map 1)
Looking North from Northwest Corner of Research Site

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Eberline Analytical
Final Report of Analysis

Report To:
James D. De Zetter, CHS
UC Berkeley E&HS - Rad Safety
2199 Addison Street
Berkeley, CA 94720

Work Order Details:
SDG: 13-07135
Purchase Order: BB00218684
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Report Units
13-07135-01	LCS	KNOWN	07/22/13 08:00	7/22/2013	7/26/2013	13-07135	Total Strontium	EChroM SRW01 Modified	4.85E+01	2.72E-01			pCi/g
13-07135-01	DUP	SPIKE	07/22/13 08:00	7/22/2013	7/26/2013	13-07135	Total Strontium	EChroM SRW01 Modified	4.94E+01	1.92E-02	1.62E-02	6.94E-01	pCi/g
13-07135-02	MBL	BLANK	07/22/13 09:00	7/22/2013	7/26/2013	13-07135	Total Strontium	EChroM SRW01 Modified	6.05E-01	2.81E-01	3.54E-01	5.55E-01	pCi/g
13-07135-03	DUP	3 OFF PAD-NW CORNER	07/05/13 13:00	7/22/2013	7/26/2013	13-07135	Total Strontium	EChroM SRW01 Modified	1.91E+00	3.79E-01	7.65E-01	5.85E-01	pCi/g
13-07135-04	DO	1 OFF PAD NW CORNER	07/05/13 13:00	7/22/2013	7/26/2013	13-07135	Total Strontium	EChroM SRW01 Modified	1.62E+00	3.51E-01	6.67E-01	5.71E-01	pCi/g
13-07135-05	TRG	3 OFF PAD-NE CORNER	07/05/13 13:05	7/22/2013	7/26/2013	13-07135	Total Strontium	EChroM SRW01 Modified	1.88E+00	3.76E-01	5.67E-01	6.78E-01	pCi/g
13-07135-06	TRG	5 OFF PAD-SE CORNER	07/05/13 13:10	7/22/2013	7/26/2013	13-07135	Total Strontium	EChroM SRW01 Modified	1.13E+00	3.78E-01	5.39E-01	6.91E-01	pCi/g
13-07135-07	TRG	7 OFF PAD SW CORNER	07/05/13 13:15	7/22/2013	7/26/2013	13-07135	Total Strontium	EChroM SRW01 Modified	9.77E-01	3.62E-01	4.97E-01	6.87E-01	pCi/g
13-07135-08	TRG	10 PARK MONUMENT	07/05/13 13:20	7/22/2013	7/26/2013	13-07135	Total Strontium	EChroM SRW01 Modified	6.71E-01	3.54E-01	4.24E-01	6.80E-01	pCi/g

CU=Counting Uncertainty; CSU=Combined Standard Uncertainty (2-sigma); MDA=Minimal Detected Activity; LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original

EBERLINE SERVICES

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

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Page 1 of 1

Eberline Analytical
Final Report of Analysis

Report To	
James D. De Zetter, CHS	
UC Berkeley E&HS - Rad Safety	
2199 Addison Street	
Berkeley, CA 94720	

Work Order Details	
SDG:	13-07136
Purchase Order:	BB00218684
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	WA

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Report Units
13-07136-01	LCS	UNKNOWN	07/22/13 00:00	7/22/2013	7/26/2013	13-07136	Total Strontium	E-ChroM SRW-01 Modified	4.88E+01	2.74E-01			pCi/l
13-07136-01	LCS	SPIKE	07/22/13 00:00	7/22/2013	7/26/2013	13-07136	Total Strontium	E-ChroM SRW-01 Modified	4.28E+01	2.57E+00	1.02E+01	1.11E+00	pCi/l
13-07136-02	MBL	BLANK	07/22/13 00:00	7/22/2013	7/26/2013	13-07136	Total Strontium	E-ChroM SRW-01 Modified	4.70E-01	2.51E-01	3.87E-01	6.98E-01	pCi/l
13-07136-03	DUP	1 Landscape Well Irrigation	07/05/13 14:40	7/22/2013	7/26/2013	13-07136	Total Strontium	E-ChroM SRW-01 Modified	3.17E-01	3.38E-01	3.56E-01	6.27E-01	pCi/l
13-07136-04	DO	1 Landscape Well Irrigation	07/05/13 14:40	7/22/2013	7/26/2013	13-07136	Total Strontium	E-ChroM SRW-01 Modified	2.42E-01	4.31E-01	4.39E-01	8.54E-01	pCi/l
13-07136-05	TRG	DW Drinking Water Well	07/05/13 14:50	7/22/2013	7/26/2013	13-07136	Total Strontium	E-ChroM SRW-01 Modified	-1.41E-01	3.35E-01	3.39E-01	7.33E-01	pCi/l

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DC=Duplicate Original

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Page 1 of 1

Eberline Analytical
Final Report of Analysis

Report To:	
James D. De Zetter, CHS	
UC Berkeley E&HS - Rad Safety	
2199 Addison Street	
Berkeley, CA 94720	

Work Order Details:	
SDG:	13-07137
Purchase Order:	3B00218884
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	VG

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Report Units
13-07137-01	LCS	KNOWN	07/22/13 00:00	7/22/2013	7/26/2013	13-07137	Total Strontium	EIChroM SRW01 Modified	4.77E+01	2.84E-01			pCi/g
13-07137-07	LCS	SPIKE	07/22/13 00:00	7/22/2013	7/26/2013	13-07137	Total Strontium	EIChroM SRW01 Modified	4.69E+01	2.54E+00	1.44E+01	1.14E+00	pCi/g
13-07137-02	MBL	BLANK	07/22/13 00:00	7/22/2013	7/26/2013	13-07137	Total Strontium	EIChroM SRW01 Modified	3.45E-01	3.59E-01	3.79E-01	7.30E-01	pCi/g
13-07137-03	DUP	T1 Live Tree S Side	07/05/13 14:00	7/22/2013	7/26/2013	13-07137	Total Strontium	EIChroM SRW01 Modified	4.57E-02	3.16E-02	3.53E-02	6.22E-02	pCi/g
13-07137-04	DO	T1 Live Tree S Side	07/05/13 14:00	7/22/2013	7/26/2013	13-07137	Total Strontium	EIChroM SRW01 Modified	8.86E-02	3.35E-02	4.38E-02	6.15E-02	pCi/g
13-07137-05	TRG	T2 Live Tree SW Corner	07/05/13 14:05	7/22/2013	7/26/2013	13-07137	Total Strontium	EIChroM SRW01 Modified	7.54E-02	3.58E-02	4.46E-02	6.90E-02	pCi/g
13-07137-06	TRG	T3 Dead Tree N Side	07/05/13 14:10	7/22/2013	7/26/2013	13-07137	Total Strontium	EIChroM SRW01 Modified	1.75E-01	3.68E-02	7.12E-02	5.97E-02	pCi/g
13-07137-07	TRG	T4 Dead Tree NE Corner	07/05/13 14:15	7/22/2013	7/26/2013	13-07137	Total Strontium	EIChroM SRW01 Modified	1.59E-01	3.49E-02	6.54E-02	5.82E-02	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original

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EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

Attendance Roster, January 23, 2014 Meeting with DOE-OLM and UC-B representatives

DOE/LBNL/UCB meeting
OLM 1/23/14

name/Affiliation		phone #
Ardyn MacKenzie	UCB/EH&S	5106437996
Jim De Zetter	UCB/EH&S	5106438765
CHRIS CLAYTON	DOE-LM	202-586-9034
Michael Wickley	Stoller (DOE contractor)	970 248 6793
Mary Gross	DOE/BSO	510 486-4373
Spencer Peterson	DOE/BSO	510-486-6626
Stan Conwell	DOE/BSO	—
Tom Klatt	UCB	847-7575
Brett Henrikson	UCOP OGC	5109879725
David Robinson	UCB-Legal Affairs	510 642 7791
ANDY GOLDBLATT	UCB-RISK SERVICES	510.643.9317
Michael Kumpf	UCB-College of Chem	510-643-0648
ALEXANDER SHTROMBERG	UCB-COC	510 642-2345
David Wemmer	UCB-CoChem	510 666 2683
Mark Freiberg	UCB EH&S	510 643 8676
Doug Clark	UCB CoC	
David Leasell	LBNL	5104867157
Tommy Ware	LBNL	510-486-7096

Photo 1. Gate at northwest corner, looking south, Burris Park, CA, January 22, 2014

Photo 2. North side of plot, looking west, Burris Park, CA, January 22, 2014

Photo 3. Plot interior, looking northwest, Burris Park, CA, January 22, 2014

Photo 4. Plot interior, looking south, Burris Park, CA, January 22, 2014

Photo 5. Plot interior, looking north, Burris Park, CA, January 22, 2014

Photo 6. Northeast corner of slab, looking west, Burris Park, CA, January 22, 2014

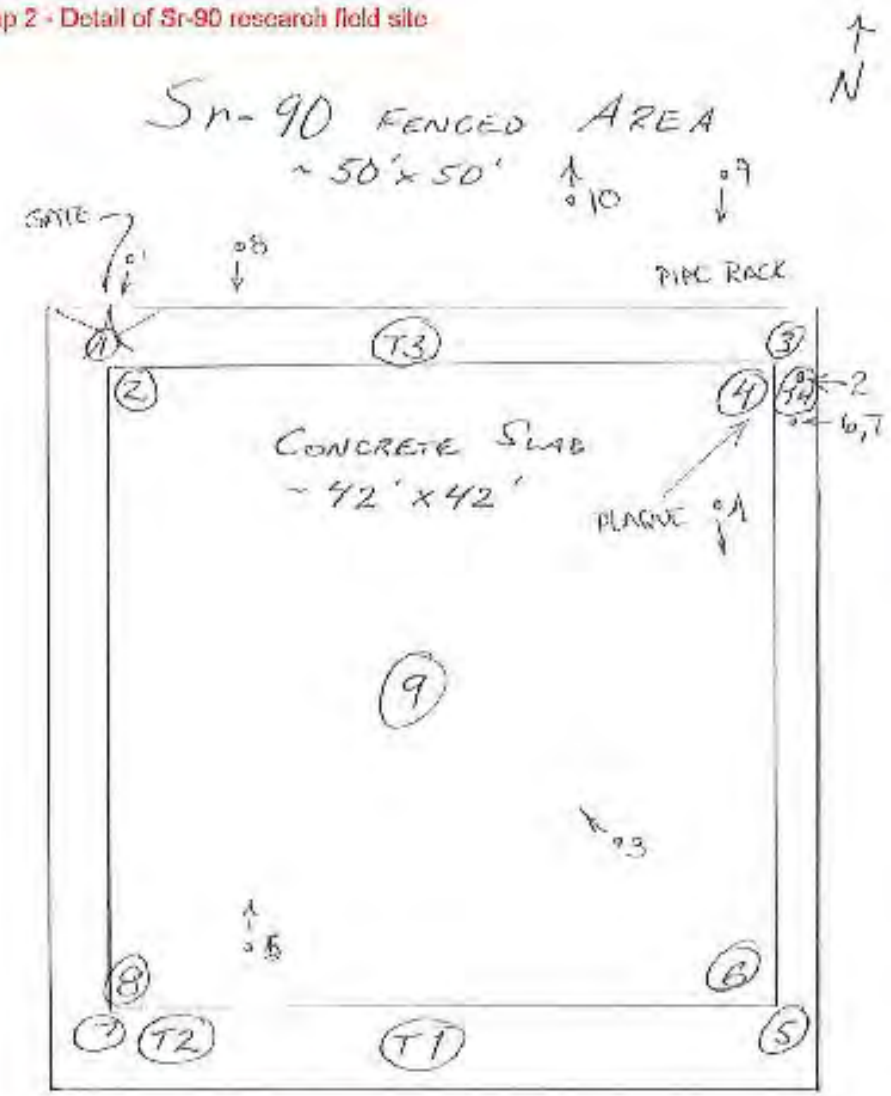
Photo 7. Plaque on northeast corner of slab, looking west, Burris Park, CA, January 22, 2014

Photo 8. Information sign, Burris Park, CA, January 22, 2014

Photo 9. Pipe stored outside north fence line, looking south, Burris Park, CA, January 22, 2014

Photo 10. Landscape irrigation well, looking north, Burris Park, CA, January 22, 2014

Map 2 - Detail of Sr-90 research field site



Direct Measurements: Locations # 1-9

Soil Sampling: Locations # 1, 3, 5 & 7

Vegetation Sampling: Locations # T1 - T4

PHOTOGRAPH LOCATION AND AZIMUTH

LOCATIONS ARE APPROXIMATE
NOT TO SCALE.

JD

PHOTOGRAPH LOCATION MAP 1/22/2014 R. Widdop
DOE-LM SITE VISIT

Burris Park, California, Site: Summary of Site Conditions and Recommendation for Post-Closure Care
January 2014 Page 11 of 34

KCDPW (Kings County Department of Public Works), 2005. H. Verheul, Kings County Department of Public Works, memorandum to Kings County Board of Supervisors, “Report of Results on Testing for Radiation at Burris Park;” August 9.

COUNTY OF KINGS

DEPARTMENT OF PUBLIC WORKS

Kings County Government Center
1400 W. Lacey Boulevard
Hanford, CA 93230
Phone: (559) 582-3211
Extension: 2690
FAX: (559) 582-2506

Harry W. Verheul, Director

TO: Members of the Board of Supervisors
FROM: Harry W. Verheul, Director
SUBJECT: **Report of Results on Testing for Radiation at Burris Park**
DATE: August 9, 2005

Since 1981, concerns have arisen over a scientific study conducted at Burris Park conducted between 1956 and 1961 by the University of California. The study was conducted to determine the effects of radioactive Strontium 90 on grains. Numerous tests have been conducted, starting in 1981 and more recently in the last several months. All of these tests for radioactivity have concluded that the level of radiation is no greater at the UC Study Site than at any other site in Kings County.

Since Hanford Elementary School District has leased the Park for use by school children, these concerns have again arisen. This report is a compilation of all of the factual test data and reports that have been developed since 1981, proving that there is no threat to school children or to the general public.

THE PERCEIVED PROBLEM

Concerns have been expressed over the years related to this issue. As early as 1981, a fireman at the Burris Park Fire Station expressed concerns, and in 1995 an employee again expressed concerns. Most recently, the issue has again arisen due to the use of the Park by school children. A series of newspaper articles in the Hanford Sentinel covered the Sr90 tests at Burris Park. These articles have raised questions by parents, school board members and the public generally as to whether the use of Burris Park is safe. Through the years and in response to these concerns, numerous tests of the UC Study Site have been done to determine whether there is any hazard at Burris Park due to elevated levels of radiation. As discussed below, each of those tests have concluded that there is absolutely no safety issue at Burris Park due to the radiation studies conducted by the University of California during the 1950's and 1960's.

WHAT ABOUT SR90 AND RADIATION?

There is some lack of understanding as to the facts. Every day we are exposed to radiation from the soil, sometimes from water, from space, from medical procedures, and things like smoke detectors and cell phones. As discussed above, the levels of naturally occurring radiation are called background levels. Sr90 radiation is a product of nuclear testing conducted in the 1950's, and it occurs at background levels throughout the United States and the world due to that nuclear testing. It is measured either in picocuries per gram for soils (pCi/g) or in picocuries per liter in liquids (pCi/l) or in milliRems (mRems) as a dosage limitation.

Background levels of Sr90 in soils at 0.1 pCi/g are typical around the United States. In order to establish background levels of Sr90 in soils in this area, tests were recently conducted at the Kings County Government Center and at one other location at Burris Park not in the vicinity of the UC Study Site. As will be discussed in more detail below, the test of these revealed background levels to be 0.67 pCi/g and 0.66 pCi/g.

TESTING DONE OVER THE YEARS

The following tests have been done over the years:

1. A University of California Safety Officer conducted tests in February 1981, and there were no readings above background level (0.02 to 0.05 mRems). (See letter dated March 4, 1981 from the University of California with attached report, concluding that since only background levels were detected in tests by both the University and the by the Kings County OES, use of the slab as a display area was acceptable. Exhibit 1)

2. In 1995, tests were done by the State of California Department of Health Services' Radiological Health Branch with the report concluding that "..no contamination found on the surface of the concrete slab or soil/dirt surrounding the edges of the slab." (See letter from Gerard Wong, California Department of Health Services, dated June 2, 1995, attached hereto as Exhibit 2.)

3. In December 2004, testing was done by FGL Environmental Labs on water samples of the two water wells at Burris Park. The results were 0.000 pCi/l in the domestic water sample and 0.257 pCi/l in the irrigation well. 8.000 pCi/l is the maximum containment level (MCL) established by the EPA. (See FGL Environmental Report dated January 3, 2005 attached hereto as Exhibit 3.) Thus, there has been no contamination of the water.

4. Soil tests were conducted by the Kings County Department of Public Health, Environmental Health Services at Burris Park and at other County Government facilities between April 7, 2005 and May 2, 2005. They conclude that "Readings obtained on and around the testing area were determined to be consistent with background levels." An examination of the results of the testing at the various sites shows that the detected levels of radiation near and on the UC Study Site at Burris Park were in the same range as the levels at Kings County Fire Station No. 4, at the Kings County Environmental Health Building in Hanford and at the Government Center Complex in Hanford. (See Kings County Department of Health Report dated May 2, 2005, attached hereto as Exhibit 4.)

5. In a very recent test of soils conducted at the UC Study Site, at another location near the Burris Park Fire Station and at the Kings County Government Center, the detected Sr90 levels at all three test locations are in the same range. Soils were tested at all sites at a depth of six inches. For the four test locations at the UC Study Site, the levels were 0.410 pCi/g, 0.630 pCi/g, 0.700 pCi/g and 0.300 pCi/g, with the average being 0.510 pCi/g. The Sr90 level at the Burris Park Fire Station was 0.660 pCi/g, and at the Government Center it was 0.670 pCi/g. Again the test results indicate that the Sr90 levels at the UC Study Site are entirely consistent with background levels at other locations throughout the County. (See Analytical Results Report from Davi Laboratories and letter from Dellavalle Laboratory regarding the results report attached hereto collectively as Exhibit 5.)

6. In a draft of a University of California Office of Environment, Health and Safety analysis of the above testing, the analyst concludes that the test results indicate that levels of Sr90 are what would be expected as background levels and that there is no health risk due to the Sr90 in the UC Study Site.

CONCLUSION

Over the last two decades, the County has conducted test after test with the same results: only background levels are detected, and there is no hazard. The concrete seal is intact and there is no leaching of or transmission of Sr90 into the underlying water or surrounding soil.

Every test conducted from 1981 to the present has shown that there are no health hazards or risk associated with the public's use of Burris Park. The facts as set forth in this report and in every test conducted in the past should lay to rest any concerns about possible Sr90 contamination to school children using Burris Park or to the general public. Comments such as referring to Burris Park as "Strontium Park" - suggesting that there is a hazard from radiation are totally unfounded and misleading. Continuing to suggest that there is a hazard is completely inaccurate and it does a disservice to the community not to refute these baseless claims.

UNIVERSITY OF CALIFORNIA, BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA

OFFICE OF ENVIRONMENTAL HEALTH BERKELEY, CALIFORNIA 94720

March 4, 1981

Mr. Calvin A. Jackson, Director
Environment, Safety and Program Support Division
Department of Energy
1333 Broadway
Oakland, California 94612

Dear Cal:

Enclosed is my report to our Radiation Safety Committee on the Burris Park situation.

Please call if you have any questions.

Sincerely,

Andris Peterson
Radiation Safety Officer

AP:fo
enc.

EXHIBIT 1

SANTA CRUZ

COWELL MEMORIAL HOSPITAL

March 2, 1981

TO: Radiation Safety Committee

FROM: A. Peterson, Radiation Safety Officer

SUBJECT: Survey of Burris Park Site

INTRODUCTION:

The Department of Plant and Soil Biology under the auspices of Atomic Energy Contract AT(11-1)-34 carried out studies on decontamination of soil containing ^{90}Sr at Burris Park located near Kingsburg, California. This work was performed during 1956-1963.

Procedures involved spreading ^{90}Sr at the rate of 1 $\mu Ci/in^2$ over 14 plots measuring 6 ft. x 6 ft., adding various electrolytes to the soil, irrigating and taking soil cores to determine distribution of the ^{90}Sr after treatment.

The project was terminated in 1963. Termination procedures involved the capping of the entire experimental area measuring 42 ft. x 42 ft. with reinforced concrete, affixing a bronze plaque and enclosing the area with a chain link fence.

QUESTIONS RAISED:

Mr. Dan Setentich, a fireman at the station located in Burris Park, telephone the Nuclear Regulatory Commission in Walnut Creek requesting information on the nature of work carried out at the site, whether any residual activity remained and the nature of hazards involved with the site.

The NRC in a letter dated December 29, 1980 requested the U.S. Department of Energy (U.S.D.O.E.) to look into the matter. Since the project appeared to involve U.C. Berkeley, Mr. Calvin D. Jackson of U.S.D.O.E. requested the campus Radiation Safety Officer to investigate the matter.

ACTION TAKEN:

The Burris Park project was discussed with Dr. Robert K. Schulz, Department of Plant and Soil Biology, one of the principal investigators involved in this work.

Dr. Schulz verified that the radioactive material had been placed on the soil during 1956-1957. He described the experimental plots and stated that each plot was surrounded by concrete curbing 6 inches above ground level and extending 30 inches into the soil. At termination

reinforced concrete had been put on the entire plot to cover the curbing and extended several feet on each side. A bronze plaque describing the project had also been placed on the concrete slab and attached to the reinforcement bars. Dr. Schulz also stated that the results of the work had been published in the May, 1959 issue of Hilgardia. A copy of the publication was sent to Mr. Jackson and the campus Office of Environmental Health and Safety.

It was decided that Dr. Schulz and Mr. A. Peterson would make a site visit to investigate the present status of the area. Calculations were made and it was determined that radioactive decay had reduced the amount of ^{90}Sr to less than 41 mCi.

The site visit was made on February 10, 1981. Mr. D. Setentich and Mr. Paul Douglass, the park caretaker, were present during the visit.

The concrete slab was in excellent condition and the chain link fence was in place. The following information was present on the bronze plaque:

"A total of 72 mCi of ^{90}Sr was placed on this area during 1956-1957.

This work was done under contract AT(11-1) - 34 Project 23 between the University of California and the U.S. Atomic Energy Commission.

Roy Overstreet R. K. Schulz
University of California, Berkeley "

The concrete slab was being used as a display area for old farm equipment.

A radiation survey using Ludlum Model 2 portable survey meters equipped with Model 44-9 pancake probes was made. No readings above normal background (0.02 - 0.05 mr/hr) were obtained.

The nature of the project, the residual activity, the significance of the G-M readings and the use of the area were discussed with Mr. Setentich and Mr. Douglass. A copy of the Hilgardia article was left with Mr. Setentich. It was learned that members of the King County Office of Emergency Services had also surveyed the slab and had found no significant readings.

Mr. Setentich and Mr. Douglass expressed their appreciation of the concern on the part of the campus, the ability to discuss the situation with someone who had been directly involved in the project and stated that they had no further questions or concerns.

CONCLUSIONS AND RECOMMENDATIONS:

It is felt that proper care was taken to terminate the project via the reinforced concrete capping procedure. As there were no readings above background, the use of the slab for a display area in the park

is entirely acceptable.

Since Mr. Setentich was satified with the information provided to him during the site visit there is no need for further action. The campus will continue to maintain the Burris Park file for future reference purposes.

AP:fo
cc: C. A. Jackson
R. F. Kerley

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY

PETE WILSON, *Governor*

DEPARTMENT OF HEALTH SERVICES
714/744 P STREET
P.O. BOX 942732
SACRAMENTO, CA 94234-7320
(916) 323-2759

June 2, 1995

Mr. Gary Curtis
County Government Center
1400 W. Lacey Blvd.
Hanford, CA 93230

SUBJECT: Concrete Capped Radioactivity in Burris Park

Dear Mr. Curtis:

This letter refers to the experimental study using Sr-90 by University of California, Berkeley (UCB) in 1956 through 1957. At the end of the study, the study site was surrounded by a fence and capped with a concrete slab. An informational plaque was placed on the concrete by UCB.

Upon receipt of the inquiry by Mr. Doyle Davis of the Kings County Office of Emergency Services (OES) via Mr. Allen Remick of U.S. Department of Energy on January 20, 1994, Radiologic Health Branch (RHB) staff requested information from both the U.S. Nuclear Regulatory Commission (NRC) and UCB concerning the subject matter. Due to an arduous retrieval process, RHB staff was finally able to review the archived files provided by NRC and UCB.

Based on the review of the archived files, the RHB dose assessment using RESRAD computer code and the site survey results, it appears that the site does not pose a significant health and safety hazard to the park workers and the general public. However, this assessment relies on the information provided by the NRC and UCB archived records without direct soil sampling. Soil sampling was not performed to avoid breaching the integrity of the concrete cap which can lead to potential contamination of the surrounding areas.

Mr. Roger Lupo, a RHB staff member, performed a survey of the experiment site on May 19, 1995. The concrete slab was found to be intact and the plaque on it was still legible. Radiation surveys were performed using an Eberline ESP-2 meter with a Ludlum Model 44-9 pancake probe. There was no contamination found on the surface of the concrete slab or soil/dirt surrounding the edges of the slab.

JUN 1995

EXHIBIT 2

However, the fence is in marginal condition and service is needed to maintain the fence. This issue needs to be resolved even though the Sr-90 under the concrete slab does not pose an external radiation hazard.

Please feel free to contact me at (916) 323-2759 or Mr. Steve Hsu of this office at (916) 322-4797 if you have any further questions concerning this matter.

Sincerely,

Gerard Wong, Ph.D., Chief
Radioactive Material Licensing Section
Radiologic Health Branch

cc: Mr. Allen Remick
U.S. Department of Energy
P.O. Box 808, M/S L-573
Livermore, CA 94550

U.S. NRC Region IV Walnut Creek Field Office
Attn: H. Dean Chaney, C.H.P.
Sr. Radiation Specialist
Radioactive Material Branch
1450 Maria Lane, Suite 210
Walnut Creek, California 94596

Mr. Rod Warren
Acting Radiation Safety Officer
Office of Radiation Safety
University of California, Berkeley
University Hall, 3rd Floor # 1154
Berkeley, CA 94720-1154

Mr. Tim Goodman, Director
Burris Park
County Government Center
1400 W. Lacey Blvd.
Hanford CA 93230

ANALYTICAL CHEMISTS

January 3, 2005

Lab ID : SP 413275
Customer : 2000450

Dellavalle Lab, Inc.
1910 W. Mckinniey, #110
Fresno, CA 93728

Laboratory Report

Introduction: This report package contains total of 4 pages divided into three sections:

Case Narrative (1 Page) : An overview of the work performed at FGL.
Chemical Results (2 Pages) : Results for each sample submitted.
Quality Control (1 Page) : Supporting Quality Control (QC) results.

This report package pertains to the following samples:

Sample Description	Date Sampled	Date Received	FGL Lab Sample ID #	Matrix
82432-1 Domestic Well	12/16/2004	12/20/2004	SP 413275-01	GW
82432-2 Landscape Well	12/16/2004	12/20/2004	SP 413275-02	GW

Sampling and Receipt Information: All samples were received, prepared and analyzed within the method specified holding times. All samples were received at room temperature. All samples were checked for pH if acid or base preservation required (except for VOAs). For details of sample receipt information, please see the attached Chain of Custody and Condition Upon Receipt Forms.

Quality Control: All samples were prepared and analyzed according to the following tables:

Radio Chemistry QC

905.0	12/23/2004:A - GP217 All analysis quality controls are within established criteria.

Certification: I certify that this data package is in compliance with NELAC Standards, both technically and for completeness, except for any conditions listed above. Release of the data contained in this data package is authorized by the Laboratory Director or his designee, as verified by the following signature.

FGL ENVIRONMENTAL

KAD:cl

Kelly A. Dunnahoo, B.S.
Laboratory Director

EXHIBIT 3

Corporate Offices & Laboratory
P.O. Box 272 / 853 Corporation Street
Santa Paula, CA 93061-0272
TEL: (805) 392-2000
FAX: (805) 525-4172
CA NELAP Certification No. 01110CA
CA ELAP Certification No. 1570

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
TEL: (209) 942-0181
FAX: (209) 942-0423
CA ELAP Certification No. 1553

Field Office
Visalia, California
TEL: (559) 734-9473
FAX: (559) 734-8435
Mobile: (559) 737-2399

ANALYTICAL CHEMISTS

Kings County Parks #12157/21

January 3, 2005

Dellavalle Lab, Inc.
1910 W. Mckinnley, #110
Fresno, CA 93728

Lab ID : SP 413275-01
Customer ID: 2-450

Sampled On : December 16, 2004-09:45
Sampled By :
Received On: December 20, 2004-10:25
Matrix : Ground Water

Description : 82432-1 Domestic Well
Project : Waters for Stronium 90 (acid field)

Sample Results - Radio

Constituents	Result ± Error	Units	MCL	Preparation Method	Preparation Date/ID	Analysis Method	Analysis Date/ID
Radio Chemistry [P:1]							
Strontium 90	0.000 ± 0.583	pCi/L	8	905.0	12/22/04:A214	905.0	12/23/2004:A01

MCL = Maximum Contaminant Level. Containers: (P) Plastic Preservatives: (1) Cool 4°C

Corporate Offices & Laboratory
P.O. Box 272 / 853 Corporation Street
Santa Paula, CA 93061-0272
TEL: (805) 392-2000
FAX: (805) 525-4172
CA NELAP Certification No. 01119CA
CA ELAP Certification No. 1573

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
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FAX: (209) 942-0423
CA ELAP Certification No. 1563

Field Office
Visalia, California
TEL: (559) 734-9473
FAX: (559) 734-8435
Mobile: (559) 737-2399

ANALYTICAL CHEMISTS

Kings County Parks #12157/21

January 3, 2005

Dellavalle Lab, Inc.
1910 W. Mckinnley, #110
Fresno, CA 93728

Lab ID : SP 413275-02
Customer ID : 2-450

Sampled On : December 16, 2004-09:45
Sampled By :
Received On : December 20, 2004-10:25
Matrix : Ground Water

Description : 82432-2 Landscape Well
Project : Waters for Stronium 90 (acid field)

Sample Results - Radio

Constituents	Result ± Error	Units	MCL	Preparation Method	Preparation Date/ID	Analysis Method	Analysis Date/ID
Radio Chemistry P:1							
Strontium 90	0.257 ± 0.647	pCi/L	8	905.0	12/22/04:A214	905.0	12/23/2004:A01

MCL = Maximum Contaminat Level. Containers: (P) Plastic Preservatives: (1) Cool 4°C

Corporate Offices & Laboratory
P.O. Box 272 / 853 Corporation Street
Santa Paula, CA 93061-0272
TEL: (805) 392-2000
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CA ELAP Certification No. 1573

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FAX: (559) 734-8435
Mobile: (559) 737-2399

PERRY RICKARD
Director of Public Health Services

MICHAEL MACLEAN, M.D., M.S.
Health Officer

COUNTY OF KINGS

DEPARTMENT OF PUBLIC HEALTH

KEITH WINKLER, DEPUTY HEALTH DIRECTOR
Environmental Health Services

330 Campus Drive - Hanford, California 93230
Telephone: (559) 584-1411 Fax: (559) 584-6040
www.countyofkings.com/health/ehs

Contaminant Exposure Monitoring Performed at Burris Park Located at Clinton & 6th Ave., Hanford, CA

Prepared By:

Kings County Department Of Public Health
Division Of Environmental Health Services

Jeff Taber, M.P.H., R.E.H.S., EHO IV, IH
Thomas Smith, M.P.H., KC Safety Officer, IH

May 2, 2005

EXHIBIT 4

EXECUTIVE SUMMARY

At the request of Thomas Smith, the Kings County Safety Officer, the Division of Environmental Health Services (KCEHS) performed Contaminant Exposure Monitoring at Burris Park on Thursday, April 7, 2005.

The purpose of the assessment was twofold. First to conduct a radiological survey through the collection a comprehensive set of data that would characterize the potential radiation exposure to the general public walking around the area where a 1950's radiation experiment was conducted within the park grounds. Secondly, to collect a comprehensive set of data that would characterize possible contaminant exposure (Sr 90) to employees that occupy the work area within and around the testing site. It is noteworthy, that there is limited access to the testing site due to a surrounding perimeter fence and locked gate. In brief, our findings and recommendations are the direct result of the April 7th investigation and subsequent analysis.

The area studied in this investigation, Burris Park, is located in a somewhat isolated rural area. The park consists of a sportsman's club, fire station #1, museum, employee housing, picnic and playground areas that are utilized by the general public and other county employees periodically. Employee housing is provided for one permanent park maintenance employee year round. The park is utilized by the general public during normal seasonal hours of operation.

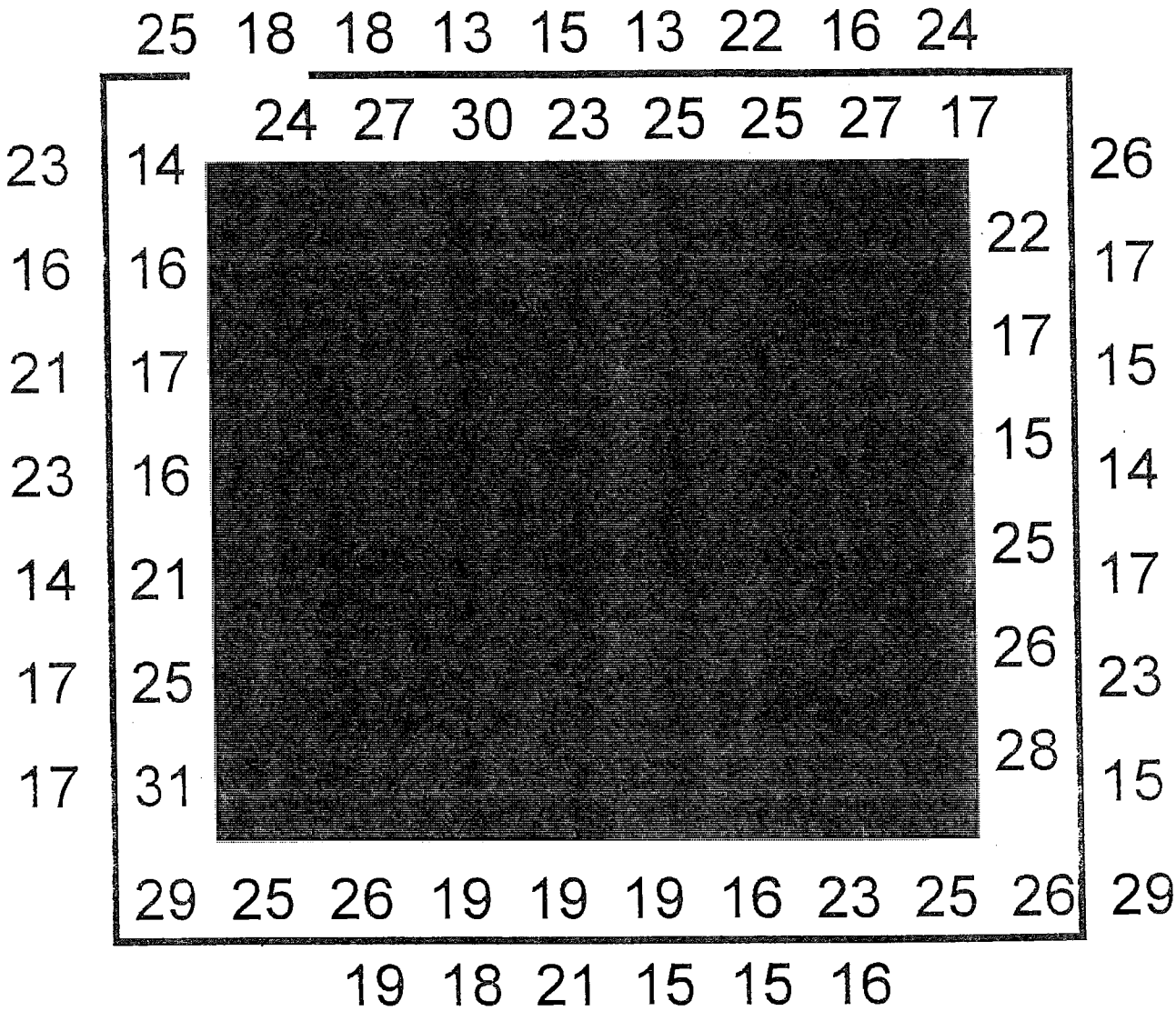
At this time, the only potential contaminant identified with the Sr 90 testing experiment in regards to possible employee exposure is the possible exposure to beta radiation (Sr 90). The primary route of exposure is by ingestion and secondarily by the inhalation of contaminated dust particles. The EPA has established a Maximum Contaminant Level (MCL) of 4 millirem per year for beta particle and photon radioactivity from man-made radionuclides in drinking water.

Personal exposure monitoring was conducted using a Ludlum Model 2241-2 Dual Detector Digital Scaler/Ratemeter Survey Meter for use with scintillation, Geiger-Mueller (G-M), and proportional-type detectors for measurement of ionizing radiation. Readings obtained on and around the testing area were determined to be consistent with background levels measured at various other areas throughout the County (Government Center, KC Fire Station #4, KC EHS Office, and the perimeter of the park itself.).

Attached are the readings obtained on April 7, 2005.

April 7th, 2005
Radiological Screening

10 ft.

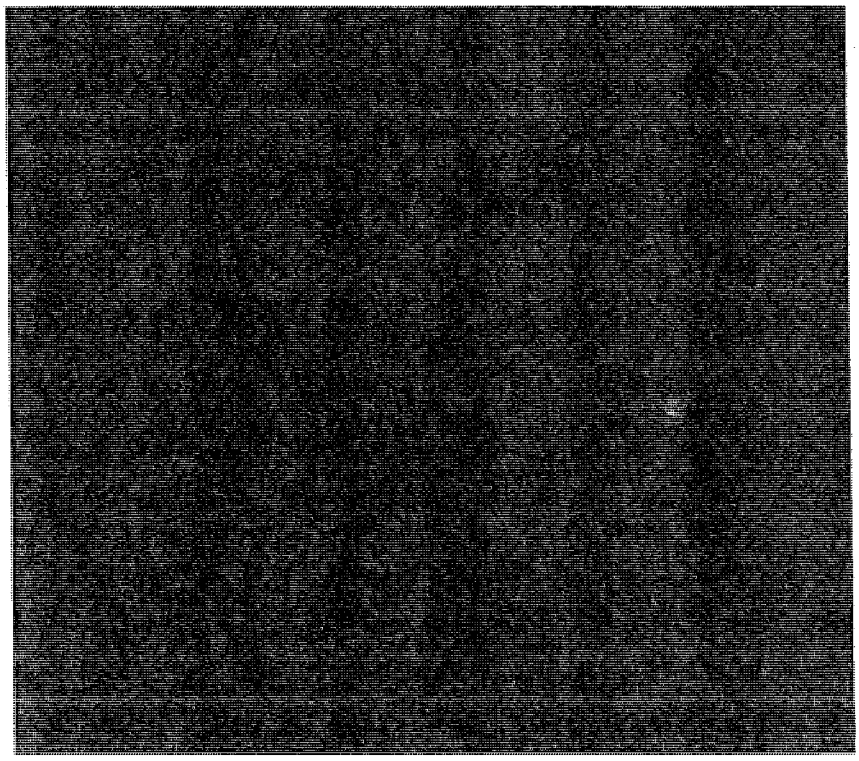


10 ft.

All measurements are in μR/hr

April 7th, 2005
Radiological Screening of the Concrete Pad (Cap)

10 ft.

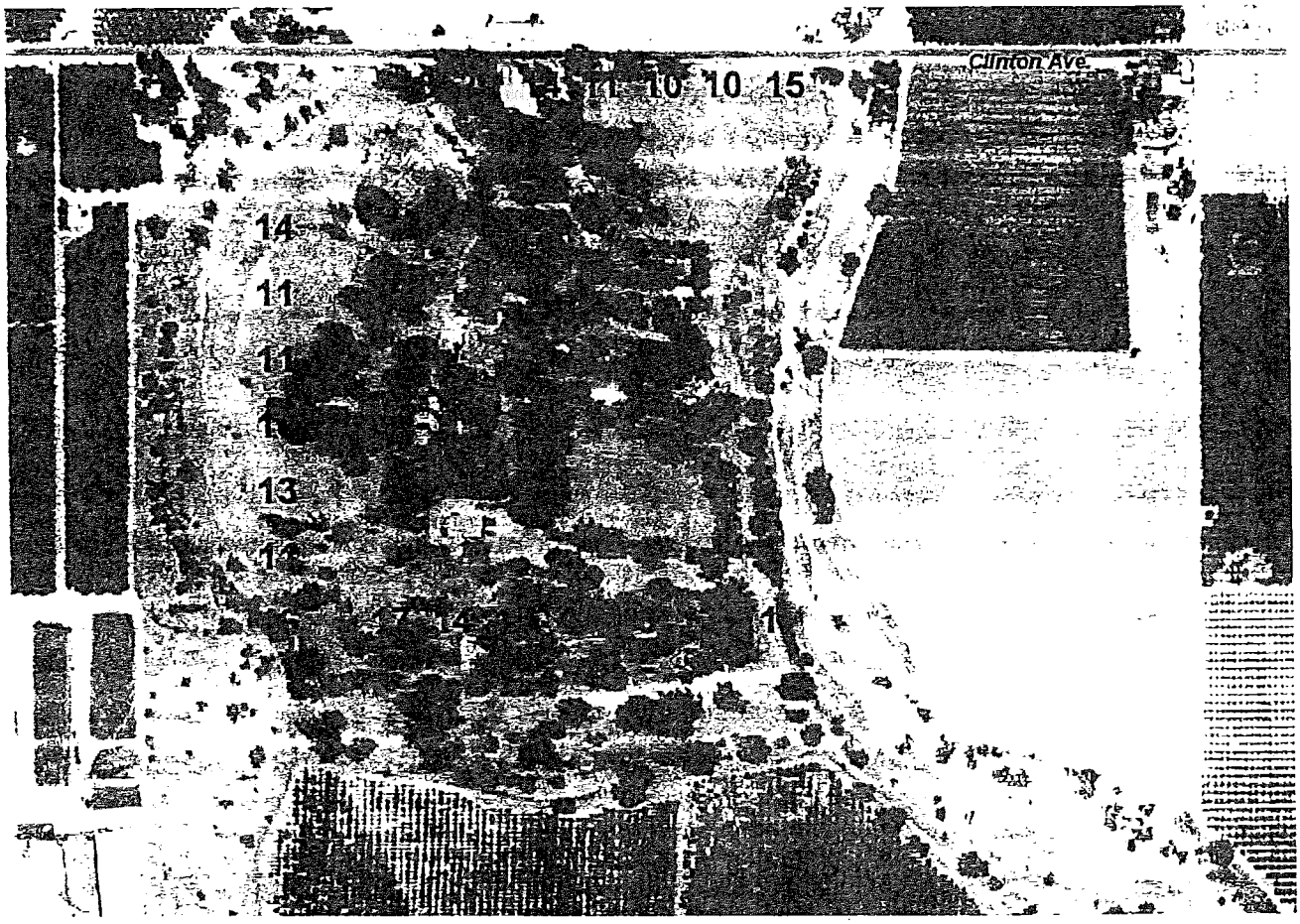


10 ft.

All measurements are in μR/hr

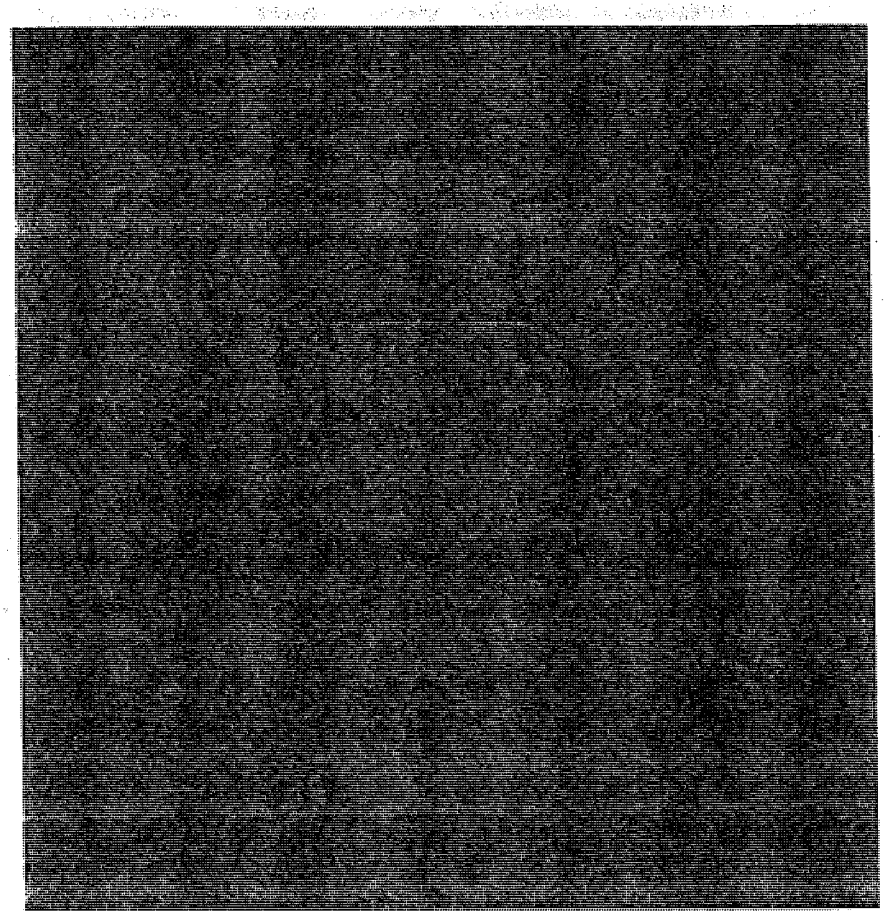
N

April 7th, 2005
Radiological Screening of Surrounding Perimeter Areas of Burris Park



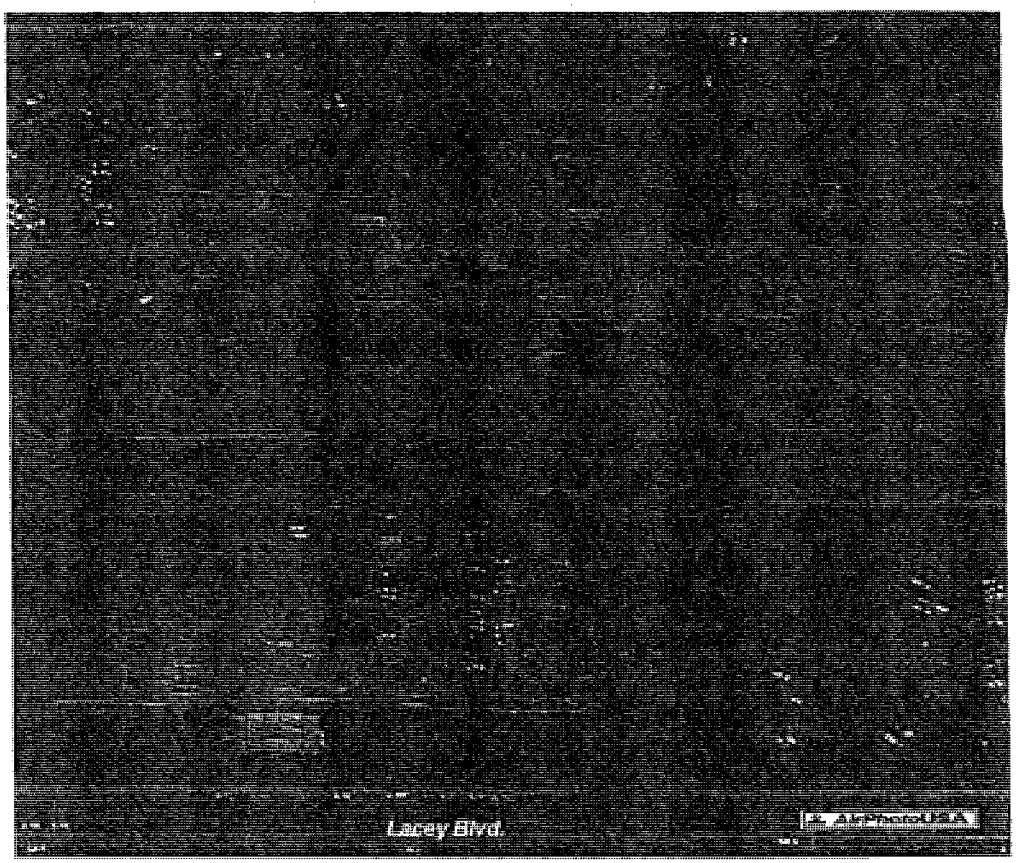
All measurements are in μR/hr

April 7th, 2005
Radiological Screening of
KC Fire Station #4



All measurements are in μR/hr

April 7th, 2005
Radiological Screening of
KC Govt. Center



Area	Above Concrete	In Office	Grounds
Kings County Government Center	13-25	8-21	11-24

* All measurements are in μR/hr

DAVI LABORATORIES, ENVIRONMENTAL ASSOCIATES
701 "B" Belmont Way • Pinole, CA 94564 • (510) 724-9450 • Fax (510) 724-9174
New Address: 730 Alfred Nobel Drive, Hercules, Ca 94547

ANALYTICAL RESULTS REPORT

Company: Dellavalle Laboratory Inc.
Address: 1910 W. McKinley, Suite 110
Fresno, CA 93728

Kings Co Parks #12157/21
Attn JD Johns

Contact: Peggy Miller
Report Date: June 29, 2005
Purchase Order: 22241

TABLE I

Sample I.D.	Collection Date/Time	Matrix	Method	Analysis	Results pCi/g	±	2Sigma error	MDA	Moisture %
85869-1 KC Govt. Center E of Bldg 6	6/03/05 (0930)	Solid	905.0	Strontium 90	0.67	±	0.28	0.50	0.30
85869-2 KC Burris Fire Stn. W side of Bldg	6/03/05 (1000)	Solid	905.0	Strontium 90	0.66	±	0.33	0.47	0.16

TABLE II QA/QC Data

Analysis.	Spike Activity pCi	Detected Activity pCi	Percent of Agreement %
Strontium 90	1121.8 pCi	1047.0 pCi	93.33

The above results are calculated as pCi/gram of dissolved dry weight of received soil.

Patricia Davi
Davi Laboratories
Qa/Qc Manager

EXHIBIT 5

DELLAVALLE®
Laboratory, Inc.
Chemists and Consultants

June 3, 2005

JD Johns
Kings County Parks #12157
1400 W Lacey Blvd
Hanford, CA 93230

Re: Lab No 84945 Burris Park Containment Area Soil Samples

Dear JD:

On May 11, 2004 I collected soil samples from the four sides of the Burris Park containment area. Samples were collected to a depth of six inches from three zones on each side with five sub-samples in each zone. Samples from each side were composited into one sample. Samples were then prepared by Dellavalle Laboratory and transported to Davi Laboratories in Hercules, CA for Strontium 90 analysis..

The laboratory results are included in this report range from 0.30 to 0.70 picocuries of strontium 90. Human exposure is measured in curies. A picocurie is one trillionth of a curie. This is very minute and is undoubtedly equivalent to the residue found anywhere on the planet. Additional specialists are being contacted to confirm the relative background information.

Please call if you have any questions.

Sincerely,

Keith M. Backman
Sr Consultant, MS Horticultural Science
Dellavalle Laboratory-Hanford Office

KMB:mc

Enclosures

1910 W. McKinley, Suite 110 • Fresno, CA 93728-1298 • (559) 233-6129
www.dellavallelab.com

DAVI LABORATORIES, ENVIRONMENTAL ASSOCIATES
701 "B" Belmont Way • Pinole, CA 94564 • (510) 724-9450 • Fax (510) 724-9174
New Address: 730 Alfred Nobel Drive, Hercules, Ca 94547

ANALYTICAL RESULTS REPORT

Company: Dellavalle Laboratory Inc.
Address: 1910 W. McKinley, Suite 110
Fresno, CA 93728

Contact: Peggy Miller
Report Date: May 30, 2005
Purchase Order: 22173

Kings County Parks #12157/21
Attn JD Johns
Burris Park-Containment Area

TABLE I

Sample I.D.	Collection Date/Time	Matrix	Method	Analysis	Results pCi/g	±	2Sigma error	MDA	Moisture %
84945-1 North Side	5/11/05	Solid	905.0	Strontium 90	0.41	±	0.18	0.21	0.17
84945-2 East Side	5/11/05	Solid	905.0	Strontium 90	0.63	±	0.29	0.36	0.17
84945-3 South Side	5/11/05	Solid	905.0	Strontium 90	0.70	±	0.31	0.37	0.15
84945-4 West Side	5/11/05	Solid	905.0	Strontium 90	0.30	±	0.21	0.42	0.16

TABLE II QA/QC Data

Analysis.	Spike Activity pCi	Detected Activity pCi	Percent of Agreement %
Strontium 90	1121.8 pCi	1056.5 pCi	94.18

The above results are calculated as pCi/gram of dissolved dry weight of received soil.

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Davi Laboratories
Qa/Qc Manager

Schulz, R.K., J.P. Moberg, and R. Overstreet, 1959. “Some Experiments on the Decontamination of Soils Containing Strontium-90,” *Hilgardia*, Volume 28, Number 17, University of California, Berkeley, May. [Includes photographs of test plots before they were capped]

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SOME EXPERIMENTS ON THE DECONTAMINATION OF SOILS CONTAINING STRONTIUM 90

R. K. SCHULZ, J. P. MOBERG,
and
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The possibility that large areas of the landscape could become contaminated with strontium 90 through fallout or reactor accidents has necessitated studies of means of decontaminating soils containing radio-strontium. In this work three possible methods were investigated: 1) displacement by electrolytes and leaching; 2) physical immobilization using asphalt preparations; and 3) placement at depth.

Of the various electrolytes used, ferric chloride and hydrochloric acid were most effective. The use of the electrolytes followed by leaching with 5 feet of irrigation water displaced up to 90 per cent of the Sr 90 below the surface 6 inches. This, however, was not sufficient decontamination so that the land could be put back into agricultural use. In addition the procedure is very expensive.

By spraying the soil surface with asphalt, it was found that 97 per cent of the Sr 90 could be removed by peeling off the hardened crust. When the crust was cultivated into the soil profile, however, the Sr 90 gradually became available to plants.

In order to investigate the possibility of reducing the uptake of Sr 90 by deep plowing, experiments were conducted in lysimeters in which the isotope was placed in bands at different depths in the soil. When the soil was cropped to barley, a marked reduction of uptake of Sr 90 with depth of placement was observed. In irrigated barley the content of strontium 90 per gram of plant material was reduced tenfold when the depth of placement was increased from 2 inches to 2 feet.

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SOME EXPERIMENTS ON THE DECONTAMINATION OF SOILS CONTAINING STRONTIUM 90[1]

R. K. SCHULZ,[2] J. P. MOBERG,[3] and ROY OVERSTREET[4]

INTRODUCTION

A STUDY of methods for decontaminating soils that contain dangerous amounts of Sr 90 is becoming quite urgent as the use of atomic energy for industrial and military purposes is constantly expanded. The possible contamination of soils by military explosions is well recognized and accidental releases of Sr 90 to the landscape through reactor accidents are definite if somewhat remote possibilities.

When Sr is adsorbed on colloidal clay surfaces, it is held in an exchangeable form with an adsorption energy similar to that of calcium (Krishnamoorthy and Overstreet, 1950).[5] Also, it has been shown that when Sr 90 is added to soil, very little of it is fixed in a nonexchangeable form, at least during short periods of time (Schulz, Overstreet, and Babcock, 1958). From this knowledge and direct laboratory experiments (Overstreet, 1956), it is known that for some time following a deposition of water-soluble Sr 90 by way of fallout, essentially all of the isotope remains in an exchangeable form in the immediate surface of the soil. This, of course, is a temporary condition, because such agents as cultivation, drying and cracking, burrowing rodents, worms, et cetera, will slowly incorporate the element into the soil profile. Thus incorporated in the soil, the Sr 90 is readily available to plants. Many investigators (Neel *et al.*, 1956; Martin *et al.*, 1957; Jacobson and Overstreet, 1947; Guliakin and Yudintseva, 1957) have shown that relatively large amounts of the radioisotope are taken up and translocated by plants growing in soils contaminated with Sr 90.

The general objective of the work reported here has been the decontamination of soils which have received a surface application of carrier-free Sr 90. The researches have been conducted along three distinct lines and each approach is reported separately.

[1] This paper is based on work performed under contract number AT-(11-1)-34, Project 23, with the U. S. Atomic Energy Commission. Received for publication October 31, 1958.

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[5] See "Literature Cited" for citations referred to in text by author and date.

Fig. 1. Construction of plots at Burris Park Field Station.

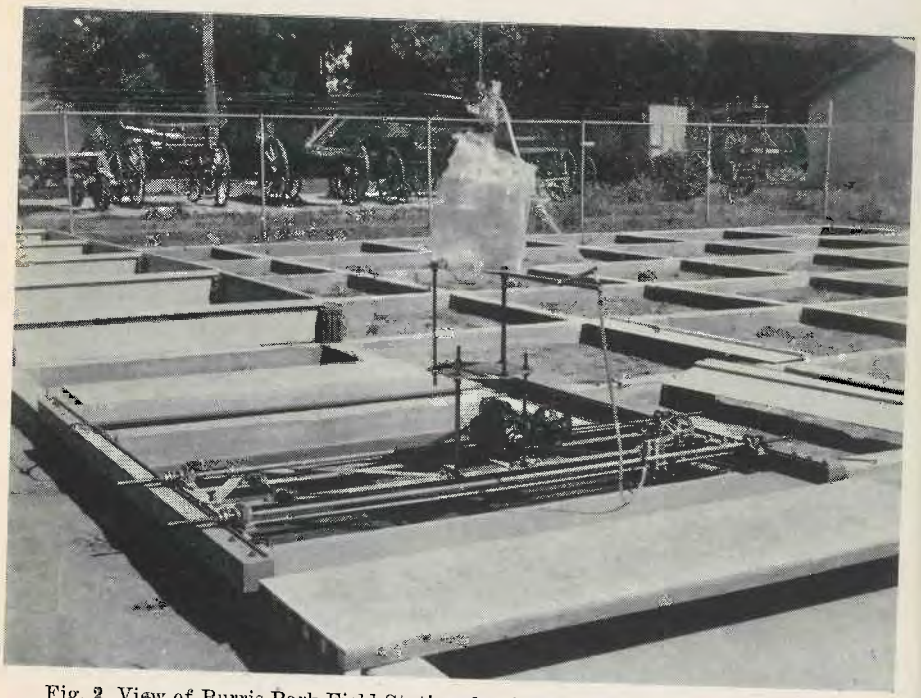

Fig. 2. View of Burris Park Field Station showing Sr 90 applicator in foreground.

1) The first procedure was the heavy application of electrolytes followed by extensive leaching with water. By this means, it was hoped that the radioisotope would be released from the soil particles and moved to lower depths in the soil profile.

2) The second procedure was based on the physical immobilization of the Sr 90. The contaminated soils were sprayed with an asphalt emulsion. By this means, the surface soil particles containing the isotope were embedded in a layer of asphalt and thus could be removed from the soil or plowed into the profile.

3) In the third procedure, the effect of depth of placement of the Sr 90 on its availability to plants was studied. The intention was to gain information on the possibility of reducing plant uptake of Sr 90 by deep plowing.

I. ADDITION OF ELECTROLYTES FOLLOWED BY LEACHING

This method is analogous to procedures used in the reclamation of soils containing undesirable amounts of adsorbed sodium and for which there is a considerable background of theory and experience. It was thought that additions of strong replacing ions such as H^+, Ca^{++}, and Fe^{+++} might effect a release of the Sr 90 to the soil solution. Thus released, the strontium conceivably could be displaced by leaching to depths in the soil profile below the major part of the root zone.

Experimental Procedure and Results

The experiments were carried out at two field stations located in areas of different soil and climate. One station is located at Burris Park, in Kings County, California. The soil of this station is a deep, very fine sandy loam of the Hanford series. The chemical analysis of the soil is given in table 1. Four borings and a random surface composite were analyzed in order to investigate the variability of the soil. The annual rainfall at this location is about 10 inches. The other station was located at the Hopland Field Station of the University of California in Mendocino County, California. The soil here is Yorkville loam with a depth of approximately 4 feet. The analysis of this soil is given in table 2. The annual rainfall at this location is about 40 inches.

Each station consists of 49 plots 6′ × 6′, laid out in a checkerboard fashion. In the construction of the plots, ditches were machine-dug 6″ wide and 30″ deep (see figure 1), forms were placed around the top of the plots and concrete was poured to give a curbing extending 6″ above the ground and 30″ into the soil profile. The completed Burris Park Station is shown in figure 2.

In order to apply the Sr 90 uniformly to the soil, a mechanical applicator was constructed. It is shown in the foreground in figure 2. Basically it consisted of a traveling sprinkler head which traverses the plots at 25 feet per minute while the whole assembly moves perpendicularly to the path of the sprinkler at the rate of 1 foot per minute. The sprinkler head was constructed of lucite and contained 17 holes in line spaced ¼ inch apart. The Sr 90 was supplied to the sprinkler in carrier-free solution from a constant head bottle. At the Burris Park station a sprinkler with 0.0350″ diameter holes was used, which delivered the solution at a rate of 1.68 liters per minute. This rate was

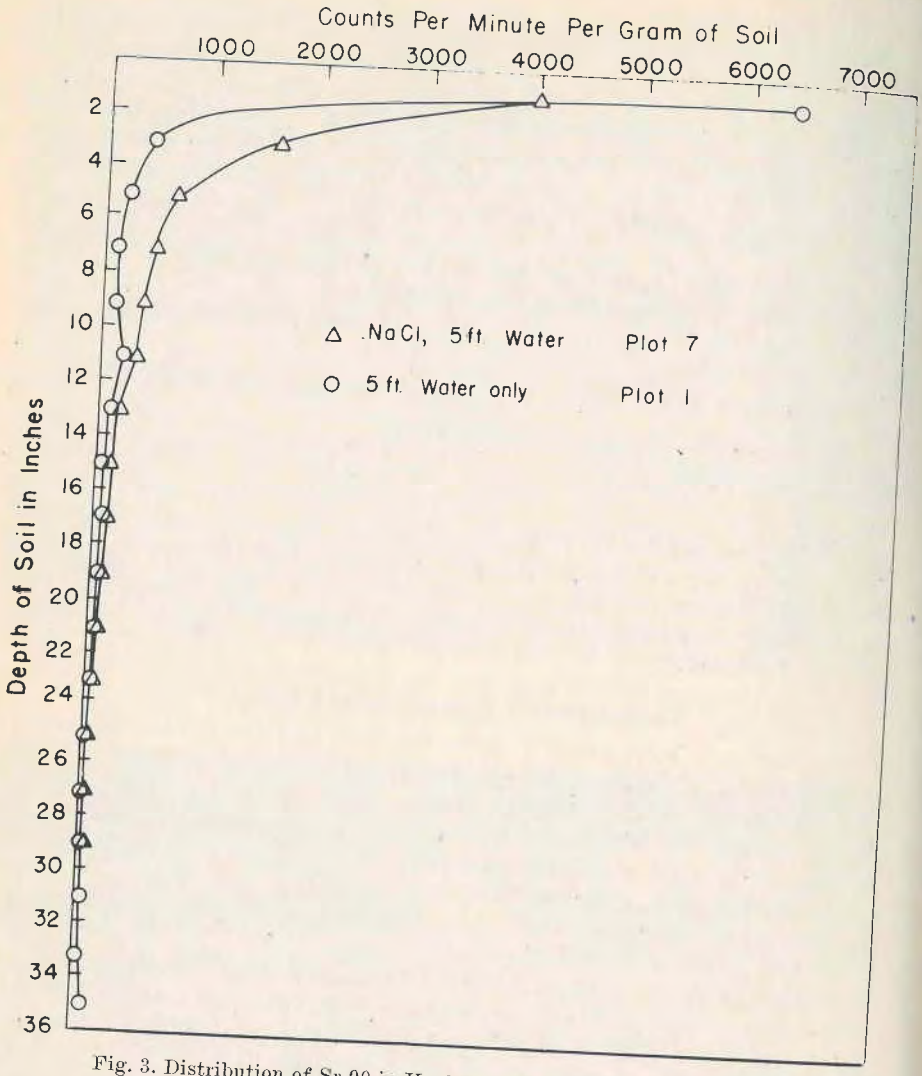

Fig. 3. Distribution of Sr 90 in Hopland soil profile after treatment.

too high, causing running of the solution on the soil surface and resulting in a somewhat uneven application of Sr 90. At the Hopland station a new sprinkler with 0.0250″ diameter holes was used, which gave an application rate of 0.98 liter per minute and resulted in a very even distribution of Sr 90 on the soil surface.

After the Sr 90 solution had been applied, the plots were allowed to dry and the following electrolytes were added in solution form: HCl, 14.9 tons per acre; $FeCl_3$, 22.1 tons per acre; H_2SO_4, 20 tons per acre; $CaCl_2$, 22.6 tons per acre; and NaCl, 23.8 tons per acre. As soon as the solutions had entered the soil, the plots were irrigated until 5 feet of water had been applied. Fol-

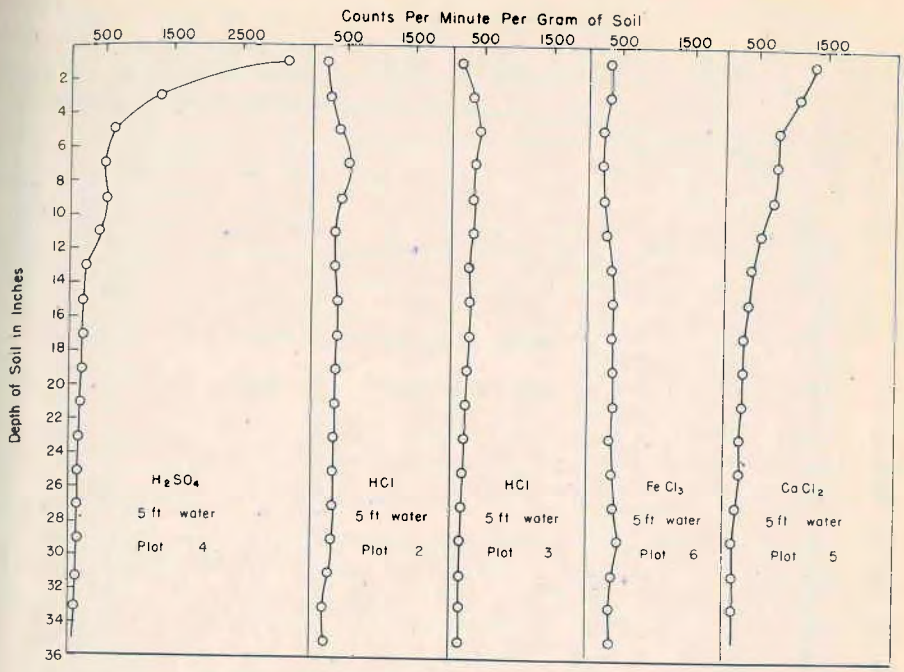

Fig. 4. Distribution of Sr 90 in Hopland soil profile after treatment.

lowing the application of the treatments, two soil cores were drawn from each plot and the distribution of the Sr 90 was determined. The results are presented in figures 3 to 6.

Two HCl plots were included to give information on the expected variability. Good duplication was obtained at the Hopland station, but a fairly large variability was encountered at the Burris Park station.

Discussion and Conclusions

It is evident from figures 3 to 6 that HCl and $FeCl_3$ were most effective in removing the Sr 90 from the surface horizons but the result differed markedly at the two stations. The observations are summarized in table 3 where the fractions of applied Sr 90 remaining in the various horizons are presented for each treatment. In general it must be concluded that the decontamination of soils by any of the above treatments would be very expensive. As an example, agricultural calcium chloride costs approximately $100 per ton. Thus, the $CaCl_2$ treatment would cost about $2,200 per acre.

II. PHYSICAL IMMOBILIZATION OF THE Sr 90

In view of the prohibitive cost of soil decontamination by chemical treatments and leaching, the possibility of physical removal or immobilization of surface contamination was investigated. Since in areas contaminated by way of fallout the Sr 90 is held initially in the immediate surface of the soil

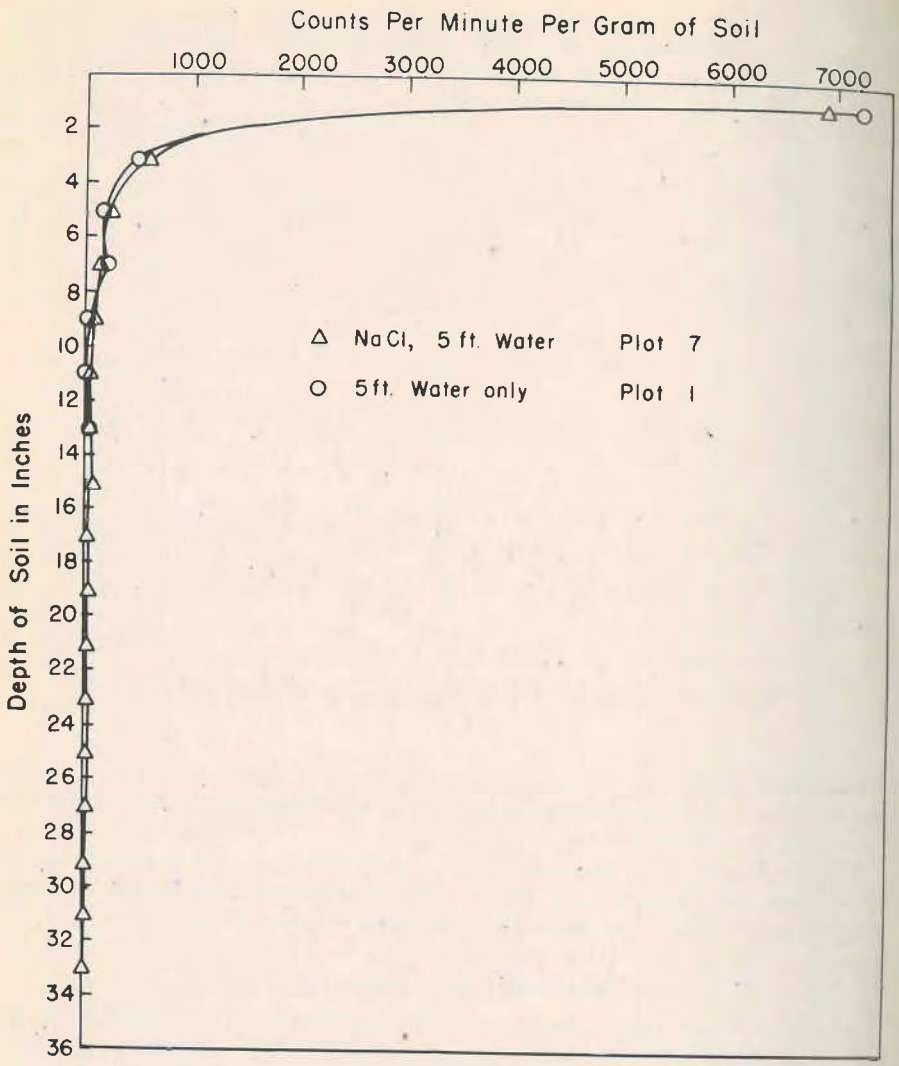

Fig. 5. Distribution of Sr 90 in Burris Park soil profile after treatment.

profile, it appeared feasible to spray the land with some material which would enclose and immobilize the radioactivity.

Experiments and Results

With the above general approach in mind, a number of experiments were conducted with asphalt emulsions prepared by the American Bitumuls Company. Four preparations were tested. Two were water emulsions of asphalt which were diluted with 2 parts water prior to use. The trade names of the products are Lakold Waterproofing and Bitusize L3L. The third preparation, RCI, was a naphtha solution of asphalt diluted with an equal part of

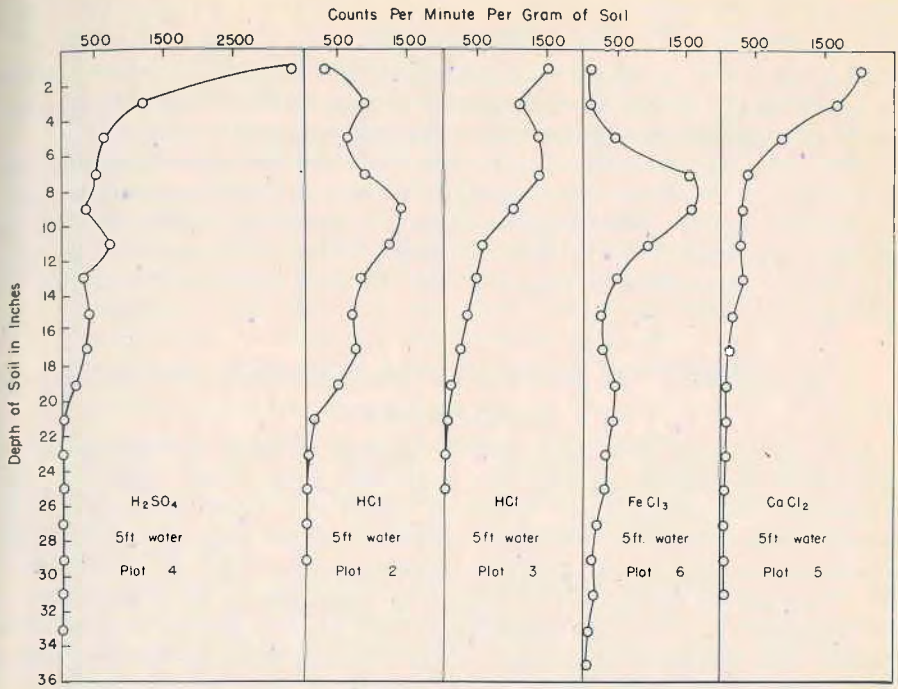

Fig. 6. Distribution of Sr 90 in Burris Park soil profile after treatment.

paint thinner. The fourth product, MCI, was similar to the third, but the asphalt was dissolved in a less volatile petroleum product. This solution was diluted with 1 part kerosene prior to use.

When the Lakold preparation was sprayed on a soil surface contaminated with Sr 90 and allowed to harden, 97 per cent of the radioactivity could be removed by peeling off the hardened crust. Apparently the contaminated surface particles of soil were imbedded in a layer of asphalt.

The question arose as to whether the radioactivity so fixed in the asphalt was available to plants. In order to investigate this, 110 pound batches of Columbia v.f.s.l. were weighed into galvanized iron containers. For each treatment the surface was contaminated with carrier-free Sr 90 at the rate of 1 micro-curie per square inch, using the device described in the previous section. Following this, the soil was allowed to dry and the various asphalt preparations were applied by spraying. The same device as used for applying the Sr 90 was employed, except that the asphalt was fed to the moving sprinkler head under a nitrogen pressure of 5 pounds per square inch. This resulted in an application of 280 ml of emulsion per square foot.

The asphalt crust was allowed to harden for one week and then was turned under and mixed throughout the soil. After this, the soil was planted to barley and the uptake of Sr 90 compared with that in the control was determined at periods of 18 days and 67 days after planting.

One of the preparations, MCI, was found to be toxic to plants. The results of the other three preparations are summarized in table 4.

Conclusions

As may be seen from table 4 the Lakold emulsion was by far the most effective in immobilizing the Sr 90. With passage of time, however, the radioactivity fixed with this emulsion became more available to plants.

The above experiments indicate that very effective decontamination of soils can be accomplished by spraying a Sr 90 contaminated soil surface with an asphalt emulsion, allowing it to harden, and peeling off the crust that is formed. However, if the crust is not peeled off but cultivated into the soil, the Sr 90 incorporated in the crust will become progressively available to plants.

III. EFFECT OF DEPTH OF PLACEMENT ON Sr 90 AVAILABILITY

From time to time, deep plowing has been proposed as a possible means of dealing with soil surfaces that have been contaminated with Sr 90. By this procedure, the contaminated surface is placed at a depth in the soil from which the Sr 90 is presumably less available to crops. In support of the idea, Guliakin and Yudintseva (1957) have found that the depth of placement of Sr 90 has a large influence on its uptake by wheat plants. They found that a given amount of Sr 90 was about 50 per cent less available at a depth of 6 inches than at a depth of 2 inches. In the experiments to be described here, the uptake of Sr 90 by barley, as influenced by depth of placement, was studied in the lysimeters at Davis, California. The studies were conducted with Columbia very fine sandy loam.

Because of the fact that the radioactivity was placed in bands at depths of from 2 inches to 4 feet, it was possible to gain information concerning the downward velocity of root growth under different irrigation procedures.

Experiments and Results

The lysimeters used were 5.5 feet deep and 27 inches in diameter. They were filled with Columbia very fine sandy loam; there was free drainage from the bottom of each container. The important chemical characteristics of Columbia v.f.s.l. are given in table 5. In all, 30 lysimeters were used in the experiments.

The Sr 90 bands were placed in the soil in the following way. The soil was dug out of the lysimeter to the appropriate depth and a carrier-free solution of Sr 90 was added to the exposed surface at a rate such as to give 1 μc per square inch. Following this, the soil that had been removed was put back into the lysimeter.

After placement of the Sr 90 bands, the soils were fertilized with $NH_4H_2PO_4$ at a rate equivalent to 90 pounds of nitrogen per acre. Three days before the experiments were started, all of the lysimeters were leached through with tap water. Thus it was assumed that all of the soils were at field capacity at the time the barley was planted.

On June 7, 1957, germinated seeds of barley were planted in the lysimeters; there were 60 plants in each lysimeter or one plant per 9 square inches. During the first eight to nine days after planting, all of the lysimeters were

irrigated lightly and any dead plants were replaced. After this period, only the lysimeters assigned for irrigation were irrigated. The general plan of the irrigation regime was as follows:

3 lysimeters, Sr 90 band at 2 inch depth, no irrigation
3 lysimeters, Sr 90 band at 2 inch depth, frequent irrigation
3 lysimeters, Sr 90 band at 1 foot depth, no irrigation
3 lysimeters, Sr 90 band at 1 foot depth, frequent irrigation
3 lysimeters, Sr 90 band at 2 foot depth, no irrigation
3 lysimeters, Sr 90 band at 2 foot depth, frequent irrigation
3 lysimeters, Sr 90 band at 3 foot depth, no irrigation
3 lysimeters, Sr 90 band at 3 foot depth, frequent irrigation
3 lysimeters, Sr 90 band at 4 foot depth, no irrigation
3 lysimeters, Sr 90 band at 4 foot depth, frequent irrigation

Where the lysimeters received "frequent irrigation," water was applied at a rate such as to maintain the soils near field capacity.

On the fourth day after planting, a systematic sampling of leaves was initiated. Ten leaf samples were taken at random from each lysimeter. When the plants were small, only the upper half of a leaf was taken; later on the whole leaf was taken.

After each sampling the leaves were assayed for radioactivity. When the count of the sample had reached or passed a value twice the background count, the sampling of the plants in the corresponding lysimeter was stopped. The double background count was arbitrarily taken as an indication that a number of roots had reached the Sr 90 band. In figure 7, the time required for the roots to reach the Sr 90 band was plotted against the depth of the band.

The barley plants were harvested on August 1–2, 1957, when the vegetative part of the plants appeared to be at its maximum growth. The dry weights (60–65° C) of the plant tops from each lysimeter are presented in table 6. At the time of harvesting, representative samples of tillers from each tank were taken and split up into lower leaves, upper leaves, stems and heads. These plant parts were assayed for radioactivity. From the assay, the total uptake of Sr 90 by the tops as well as by the individual parts was calculated. In figure 8 the uptake by the tops, expressed as m μc Sr 90 per gram of dry plant material, is plotted against the depth to the Sr 90 band. In figure 9 the gross uptake by the tops, expressed as percentage of the Sr 90 added to the soil, is plotted as function of depth to the Sr 90 band. In figures 10 and 11 the radioactivity of the plant parts, expressed as m μc Sr 90 per gram of dry plant material is plotted against depth to the Sr 90 band.

When the plants had been harvested, borings were taken in each lysimeter. An examination of the soil of the borings for radioactivity indicated that there was essentially no diffusion of the Sr 90 from the bands during the course of the experiments.

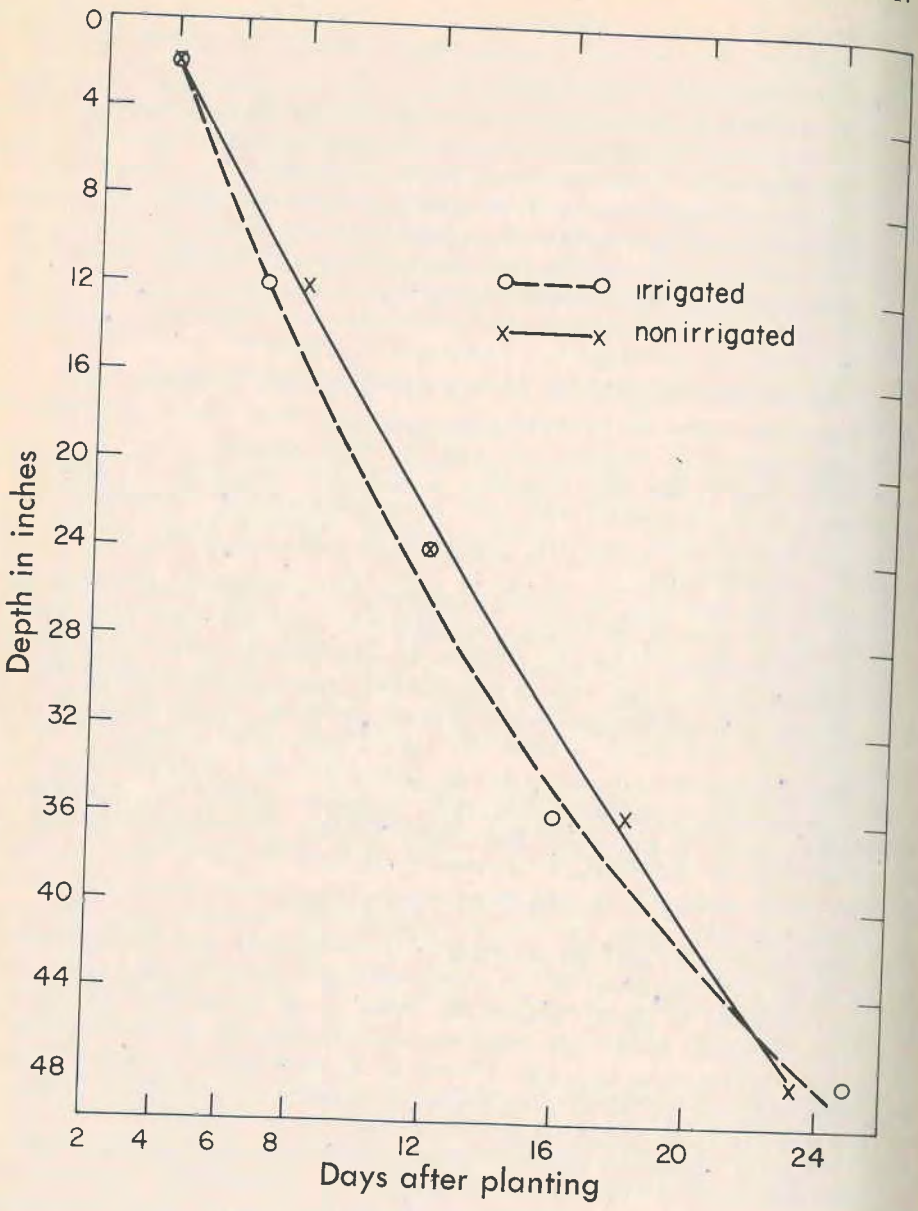

Fig. 7. Root growth in depth related to time.

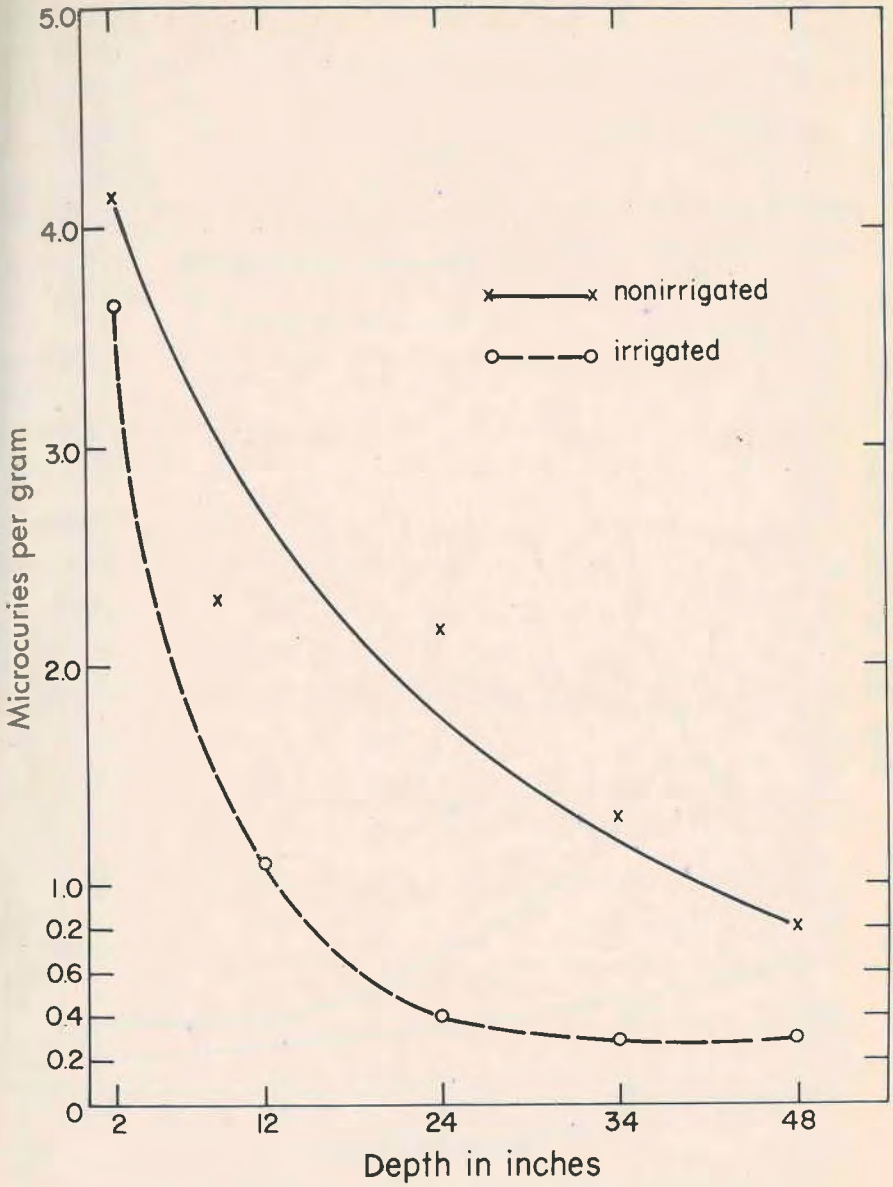

Fig. 8. Sr 90 taken up from different depths (mμc per gram dry plant material).

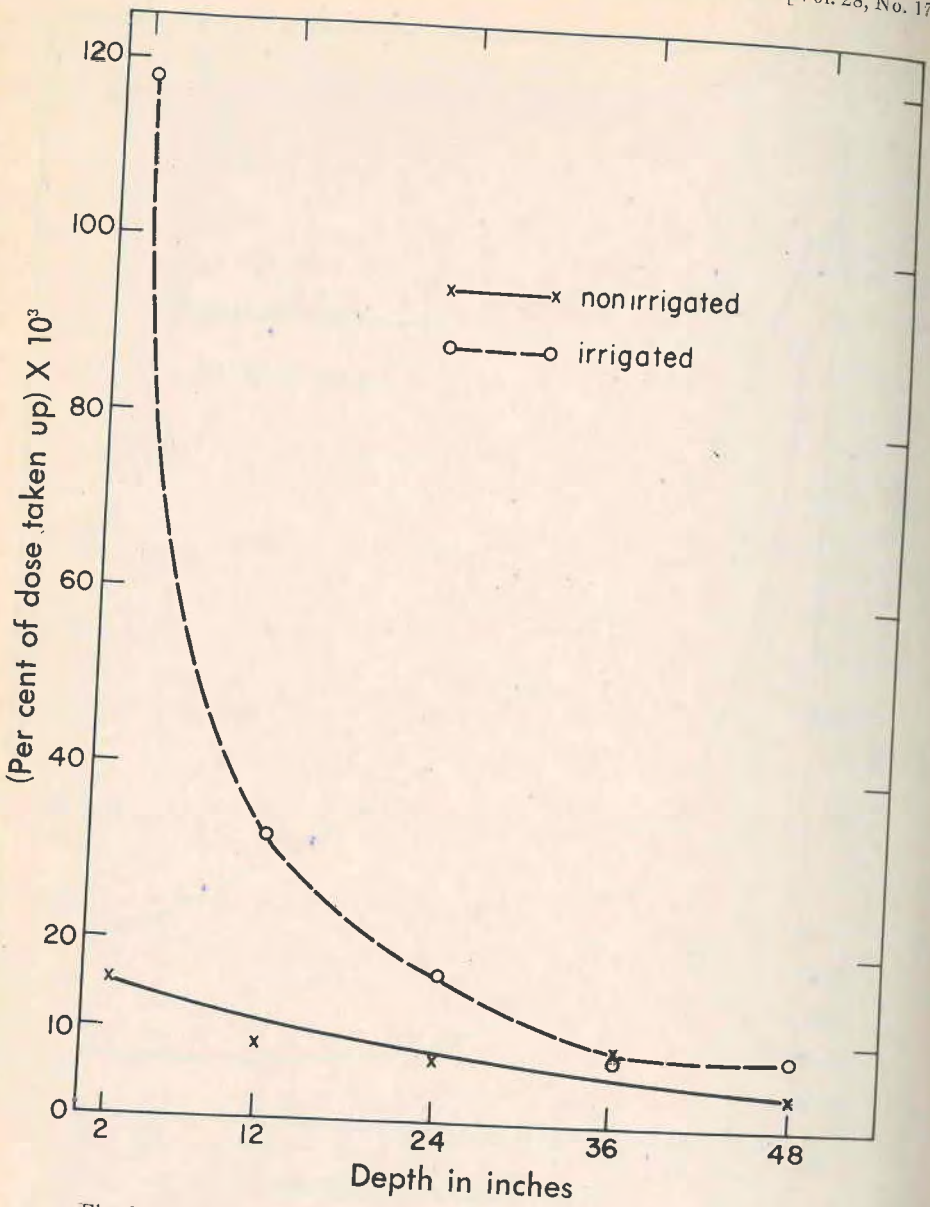

Fig. 9. Per cent of Sr 90 dose taken up by barley from different depths.

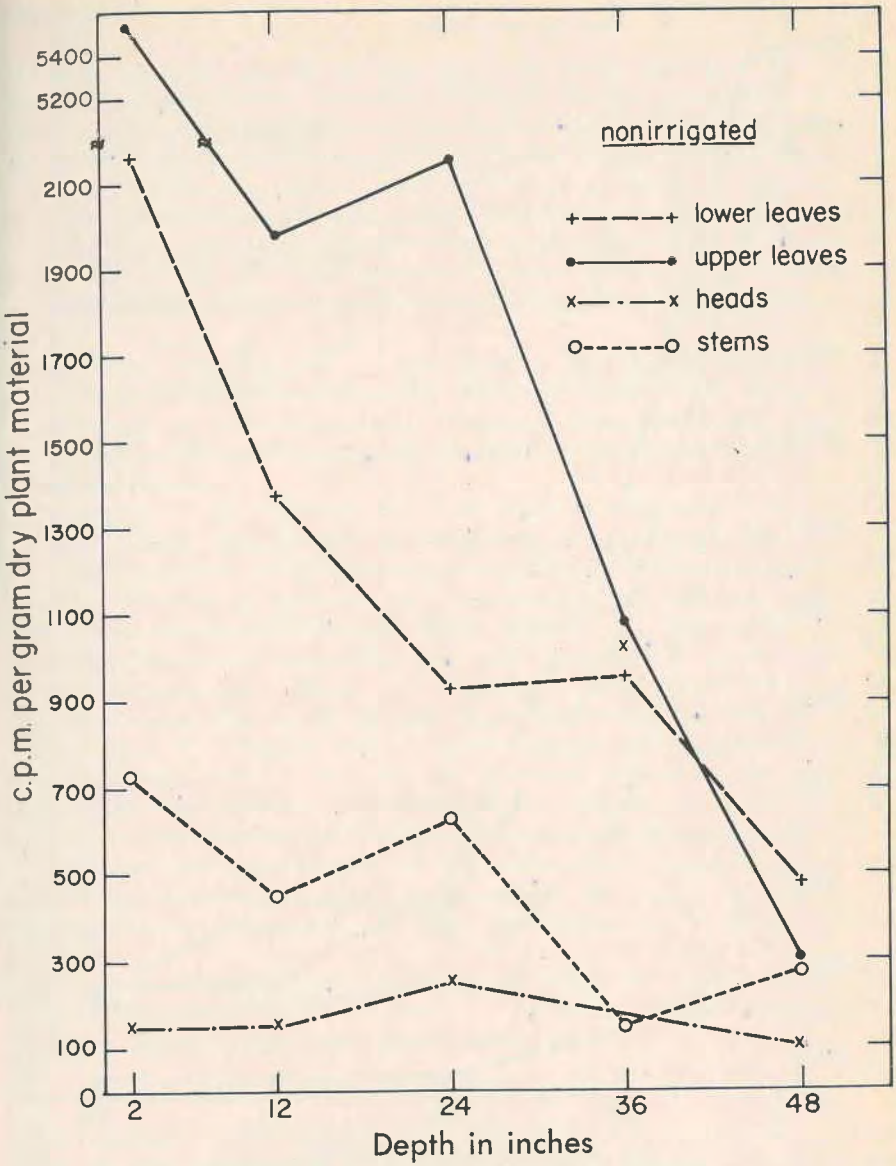

Fig. 10. Distribution of Sr 90 within the plants, nonirrigated.

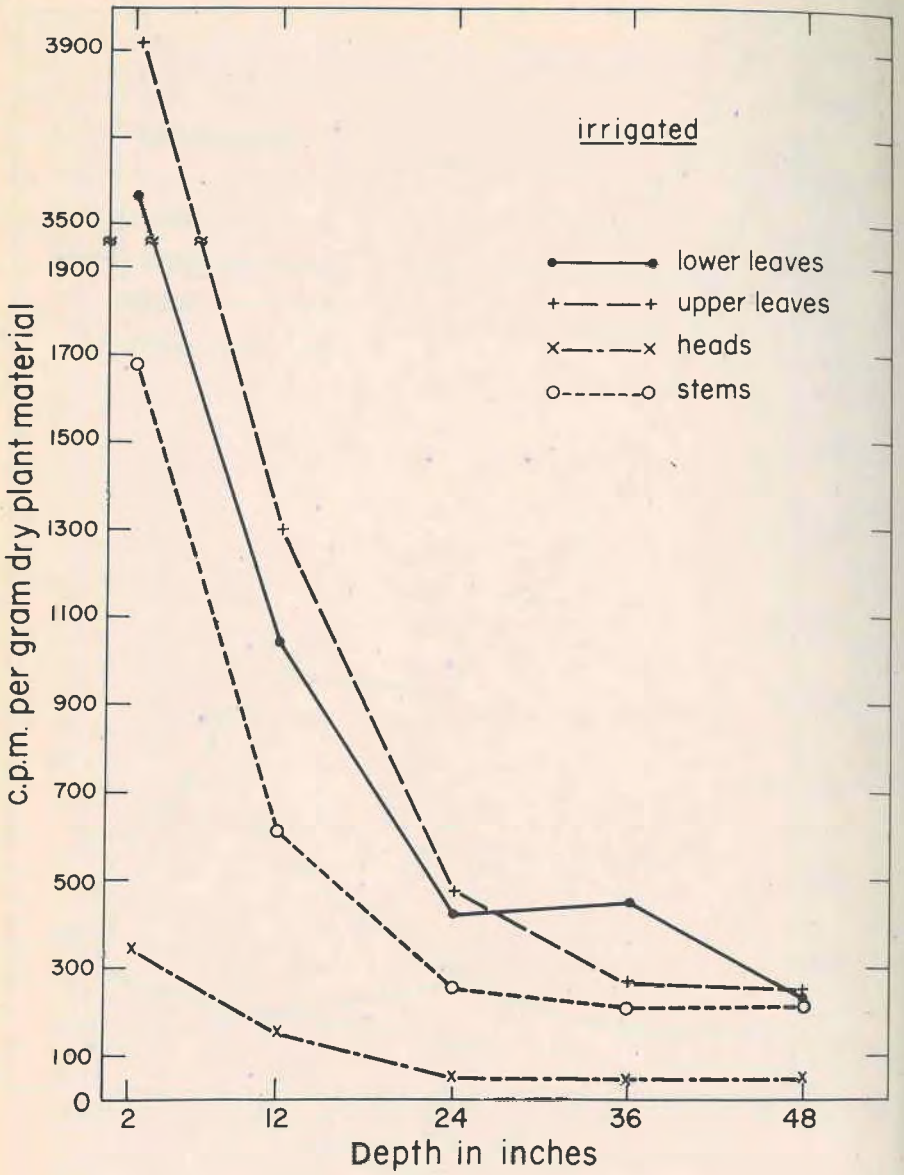

Fig. 11. Distribution of Sr 90 within the plants, irrigated.

Discussion and Conclusions

The data of figure 7 reveal that the rate of downward growth of the barley roots was independent of the water treatment during the growing season. That is, in spite of the fact that the roots of the barley in the irrigated lysimeters were always well supplied with water and nutrients in the upper foot of the soil, the rate of downward growth was essentially the same as that in the nonirrigated lysimeters where the roots had to grow downward in order to obtain water. In both instances the rate of growth in depth was approximately linear with time and amounted to about 2 inches per day. These results are in general agreement with the findings of Conrad and Veihmeyer (1929).

As may be seen from table 6 and figure 8, the irrigated plants, which showed the largest vegetative growth, contained less Sr 90 per gram of dry material than the nonirrigated plants. This was true at all depths of the Sr 90 band, but the difference was not very pronounced when the Sr 90 band was at a depth of 2 inches.

The content of Sr 90 per gram of dry material decreased with depth of placement of the band for both the irrigated and nonirrigated plants. With the irrigated plants, the uptake per gram of dry plant material fell off quite rapidly with depth of placement to a depth of about 2 feet, below which it remained nearly constant down to 4 feet (figure 8). If this pattern should prove characteristic of other plants and soils, deep plowing, whereby a Sr 90 contaminated surface is placed at a depth of 2 feet or more, should be an effective measure against the introduction of the isotope into food chains.

From figure 9 it is evident that the gross uptake of Sr 90, expressed as percentage of that added to the soil, was generally higher for the irrigated plants. Also, the difference in uptake was very pronounced for the shallow depths. The gross uptake by the irrigated plants fell off rapidly with depth of placement. The gross uptake for the nonirrigated plants, however, was not greatly affected by the depth of placement of the isotope. In general, the gross uptake was considerably less than 0.1 per cent of the Sr 90 added to the soil.

With both the irrigated and nonirrigated plants (see figures 10 and 11), the concentration of Sr 90 per gram of dry plant material assumed the following sequence among the various plant parts:

upper leaves > lower leaves > stems > heads

The significant concentration of Sr 90 in the grain of the nonirrigated plants for the 2-inch depth of placement is notable because at the time the heads were formed in these plants the soil at the 2-inch depth was quite dry. Thus the Sr 90 must have been brought into the grain by translocation or by its absorption from very dry soil. Unfortunately, it is not possible to conclude further concerning these interesting possibilities.

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TABLE 1

ANALYSES OF SOIL SAMPLES FROM BURRIS PARK AREA

Depth of soil (inches)	Boring no.	pH 1 : 5 susp.	Soluble cations m.e. per 100 gm				Exchangeable cations m.e. per 100 gm				Exchange capacity m.e./100 gm (NH_4Ac)
			Ca	Mg	Na	K	Ca	Mg	Na	K	
0–12	1	7.7	0.38	0.09	0.08	0.06	14.3	3.2	1.41	0.79	12.9
0–12	2	7.7	0.42	0.09	0.08	0.05	15.0	3.3	1.45	0.64	12.9
0–12	3	7.6	0.28	0.07	0.05	0.08	14.1	2.9	0.10	0.73	12.2
0–12	4	7.8	0.32	0.09	0.08	0.05	15.0	3.3	0.13	0.58	12.8
0–12	Composite	7.9	0.37	0.09	0.07	0.05	15.3	2.9	0.38	0.60	12.2
12–24	1	7.8	0.24	0.06	0.08	0.01	13.9	3.0	1.24	0.34	11.9
12–24	2	7.5	0.22	0.06	0.12	0.05	12.9	3.0	1.01	0.18	11.4
12–24	3	7.5	0.13	0.03	0.08	0.01	10.4	2.0	0.17	0.14	8.9
12–24	4	7.4	0.16	0.02	0.06	0.01	12.6	2.6	0.15	0.17	11.1
24–36	1	7.5	0.14	0.05	0.08	0.01	11.0	3.6	0.56	0.17	10.0
24–36	2	7.2	0.13	0.05	0.08	0.01	9.9	2.7	0.14	0.10	8.9
24–36	3	7.4	0.08	0.02	0.08	0.01	8.1	2.5	0.15	0.10	7.0
24–36	4	7.0	0.18	0.09	0.08	0.01	11.1	3.2	0.11	0.11	9.8

Soluble anions are predominantly HCO_3^-.

TABLE 2

ANALYSES OF SOIL SAMPLES FROM HOPLAND AREA

Depth of soil (inches)	Boring no.	pH 1 : 5 susp.	Soluble cations m.e. per 100 gm				Exchangeable cations m.e. per 100 gm				Exchange capacity m.e./100 gm (NH_4Ac)
			Ca	Mg	Na	K	Ca	Mg	Na	K	
0–12	1	6.0	0.04	0.07	0.03	0.01	6.6	6.7	0.04	0.29	13.5
0–12	2	5.9	0.04	0.06	0.03	0.01	7.1	8.5	0.04	0.29	14.9
0–12	3	5.9	0.04	0.06	0.03	0.01	6.4	7.1	0.05	0.19	13.4
0–12	4	5.9	0.05	0.09	0.03	0.01	6.7	7.2	0.07	0.20	13.9
0–12	Composite	6.2	0.04	0.05	0.04	0.01	7.1	6.4	0.04	0.26	13.4
12–24	1	6.2	0.02	0.05	0.03	0.01	6.4	8.3	0.05	0.19	13.8
12–24	2	6.3	0.03	0.05	0.03	0.01	6.6	8.4	0.07	0.18	14.0
12–24	3	6.2	0.03	0.04	0.02	0.01	5.7	7.7	0.06	0.18	12.8
12–24	4	6.3	0.03	0.05	0.03	0.06	6.0	8.0	1.29	0.29	12.5
24–36	1	6.4	0.02	0.04	0.04	0.01	6.0	8.6	0.04	0.17	13.3
24–36	2	6.4	0.03	0.05	0.03	0.01	5.9	8.5	0.05	0.18	13.2
24–36	3	6.4	0.03	0.06	0.03	0.01	6.2	9.0	0.07	0.19	15.4
24–36	4	6.4	0.03	0.05	0.05	0.08	6.1	8.7	1.30	0.16	13.0

Soluble anions are predominantly HCO_3^-.

TABLE 3

PER CENT OF APPLIED Sr 90 RETAINED IN THE SOIL PROFILE AFTER TREATMENT WITH VARIOUS CHEMICALS AND IRRIGATION WITH 5 FEET OF WATER

HOPLAND FIELD STATION

Depth of soil (inches)	Treatments and Plot Number						
	1 Control	2 HCl	3 HCl	4 H_2SO_4	5 $CaCl_2$	6 $FeCl_3$	7 NaCl
0–6	87.4	11.1	11.6	63.1	38.9	11.7	76.8
0–12	92.8	27.3	24.7	80.6	63.7	21.7	90.7
0–24	97.4	52.7	43.6	94.0	86.4	49.0	98.3
0–36	100	71.7	56.0	100	95.6	77.0	100

BURRIS PARK FIELD STATION

Depth of soil (inches)	Treatments and Plot Number						
	1 Control	2 HCl	3 HCl	4 H_2SO_4	5 $CaCl_2$	6 $FeCl_3$	7 NaCl
0–6	97.0	22.2	49.3	64.1	62.0	9.6	94.8
0–12	100	64.6	85.8	83.5	85.2	59.7	98.0
0–24	100	99.8	100	99.6	97.4	88.4	99.5
0–36	100	100	100	100	100	100	100

The treatments were made at the rates: HCl, 14.9 tons per acre; $FeCl_3$, 22.1 tons per acre; H_2SO_4, 20 tons per acre; $CaCl_2$, 22.6 tons per acre; and NaCl, 23.8 tons per acre.

TABLE 4

UPTAKE OF Sr 90 BY TOPS OF BARLEY PLANTS GROWN IN ASPHALT-TREATED SOIL; RESULTS EXPRESSED AS PER CENT OF CONTROL

Emulsion applied	18 days after planting	67 days after planting
0	100	100
Lakold	28	58.5
Bitusize L3L	78	70.4
RCI	85	73.5

The plants were grown in galvanized tubs, each containing 110 pounds of Columbia soil. In each instance the surface area of the soil was 400 square inches. The Sr 90 was applied at the rate of 1 μc per square inch.

At 67 days after planting, the tops of the control plants contained 0.51 per cent of the applied Sr 90.

TABLE 5

ANALYSIS OF COLUMBIA VERY FINE SANDY LOAM SOIL USED IN LYSIMETER STUDY

pH 1 : 5 suspension	Soluble cations m.e. per 100 gm				Exchangeable cations m.e. per 100 gm				Exchange capacity m.e./100 gm (NH_4Ac)
	Ca	Mg	Na	K	Ca	Mg	Na	K	
6.6	0.14	0.07	0.05	0.06	13.5	3.70	0.83	0.15	13.9

TABLE 6

YIELD OF BARLEY IN IRRIGATED AND NONIRRIGATED LYSIMETERS WHICH HAD A BAND OF Sr 90 AT DIFFERENT DEPTHS IN THE SOIL. RESULTS ARE EXPRESSED AS GRAMS OF OVEN-DRY (60–65° C) MATERIAL

Depth of Sr 90 band (inches)	Wt. of tops, irrigated lysimeters	Average	Wt. of tops, nonirrigated lysimeters	Average
2	212.4		19.40	
	179.2	171.7	15.31	19.89
	123.5		24.97	
12	138.3		34.33	
	214.0	161.6	20.34	22.68
	132.5		13.36	
24	156.3		22.99	
	154.4	154.5	16.69	17.89
	152.7		13.98	
35	119.2		50.73	
	200.4	164.3	25.40	36.26
	173.3		32.66	
48	132.5		32.27	
	160.7	149.3	23.49	26.82
	154.6		24.69	

4*m*-5,'59(9922)M.H.

The journal *Hilgardia* is published at irregular intervals, in volumes of about 600 pages. The number of issues per volume varies.

Subscriptions are not sold. The periodical is sent as published only to libraries, or to institutions in foreign countries having publications to offer in exchange.

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UC (University of California), date unknown. *Annual Report, 1955-1956, State-Wide Division of Radiation Safety*.

ANNUAL REPORT
1955 - 1956

STATE-WIDE DIVISION OF RADIATION SAFETY

ROUTINE OPERATION

The Division of Radiation Safety, under authority granted to the University Physician by University Regulation No. 18, supervises the enforcement of the provisions for radiation safety. This consists of periodically surveying all laboratories employing sources of ionizing radiation, surveying installation and changes of machines capable of producing ionizing radiation, approving for safety every use of radionuclides, the purchase and resale of certain isotopes, and approving plans for specifications for new buildings and modifications to existing structures. In addition this Division provides a completely equipped hot laboratory on the Berkeley and Los Angeles campuses for the short term use of departments not wishing to enter into full-scale radioactivity programs, provides for the disposal of radioactive wastes, and affords consultation on all phases of work with ionizing radiation.

MEDICAL PROGRAM

Employees and students potentially exposed to significant amounts of ionizing radiation are provided with 18-month medical examinations which consist of a physical examination, complete blood count, urinalysis and a 14" x 17" chest X-ray. At nine-month intervals the blood count and urinalysis are repeated; at 18 months the entire medical examination. The medical reports are reviewed by the Medical-Physics Physician, then microfilmed for permanent filing.

Out of 993 individuals engaged in work involving ionizing radiation 631 were on the medical program during the period covered by this report. Exemption is based on the following consideration:

1. The amount of nuclide in process at any one time is less than that amount which if ingested or inhaled would produce any measurable physiological effect, and the external radiation would not produce an exposure in excess of prescribed limits. The exposure received from a machine capable of producing ionizing radiation would not be in excess of prescribed limits.

2. The duration of project is such that in the opinion of the Medical-Physics Physician prescribed limits of dosage will not be exceeded.

3. The material is used in a such a manner that prescribed limits of dosage will not be exceeded.

Calculations for the isotopic amounts referred to in (1) are based on a knowledge of the physical and biological half-lives, the maximum permissible body burden for critical organs, and the energy and range of the emitted radiation. Irradiation of the gastro-intestinal tract in the event of ingestion, or irradiation of the lungs when inhalation occurs, is considered for those isotopes which have less than 25% uptake to some other organ. When allowable amounts are calculated by two or more methods the lowest figure is used for estimating possible organ damage.

For example, the maximum permissible monthly consumption of Co-60 is only 10.8 microcuries when calculated for the gastro-intestinal tract, as contrasted with 1900 microcuries calculated for the 0.4% fraction to reach the liver. As 10.8 microcuries is the smaller of the two figures, the gastro-intestinal tract rather than the liver is considered to be the critical organ; and 10.8 microcuries is the minimum amount of Co-60 which, if ingested, would irradiate any organ with the monthly permissible dose of 1.2 roentgens. Now 1900 microcuries would irradiate the liver with only 1.2 roentgens if the total irradiation could be attributed to the 0.4% of the ingested 1900 microcuries deposited in that organ. Not only does 1900 microcuries irradiate the gastro-intestinal tract with about 200 roentgens, which is the significant irradiation, but some of the radiation from the isotope in transit through the gastro-intestinal tract reaches the liver, more than doubling the radiation from the 0.4% of the 1900 microcuries in the liver. It can be seen, therefore, that 10.8 microcuries for the gastro-intestinal tract should be used as the maximum permissible consumption figure for Co-60, as this amount cannot irradiate any organ with more than the monthly permissible dose of 1.2 roentgens. The inhalation figure of 14 millicuries would be used only where inhalation and not ingestion of the isotope is possible, in which event the lung is the critical organ, and maximum permissible quantities of the isotope per milliliter of air is the controlling variable for inhalation calculations.

Statistics on Medical Examination Program

	Northern Division	Southern Division	State-wide Division
Physical Examinations	320	164	484
Complete Blood Counts	485	206	691
Partial Blood Counts	36	49	85
Urinalyses	397	230	627
X-rays	334	145	479
Miscellaneous	21	9	30

NEW PROCEDURES

New "Application for Use of Radioisotope" forms are now submitted in the original and copies are to be made in the Radiation Safety Offices with a "Thermo-fax" copying machine. In addition to the usual information requested, number of shipments and millicuries or microcuries per shipment is indicated on the new form. Copies of this form are used to obtain a research discount from the Atomic Energy Commission Division of Biology and Medicine and also to report to the Civilian Applications Branch of the Atomic Energy Commission.

Some 1000 Radiation Safety manuals were printed in 5" x 7 3/4" pamphlet form. Copies have been distributed to all laboratories using radioisotopes or other sources of ionizing radiation. Contained in Appendix III of the new manual are the provisions set forth by the Atomic Energy Commission for licensing of by-product material. By-product materials are listed showing both sealed source and non-source quantities which are generally licensed.

Whenever an order for radioactive isotopes is placed with the Purchasing Department for Berkeley and Davis a notice is sent from that department to the Division of Radiation Safety. The notice form includes the following information: isotope, amount, application number, and date of order. This information enables the Radiological Safety Engineer to make a more accurate estimate of material on hand in the various laboratories, and forewarns of special and/or "hot" projects which necessitate investigation before their initiation.

Film badge dosimetry has been simplified by the use of Du Pont 558, a double-pack film with approximately the same sensitivity as the two single films previously in use. Back films (less sensitive) are more subject to "cloudiness" in the developing process than the Eastman films, but are still readable in the event of an exposure which penetrates the front film. The new films, however, are faster to load in the film badge racks, are more compact, and age more slowly.

NEW EQUIPMENT

Four U. S. Navy "Radiac" beta-gamma survey meters were purchased from the State Educational Surplus. Two of the meters are used by the Southern Division. Reading response ranges from 0.5 mr/hr to 500 mr/hr.

A transistorized power supply has been introduced into two beta-gamma survey meters used by the Northern Division. A substantial reduction in weight and volume was effected, allowing for greater portability.

RECENT GROWTH

Following is a table showing growth in monitoring coverage during the past three years:

	Rooms	Persons	Curies
1953-54	275	700	35
1954-55	365	970	29
1955-56	404	993	24

It may be seen that there has been a definite decrease in millicuries per laboratory, while there is the beginning of a trend toward leveling of personnel. The continual increase of rooms unaccompanied by a parallel increase in personnel may be due to a general increase in available space. Though 26% more persons are using radioisotopes and X-radiation now than three years ago, they encounter lower levels of activity per unit working space. It would be expected, therefore, that hazardous radiation levels, radiation accidents, spillages, contaminations, doses exceeding prescribed limits, etc., should have markedly decreased over the above time period. That this is true is indicated by monthly monitoring reports and weekly film badge dosimetry reports. It should be noted, however, that increasing familiarity with appropriate usage of ionizing radiation in various projects has increased familiarity with radiation safety practices. Our Division has been more and more successful in helping users become aware of the necessity for safer practices.

Analysis of growth of the medical program is afforded by the table below:

	1953-54	1954-55	1955-56
Physical Examinations	401	450	484
Complete Blood Counts	769	746	691
Partial Blood Counts	77	85	85
Urinalyses	610	650	627
X-rays	425	466	479
Miscellaneous	28	13	30

MONITORING EVENTS AND SPECIAL PROJECTS

Berkeley Campus - July 1955

A minor spill in room 185 Le Conte of short-lived target material from the cyclotron occurred on the night of July 26. By the time this Division was informed of the spill the next morning a satisfactory amount

of decontamination had been accomplished. The accident happened because a beaker containing dissolved target material broke while being heated. As no spill pan was being used the material ran down from the hood onto the floor. Corrections to minimize the danger of any future spills were outlined by memos from the Health Chemistry Division of the Radiation Laboratory and this Division. Large pans for the hood and bench are to be provided by Health Chemistry. It was also recommended that the floor be covered with an impervious roll flooring material, since the paint had worn off the concrete and fairly extensive cracks existed leading to the room below.

Berkeley Campus - August 1955

As part of a project by a graduate student in Zoology a field experiment using Co-60 was established in the Tioga Pass area. Part of the montane population of Yosemite toads (about thirty) was tagged with 100 microcuries, beta shielded pellets, inserted subcutaneously. The radiation from one of these sources was about six times normal background at three feet. The tagging was done to enable recovery of the toads during summer retreat and hibernation, at which time they are usually a foot or so down an animal burrow such as a gopher hole. Tracing with a survey meter would then indicate which gopher hole to dig in.

The particular meadow selected for the project has a shallow layer of swampy soil containing loose rocks which have become detached from the surrounding ridges. In surveying the meadow the natural background in air was found to be approximately normal for the elevation. However, when the actual tracking of toads to particular burrows was attempted it was found that about the same count was obtained for some of the sub-surface rocks as would be obtained from the toads. Most of the gopher holes were, of course, dug under rocks for support in the swampy soil. The "not" rocks are explained by the fact that the top thousand feet of the ridges are a sedimentary overlay of the basic magmatic structure of the mountains in that section so that at Tioga Pass the basic structure contains almost no radioactivity, while the rocks detached from the ridges may be quite radioactive.

Berkeley Campus - October 1955

A reading of 15 mr/hr was detected in room 187 Le Conte Hall. Radiation was coming through the wall from room 185 where some samples had been left on top of the lead shielding, the samples reading some 200 mr/hr at two inches.

The three different groups performing radiochemistry in room 185 had been negligent in using the shielding provided, as well as in cleaning up after experiments.

Davis Campus - July 1955

Extension of an Atomic Energy Commission contract with the School of Veterinary Medicine concerning radiation effects on dogs was discussed with Dean Jasper, Dr. Paul Pearson of the Atomic Energy Commission Division of Biology and Medicine, and Dr. A. C. Anderson who is in charge of the project. The additional work discussed covered proposed experiments to study the long-term effects to dogs of amounts of Sr-90 from one to ten times the equivalent to the present maximum permissible body burden. Potential hazards and methods of controlling them were discussed at length, and most details of the proposed operation were outlined.

San Francisco Campus - February 1956

On the morning of February 2 it was discovered that fifteen Co-60 needles were missing from the Gynecology Operating Room in Moffitt Hospital. The hospital area was searched with a Geiger counter, special attention given to the operating room, laundry chutes and trash disposal units.

That afternoon radiation safety engineers joined the search; suspect areas were further investigated, including thorough monitoring of the laundry room. Still unable to detect the needles, the monitors proceeded to the incinerator building. There the counters indicated that the needles were deposited at the bottom of the ash receptical near one side.

The refuse was shovelled out toward the source of radiation, each spadeful being monitored before it was dumped into a box. A couple of feet down a spadeful of refuse proved to be hot and was spread out on the floor; the fifteen needles were still strung together on a wire, but were badly charred and distorted. The needles, which contained a total of 4.5 millicuries of radioactivity, were placed in a lead container and deposited in a radioactive waste drum.

San Francisco Campus - March 1956

On March 26, Radiation Safety personnel installed an aural monitor in room 1274, Moffitt Hospital. The monitor has a dual purpose: to remind those handling radioactive material to store it back in the safe before leaving the room, and to inform those entering the room that radiation may be present. It connects Geiger pulses to sound, which is projected into the room by a loudspeaker. Increased radiation levels produce much higher sound levels than the normal clicking caused by the radium correctly shielded inside the safe. Located by the work table is a foot switch, which when depressed silences the speaker while the radium is being handled.

Los Angeles Campus - September 1955

The use of an automatic injector for $CrP^{32}O_4$ resulted in certain personnel handling chronically contaminated equipment. In MCB3-215 J unlabeled contaminated equipment, in addition to injector parts, was detected. The equipment, however, was not close to working areas, and the laboratory was locked when its occupants were out. Personnel involved were instructed in proper techniques.

The Division of Radiation Safety tested some laboratory furniture surface materials for ease of decontamination at the request of the Office of Architects and Engineers. A report of results was sent to Mr. Larry Riddle.

Los Angeles Campus - October 1955

The Southern Regional Advisory Committee on Radiological Safety met to consider some minor problems and to acquaint the new members with the tasks of the Committee.

Los Angeles Campus - November 1955

Amounts of P-32 contamination ranging to 7 mr/hr were detected on absorbent paper and a beaker holder in MC B3-176. This laboratory is designed for use as a hot laboratory and preparations are performed therein. All equipment is checked for contamination prior to its removal from this area. The personnel perform frequent monitoring of the area and the absorbent paper is changed regularly.

A considerable spread of moderate C-14 contamination was found in Chemistry 4033, a student research laboratory, on the top of a work bench and on the floor of a fume hood. The monitor advised the personnel in the laboratory regarding the use of Kimpak, radioactivity stickers for glassware, and greater caution in working with C-14. Effort was made to remove the contamination.

Mr. Bingham met with the Veteran Administration Hospital Committee on Human Use of Radioisotopes to discuss the overlapping of health physics responsibilities arising from persons using radioactive material at both institutions.

Los Angeles Campus - January 1956

In MC B3-215J contaminated paper towels were found in a waste basket, which is regularly emptied by the janitor. Beta radiation from the paper measured 20 mr/hr. The Radiological Safety Engineer left instructions for placing such waste in standard radioisotope disposal containers.

Los Angeles Campus - February 1956

A survey of the transfer from temporary to permanent storage and unpacking of 550 mg of radium in assorted needle sizes was conducted by this office. Alpha wipes were taken from the inner surfaces of the lead pigs to check for needle leakage. This test and a subsequent check on the individual needle thimbles were made by the Health Physics Section, Atomic Energy Project. A summary of the findings of the survey made by this office along with recommendations for maintaining a log showing the location and doctors responsible was sent to the Chairman of the Department of Radiology.

At the request of the Purchasing Department a conference was held to review and evaluate normal procedures on the Los Angeles Campus. New personnel handling the processing of purchase orders, etc., necessitated the conference.

The electron microscope, Hitachi Model HU-9, presented to the Department of Infectious Diseases by the Japanese government was surveyed for leakage radiation. A report of findings was submitted to the chairman of the department. No excess leakage was indicated.

Evaluation of film badges revealed that there had occurred an exposure in excess of the permissible limits. Follow-up indicated that a technician had removed three 25 mg radium needles from an applicator and had then assumed that the applicator was empty. The doctor carried the applicator in his laboratory coat pocket for about an hour before discovering that there was still a 10 mg needle in the applicator. The conditions leading to this occurrence were discussed with the departmental chairman and recommendations were submitted. Compliance therewith was indicated.

Los Angeles Campus - March 1956

The Division of Radiation Safety was called upon for advice pertaining to the procedures for autopsies on bodies containing therapeutic amounts of radioisotopes. The problem was discussed with the Pathology personnel and recommendations were sent to the Chairman of the Department of Pathology and to the Hospital Administrator. Continuous liaison was planned.

It was decided that all shipments of radioactive material to the Los Angeles Campus are to be delivered to the Division of Radiation Safety. This plan insures more accurate recordings of isotopes on hand and in process, and enables other departments to utilize the Division of Radiation Safety storage facilities rather than an often make-shift storage vault.

Los Angeles Campus - April 1956

Survey measurements in MCB3-176B (radium vault) indicated the presence of dose rates in excess of prescribed limits in adjacent working areas. Liaison was initiated to rectify the situation.

Spots of P-32 contamination on disposable surfaces in MCB3-171, MCB3-176A, and MCB3-176 were called to the attention of laboratory personnel. The contamination was promptly removed and placed in the radioactive waste can.

Mr. Bingham met with representatives of the Hospital and the School of Medicine to formulate a general guide for radiation safety within the hospital.

Los Angeles Campus - May 1956

Mr. Gene Blanc, Field Representative from the Atomic Energy Commission Division of Radiation Safety, made an inspection of the isotope facilities on the Los Angeles campus. The records kept by this office pertaining to dosimetry and procurement were also reviewed.

La Jolla Campus - September 1955

Radiation from a 3 mc Co-60 source stored in a remote corner of room T-2 raised the background on the film badges kept on a rack in the room. Recommendations to change the location of the film badge rack and provide additional shielding for the radioactive cobalt were complied with.

La Jolla Campus - March 1956

A campus committee, Dr. Leonard Liebermann, Chairman, was appointed to consider problems arising from technical, non-hazardous contamination. Liaison with the committee was initiated.

Riverside Campus - October 1955

Several people were accidentally sprayed with P-32 labeled insecticide due to the failure of a hose clamp under pressure. They immediately removed their clothing and took a shower until no detectable activity remained. Film badges indicated that the holders had also been contaminated with a dose of around 2 roentgens due to about one week of radioautograph work. The spraying operation was conducted in a remote area of the Citrus Experiment Station.

Riverside Campus - June 1956

The discovery of P-32 contamination in the hood in the hot lab of Insecticide Lab 9 prompted this Division to recommend the use of absorbent paper throughout the hood. The recommendation was sent to the project leader. A follow-up was made.

Santa Barbara - August 1955

The monitor, visiting the Goleta Campus, was consulted regarding the construction and shielding of a floor vault for the storage of radio-isotopes. Recommendations were made regarding increased protection in the lid of the vault by the use of a lead lining.

Soils and Plant Nutrition Project - 1955-56

On October 13 at Davis the Provost's Committee for Radiation Safety met to discuss possible hazards and inconveniences on the campus which might occur when radioactive work is conducted in the lysimeters. The experiments to be performed are part of a five-year project conducted by the Department of Soils and Plant Nutrition at Berkeley to test possible methods of removal of fission products from soil. Research is carried out in consultation with the Radio-ecology group of the Atomic Energy Project on the Los Angeles campus.

Preliminary soil column tests show that certain long-lived fission products without carrier are strongly adsorbed in the top inches of the soil; wind erosion, therefore, would be the only likely means by which any radio-activity could be scattered from the area. It was decided that suitable fencing should be erected to prevent wind erosion, and that grass should be planted in adjacent areas. Assays of the grass should show the maximum amount of concentration which could be achieved by plants from materials blown from the lysimeters.

As leaching with water is ineffective in removing the activity from the soil surface, two steps are necessary for radioactive decontamination: 1) release of radioactive elements from soil particles by ionic exchange in the presence of salt solutions, 2) the released isotopes plus the added salts must be leached by irrigation water into the subsoil. According to Dr. Roy Overstreet, supervisor of the project, the immediate problem is to determine the disposition of the salt $SrCl_2$ when leached into the subsoil.

At Burris Park on June 6 soil plots were treated with $Sr^{90}Cl_2$ in order that studies could be made of the disposition of the salt as it adheres to soil particles and integrates into plants. The previous day at the Radiation Safety Division hot lab dilutions of 4.8 mc/12 liters of

water had been made, allotting 15 liters of solution to each of seven 20-liter flasks. Enclosed in polyethylene bags and placed in radioactive waste drums, the flasks were transported by station wagon to Burris Park, where laid out in a checkerboard pattern are 49 six-foot by six-foot plots of smoothed soil bordered by concrete 30 inches deep. A high wire fence tagged with radiation warning signs encloses the area. A motor-driven sprayer unit uniformly spread 12 liters on each of seven plots, 4.8 mc/plot representing an activity of 1 microcurie/per square inch. The liters were spread in two layers with an interval of around twenty minutes between spreads in order that the first layer could be adequately absorbed before the second layer was introduced.

Radiation Safety personnel equipped with survey instruments were on hand to monitor the project. No significant radioactive contamination was detected on personnel or equipment with the exception of rubber gloves and tubing, which were disposed of in a radioactive waste drum. Radiation one foot above the center of a plot read 15 to 20 mrep/hr. Readings were well below 6.25 mreph/hr in the working vicinity a few feet from the plots.

Another run at Hopland Field Station was monitored on June 14. The plot lay-out there is identical with the Burris Park site, and the experiment was performed in the same manner except that only one layer was sprayed on a plot, the same activity in millicuries being concentrated in half the solution used previously. Survey instruments indicated essentially the same external radiation from plots as before. No significant contamination was found.

Soil samples were taken from topsoil surrounding the treated plots inside and outside the fenced areas at Hopland Field Station and Burris Park about one month after the above applications. No reading above normal background was revealed when the samples were counted with a scaler. Survey meter readings a couple of inches above each plot surface at the center ranged from 0.5 mrep/hr to 15 mrep/hr, the higher readings being at plots #1 and #7 at each location.

In the near future work will begin at the lysimeter area on the Davis Campus, and selection of additional sites if necessary may further expand the project.

UC-B (University of California-Berkeley), 1981. A. Peterson, Radiation Safety Officer, letter to C. Jackson, Director, Environment, Safety, and Program Support Division, includes report, "Survey of the Burris Park Site," March 2.

UNIVERSITY OF CALIFORNIA, BERKELEY

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OFFICE OF ENVIRONMENTAL HEALTH BERKELEY, CALIFORNIA 94720

March 4, 1981

Mr. Calvin A. Jackson, Director
Environment, Safety and Program Support Division
Department of Energy
1333 Broadway
Oakland, California 94612

Dear Cal:

Enclosed is my report to our Radiation Safety Committee on the Burris Park situation.

Please call if you have any questions.

Sincerely,

Andris Peterson
Radiation Safety Officer

AP:fo
enc.

BE[illegible]LEY: OFFICE OF ENVIRONMENTAL HEALT
COWELL MEMORIAL HOSPITAL

March 2, 1981

TO: Radiation Safety Committee

FROM: A. Peterson, Radiation Safety Officer

SUBJECT: Survey of Burris Park Site

INTRODUCTION:

The Department of Plant and Soil Biology under the auspices of Atomic Energy Contract AT(11-1)-34 carried out studies on decontamination of soil containing ^{90}Sr at Burris Park located near Kingsburg, California. This work was performed during 1956-1963.

Procedures involved spreading ^{90}Sr at the rate of 1 $\mu Ci/in^2$ over 14 plots measuring 6 ft. x 6 ft., adding various electrolytes to the soil, irrigating and taking soil cores to determine distribution of the ^{90}Sr after treatment.

The project was terminated in 1963. Termination procedures involved the capping of the entire experimental area measuring 42 ft. x 42 ft. with reinforced concrete, affixing a bronze plaque and enclosing the area with a chain link fence.

QUESTIONS RAISED:

Mr. Dan Setentich, a fireman at the station located in Burris Park, telephone the Nuclear Regulatory Commission in Walnut Creek requesting information on the nature of work carried out at the site, whether any residual activity remained and the nature of hazards involved with the site.

The NRC in a letter dated December 29, 1980 requested the U.S. Department of Energy (U.S.D.O.E.) to look into the matter. Since the project appeared to involve U.C. Berkeley, Mr. Calvin D. Jackson of U.S.D.O.E. requested the campus Radiation Safety Officer to investigate the matter.

ACTION TAKEN:

The Burris Park project was discussed with Dr. Robert K. Schulz, Department of Plant and Soil Biology, one of the principal investigators involved in this work.

Dr. Schulz verified that the radioactive material had been placed on the soil during 1956-1957. He described the experimental plots and stated that each plot was surrounded by concrete curbing 6 inches above ground level and extending 30 inches into the soil. At termination

reinforced concrete had been put on the entire plot to cover the curbing and extended several feet on each side. A bronze plaque describing the project had also been placed on the concrete slab and attached to the reinforcement bars. Dr. Schulz also stated that the results of the work had been published in the May, 1959 issue of Hilgardia. A copy of the publication was sent to Mr. Jackson and the campus Office of Environmental Health and Safety.

It was decided that Dr. Schulz and Mr. A. Peterson would make a site visit to investigate the present status of the area. Calculations were made and it was determined that radioactive decay had reduced the amount of ^{90}Sr to less than 41 mCi.

The site visit was made on February 10, 1981. Mr. D. Setentich and Mr. Paul Douglass, the park caretaker, were present during the visit.

The concrete slab was in excellent condition and the chain link fence was in place. The following information was present on the bronze plaque:

"A total of 72 mCi of ^{90}Sr was placed on this area during 1956-1957.

This work was done under contract AT(11-1) - 34 Project 23 between the University of California and the U.S. Atomic Energy Commission.

Roy Overstreet R. K. Schulz
University of California, Berkeley "

The concrete slab was being used as a display area for old farm equipment.

A radiation survey using Ludlum Model 2 portable survey meters equipped with Model 44-9 pancake probes was made. No readings above normal background (0.02 - 0.05 mr/hr) were obtained.

The nature of the project, the residual activity, the significance of the G-M readings and the use of the area were discussed with Mr. Setentich and Mr. Douglass. A copy of the Hilgardia article was left with Mr. Setentich. It was learned that members of the King County Office of Emergency Services had also surveyed the slab and had found no significant readings.

Mr. Setentich and Mr. Douglass expressed their appreciation of the concern on the part of the campus, the ability to discuss the situation with someone who had been directly involved in the project and stated that they had no further questions or concerns.

CONCLUSIONS AND RECOMMENDATIONS:

It is felt that proper care was taken to terminate the project via the reinforced concrete capping procedure. As there were no readings above background, the use of the slab for a display area in the park

is entirely acceptable.

Since Mr. Setentich was satified with the information provided to him during the site visit there is no need for further action. The campus will continue to maintain the Burris Park file for future reference purposes.

AP:fo
cc: C. A. Jackson
R. F. Kerley

UC-B (University of California-Berkeley), 2013a. *Radiation Safety Survey Report*, July 5.

6 August 2013

University of California, Berkeley
Office of Environment, Health, and Safety
RADIATION SAFETY SURVEY REPORT
Date of the survey: 5 July 2013
Location: Burris Park (Kings County, CA)
6500 Clinton Avenue, Kingsburg, CA 93631

Burris Park is a public county park located in Kings County, CA near Hanford, CA. A portion of the park was used as a research field site by University of California Berkley researchers in 1956-1957. The research applied 72 millicuries of strontium-90 to plots of soil at the field site. The research was terminated and the field site was capped with a concrete slab, and surrounded by a fence, in 1963.

A visit to the former research site was conducted on 5 July 2013 to assess the current status of the location. Direct radiation measurements were performed along with collection of soil, water and vegetation samples. The fence surrounding the site is chain link and topped with barbed wire. It is in generally good condition but, portions of the top of the fence have apparently been damaged by falling tree branches. Eight signs identifying the original use of strontium-90 are posted on the site fence – two on each side of the site.

Direct radiation measurements of the concrete slab, and the ground immediately adjacent to the slab, were performed using an open window pancake type Geiger-Mueller detector. The direct measurements of the concrete, and the adjacent ground, were not distinguishable from background measurements of the ground located in other areas of Burris Park.

The soil, water and vegetation samples were sent to a commercial analytical laboratory for analysis of total radioactive strontium content. The soil samples were obtained from locations within the fenced area directly adjacent to the concrete slab. An additional soil sample was collected from adjacent to the park monument located about 200 feet east of the research site for use as a background control sample. The water samples were obtained from two wells located in the park. One well is for landscape irrigation and the other is used for drinking water. The wells are functionally similar. The irrigation well is approximately 200 feet north of the research site and the drinking water well about 300 feet northeast of the research site. Vegetation samples consisted of tree cuttings (leaves and branches) from four trees located just within the fenced research site. Two of the trees were living and two were apparently dead, without leaves.

The soils samples appear to be comparable to the background control sample with the exception of one soil sample. Additional analysis and sampling is recommended to better identify the possible presence of strontium-90.
The water samples do not show detectable levels of radioactive strontium.
The vegetation samples from the live trees do not show activity significantly above the minimum detectable activities. The dead tree samples suggest additional analysis and sampling to identify the possible presence of strontium-90.

Map and analytical reports are attached.

Survey performed by: Jim De Zetter James D De Zetter

Burris Park - Survey – 5 July 2013

Direct Radiation Measurements

Survey measurements: Meter monitoring was performed using a RadEye GX (S/N 10920) with an open window Ludlum model 44-9 (S/N PR059330) pancake G-M probe.

Direct readings were measured at contact with the soil at locations # 1-9 (Map 2) with results indistinguishable from background. Readings ranged from 100-125 cpm. Background was measured at location # 11 (Map 1), approximately 300 feet from the research site, with a reading of 105 cpm.

Environmental Samples

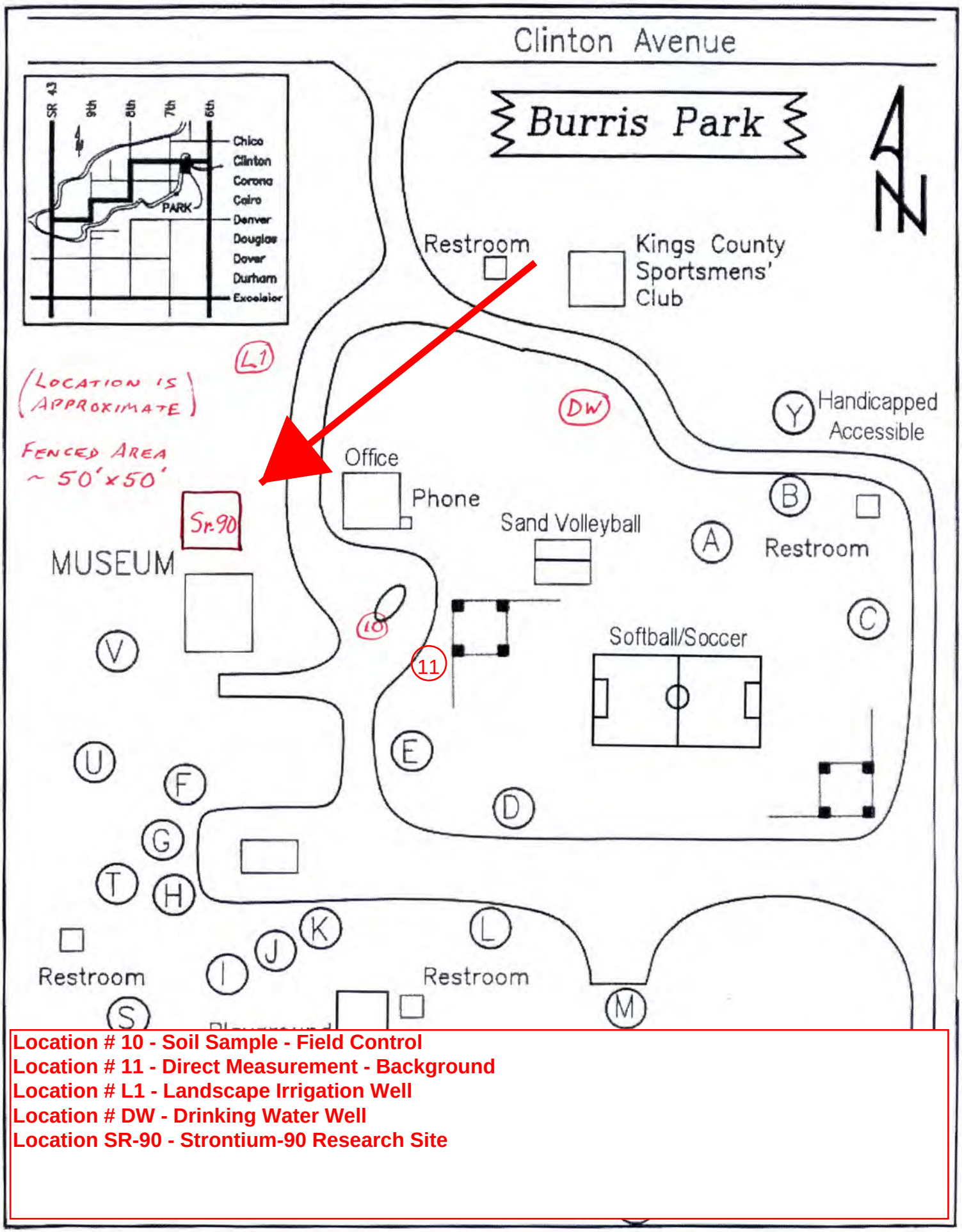
Soil samples: Samples of surface soil were obtained at locations # 1, 3, 5 & 7 (Map 2). A background control soil sample was obtained at location # 10 (Map 1), adjacent to the Burris Park monument. The monument is approximately 200 feet from the research site. Analytical results are attached in report 13-07135.

Water samples: Samples were obtained at location # L1 (Map 1) and location # DW (Map 1). Location # L1 is a landscape irrigation well located about 200 feet from the research site. Location # DW is a drinking water well located about 300 feet from the research site. Analytical results are attached in report 13-07136.

Vegetation samples: Samples were obtained from four trees located within the fenced research site. The trees were at locations # T1, T2, T3 andT4 (Map 2). Trees at locations # T1 and T2 appeared to be living and possessed leaves. Trees at locations # T3 and T4 appeared to be dead, had no leaves, and were surrounded by fallen branches. Samples from trees at locations # T1 and T2 contained branches and leaves. Samples from trees at locations # T3 and T4 contained only branches. Analytical results are attached in report 13-07136.

Map 1 - Location of Sr-90 research field site

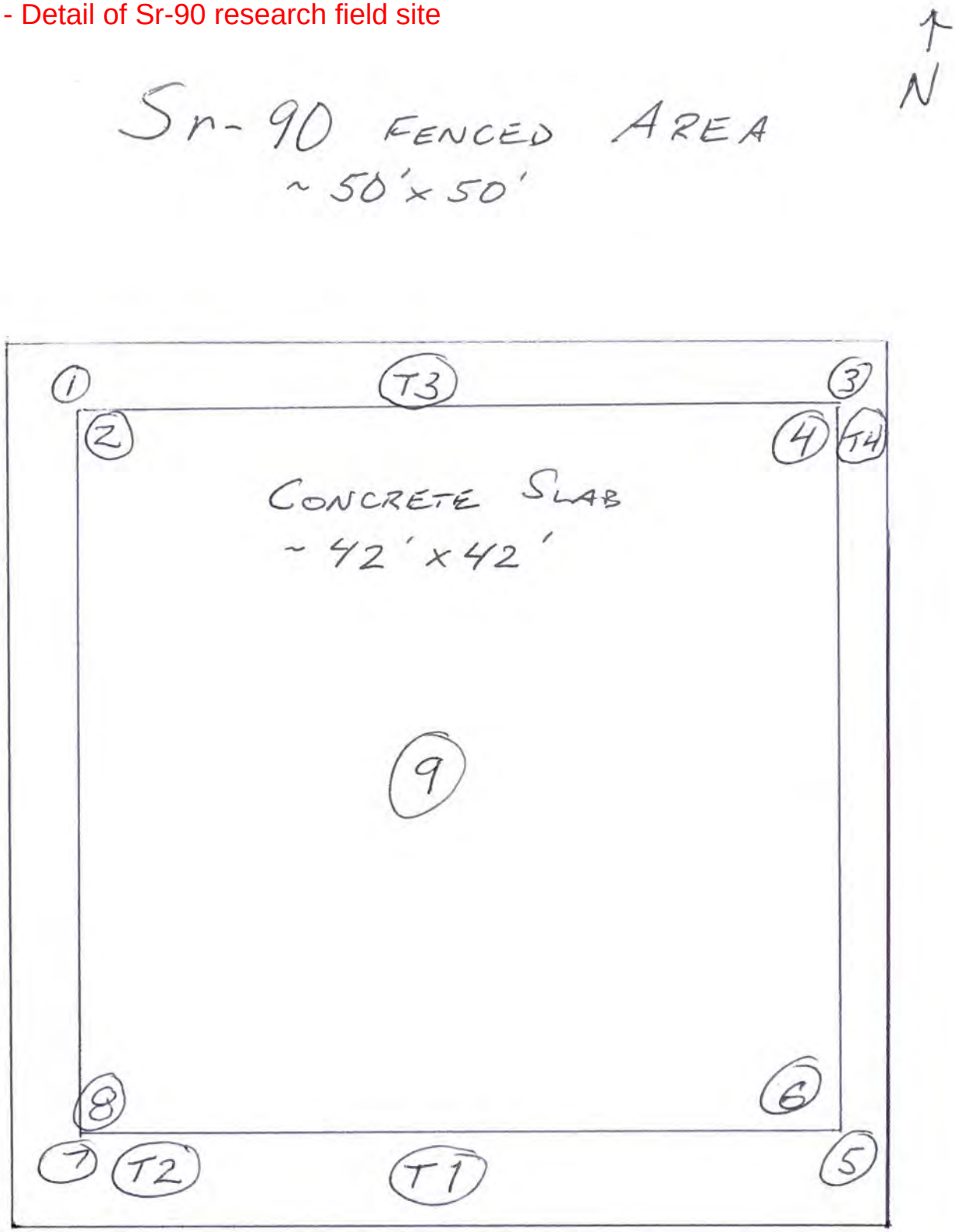
1 AUG 2013



Location # 10 - Soil Sample - Field Control
Location # 11 - Direct Measurement - Background
Location # L1 - Landscape Irrigation Well
Location # DW - Drinking Water Well
Location SR-90 - Strontium-90 Research Site

Field site detail on Map 2

Map 2 - Detail of Sr-90 research field site



Direct Measurements: Locations # 1-9

Soil Sampling: Locations # 1, 3, 5 & 7

Vegetation Sampling: Locations # T1 - T4

LOCATIONS ARE APPROXIMATE
NOT TO SCALE.

Burris Park Historical Museum with fenced research site to the right

Burris Park Monument

Location # 10 (Map 1)

Strontium-90 Research Site
Looking West

A TOTAL OF 72 MILLICURIES OF STRONTIUM 90
WAS PLACED ON THIS AREA DURING 1956 AND 1957.
THIS WORK WAS DONE UNDER CONTRACT AT (11-1)-34.
PROJECT 23 BETWEEN THE UNIVERSITY OF CALIFORNIA AND
THE UNITED STATES ATOMIC ENERGY COMMISSION.
ROY OVERSTREET
R.K. SCHULZ
UNIVERSITY OF CALIFORNIA, BERKELEY

Research Site
Looking South
Trees T4 (left) & T3 (right)

Landscape Irrigation Well at Location # L1 (Map 1)
Looking North from Northwest Corner of Research Site

Eberline Analytical
Final Report of Analysis

Report To:	
James D. De Zetter, CHS	
UC Berkeley E&HS - Rad Safety	
2199 Addison Street	
Berkeley, CA 94720	

Work Order Details:	
SDG:	13-07135
Purchase Order:	BB00218684
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Report Units
13-07135-01	LCS	KNOWN	07/22/13 00:00	7/22/2013	7/26/2013	13-07135	Total Strontium	ElChroM SRW01 Modified	4.85E+01	2.72E-01			pCi/g
13-07135-01	LCS	SPIKE	07/22/13 00:00	7/22/2013	7/26/2013	13-07135	Total Strontium	ElChroM SRW01 Modified	4.64E+01	1.32E+00	1.62E+01	6.09E-01	pCi/g
13-07135-02	MBL	BLANK	07/22/13 00:00	7/22/2013	7/26/2013	13-07135	Total Strontium	ElChroM SRW01 Modified	6.05E-01	2.85E-01	3.54E-01	5.35E-01	pCi/g
13-07135-03	DUP	1 OFF PAD-NW CORNER	07/05/13 13:00	7/22/2013	7/26/2013	13-07135	Total Strontium	ElChroM SRW01 Modified	1.91E+00	3.79E-01	7.65E-01	5.86E-01	pCi/g
13-07135-04	DO	1 OFF PAD-NW CORNER	07/05/13 13:00	7/22/2013	7/26/2013	13-07135	Total Strontium	ElChroM SRW01 Modified	1.62E+00	3.57E-01	6.67E-01	5.71E-01	pCi/g
13-07135-05	TRG	3 OFF PAD-NE CORNER	07/05/13 13:05	7/22/2013	7/26/2013	13-07135	Total Strontium	ElChroM SRW01 Modified	1.18E+00	3.76E-01	5.57E-01	6.78E-01	pCi/g
13-07135-06	TRG	5 OFF PAD-SE CORNER	07/05/13 13:10	7/22/2013	7/26/2013	13-07135	Total Strontium	ElChroM SRW01 Modified	1.11E+00	3.76E-01	5.39E-01	6.81E-01	pCi/g
13-07135-07	TRG	7 OFF PAD-SW CORNER	07/05/13 13:15	7/22/2013	7/26/2013	13-07135	Total Strontium	ElChroM SRW01 Modified	9.77E-01	3.62E-01	4.97E-01	6.67E-01	pCi/g
13-07135-08	TRG	10 PARK MONUMENT	07/05/13 13:20	7/22/2013	7/26/2013	13-07135	Total Strontium	ElChroM SRW01 Modified	6.71E-01	3.54E-01	4.24E-01	6.80E-01	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original

EBERLINE SERVICES

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

Eberline Analytical
Final Report of Analysis

Report To:	
James D. De Zetter, CHS	
UC Berkeley E&HS - Rad Safety	
2199 Addison Street	
Berkeley, CA 94720	

Work Order Details:	
SDG:	13-07136
Purchase Order:	BB00218684
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	WA

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Report Units
13-07136-01	LCS	KNOWN	07/22/13 00:00	7/22/2013	7/26/2013	13-07136	Total Strontium	ElChroM SRW01 Modified	4.89E+01	2.74E-01			pCi/l
13-07136-01	LCS	SPIKE	07/22/13 00:00	7/22/2013	7/26/2013	13-07136	Total Strontium	ElChroM SRW01 Modified	4.29E+01	2.57E+00	1.52E+01	1.11E+00	pCi/l
13-07136-02	MBL	BLANK	07/22/13 00:00	7/22/2013	7/26/2013	13-07136	Total Strontium	ElChroM SRW01 Modified	4.70E-01	3.51E-01	3.87E-01	6.98E-01	pCi/l
13-07136-03	DUP	L1 Landscape Well Irrigation	07/05/13 14:40	7/22/2013	7/26/2013	13-07136	Total Strontium	ElChroM SRW01 Modified	3.17E-01	3.38E-01	3.56E-01	6.87E-01	pCi/l
13-07136-04	DO	L1 Landscape Well Irrigation	07/05/13 14:40	7/22/2013	7/26/2013	13-07136	Total Strontium	ElChroM SRW01 Modified	2.42E-01	4.31E-01	4.39E-01	8.94E-01	pCi/l
13-07136-05	TRG	DW Drinking Water Well	07/05/13 14:50	7/22/2013	7/26/2013	13-07136	Total Strontium	ElChroM SRW01 Modified	-1.41E-01	3.35E-01	3.39E-01	7.33E-01	pCi/l

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original

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601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

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Eberline Analytical
Final Report of Analysis

Report To:	
James D. De Zetter, CHS	
UC Berkeley E&HS - Rad Safety	
2199 Addison Street	
Berkeley, CA 94720	

Work Order Details:	
SDG:	13-07137
Purchase Order:	BB00218684
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	VG

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Report Units
13-07137-01	LCS	KNOWN	07/22/13 00:00	7/22/2013	7/26/2013	13-07137	Total Strontium	ElChroM SRW01 Modified	4.71E+01	2.64E-01			pCi/g
13-07137-01	LCS	SPIKE	07/22/13 00:00	7/22/2013	7/26/2013	13-07137	Total Strontium	ElChroM SRW01 Modified	4.09E+01	2.54E+00	1.44E+01	1.14E+00	pCi/g
13-07137-02	MBL	BLANK	07/22/13 00:00	7/22/2013	7/26/2013	13-07137	Total Strontium	ElChroM SRW01 Modified	3.45E-01	3.59E-01	3.79E-01	7.30E-01	pCi/g
13-07137-03	DUP	T1 Live Tree S Side	07/05/13 14:00	7/22/2013	7/26/2013	13-07137	Total Strontium	ElChroM SRW01 Modified	4.57E-02	3.16E-02	3.53E-02	6.22E-02	pCi/g
13-07137-04	DO	T1 Live Tree S Side	07/05/13 14:00	7/22/2013	7/26/2013	13-07137	Total Strontium	ElChroM SRW01 Modified	8.96E-02	3.35E-02	4.58E-02	6.15E-02	pCi/g
13-07137-05	TRG	T2 Live Tree SW Corner	07/05/13 14:05	7/22/2013	7/26/2013	13-07137	Total Strontium	ElChroM SRW01 Modified	7.54E-02	3.60E-02	4.46E-02	6.90E-02	pCi/g
13-07137-06	TRG	T3 Dead Tree N Side	07/05/13 14:10	7/22/2013	7/26/2013	13-07137	Total Strontium	ElChroM SRW01 Modified	1.75E-01	3.68E-02	7.12E-02	5.97E-02	pCi/g
13-07137-07	TRG	T4 Dead Tree NE Corner	07/05/13 14:15	7/22/2013	7/26/2013	13-07137	Total Strontium	ElChroM SRW01 Modified	1.59E-01	3.49E-02	6.54E-02	5.82E-02	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample; MBL=Blank; DUP=Duplicate; TRG=Normal Sample; DO=Duplicate Original

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601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

UC-B (University of California-Berkeley), 2013b. C. Mac Kenzie, UC-B, letter to C. Rexroth, California Department of Public Health, “DOCKET NUMBER 082013-1333- Response to CDPH's November 6, 2013 Letter,” December 5. [Contains dose estimate for child ingesting soil]

UNIVERSITY OF CALIFORNIA, BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

OFFICE OF ENVIRONMENT, HEALTH AND SAFETY
317 UNIVERSITY HALL
BERKELEY, CALIFORNIA 94720-1150

December 5, 2013

California Department of Public Health
Food, Drug and Radiation Safety, Radiologic Health Branch
PO Box 997414, MS 7610
Sacramento, CA 95899-7414
Attention: Carol Rexroth DOCKET NUMBER 082013-1333

RE: DOCKET NUMBER 082013-1333- Response to CDPH's November 6, 2013 Letter

Dear Ms. Rexroth,

In response to your request to use Form RH 5314 for the removal of 4 locations from our radioactive materials license, the completed forms and supporting information as requested are enclosed.

Responses to your other specific requests are as follows:

1. Location to be deleted:
   Russell Evergreen Tree Farm, 4927 Happy Valley Road, Lafayette, CA 94549

Requested information:

a. **Submit a map identifying where radionuclides were used on the property:** ***Attachment I*** contains a map of the Russell Evergreen Tree Farm from 1966 that has indications of where the radiotracer studies were carried out behind fences. Also enclosed is a current site map.

b. **Identify the total quantity of radionuclides used on the property:** We had previously only located a published document by Dr. Paris on P-32 use at Russell Evergreen Tree Farm. On further investigation into our old AEC files, we found earlier use of other short-lived radionuclides under an authorization for Dr. Oscar Paris (RUA 408052) at Russell Evergreen Tree Farm from ~1964-1971. The authorized radionuclides are listed below and the maximum amount authorized for use on the RUA is also listed:

Isotopes Used at Russell Reservation Under Paris RUA#408052		Maximum amount authorized use
Isotope	**Half Life**	**mCi**
P-32	14.4 days	25
Sr-89	50.55 days	3
Sr-85	66 days	25
Sc-46	83.83 days	4
Fe-59	44.5 days	20
Zn-65	245 days	25
Cd-115	53.46 days	5
Ca-45	163 days	5
Rb-86	18.66 days	15
Cs-134	752.63 days (2.062 years)	5
Co-58	70.86 days	5
Se-75	120 days	5

c. **Submit a copy of the closeout survey:** Enclosed in ***Attachment I*** is a copy of the close out surveys that were done in 1980 and in 2009. In the 1980 survey, it states that the area was surveyed with a Geiger counter and that soils were analyzed at the lab and the results were reported as "no radioactive materials were detected." Signage was removed at that time. In the 2009 survey, no physical measurements were taken, since it had been 38 years since any radionuclides had been used at the property, therefore none of the possible radionuclides used at the site could have still been present. The longest half-life radionuclide used onsite was Cs-134 and since work stopped in 1971, 18 half-lives have passed. The inspector did confirm that all postings have been removed from the site and confirmed with the property manager that no use of radionuclides had occurred at the farm since 1971.

d. **Submit a dose assessment in mrem/year to a member of the public:** Since it has been 42 years since the site was used for research involving short-lived radionuclides, and no residual radioactivity as a result of this research is present on the property today, there is a 0 mrem/year dose to an individual member of the public.

2. Location to be deleted:
Hastings Natural History Reservation- UCB NRS Reserve 38601 E. Carmel Valley Rd., Carmel Valley, CA 93924

Requested information:

a. **Submit a map of where the tritiated water was used at the reserve:** Dr. Janis Dickinson sent the map enclosed in ***Attachment II*** that shows the primary nesting area on the center of the reserve where the work took place.

b. **Identify the total amount of tritiated water used at the reserve:** Dr. Dickinson advised me that a total of 0.76 mCi of H-3 labeled water was used in both bluebirds and acorn woodpeckers with the work ending in 1992.

c. **Submit a copy of the closeout survey:** This work was done in collaboration with Dr. Wes Weathers from UC Davis but, despite a diligent search, neither UCD nor UCB could locate a closeout survey performed at the end of the work. We did talk to the researchers and learned that the H-3 was carried in a tackle box when in the field and for a period of up to a month was stored when not in use in Hastings lab located at the reserve. A recent visit was made to the Hastings lab at the reserve and wipes were taken of the laboratory. No contamination was found and no old postings were present. See ***Attachment II*** for a copy of this recent closeout survey.

d. **Provide a dose assessment in mrem/year to a member of the public:** If we assume that all of the tritium was excreted from the birds, than 0.76 mCi of tritium was emitted to the environment as a result of this research. The Annual Limit of Intake from ingestion or inhalation of H-3 labeled water is 80 mCi. The release of 0.76 mCi to the environment over a large area would therefore result in a 0 mrem per year dose to an individual member of the public from the residual contamination.

3. Location to be deleted:
Blodgett Research Station- UCB Experimental Forest, 4501 Blodgett Forest Road, Georgetown, CA 95634

Requested information:

a. **Identify specifically where the trees were exposed to C-14 and planted by submitting a map:** Pictures of the site are included in the closeout survey. Enclosed in ***Attachment III*** is a map of Blodgett Research Station with an indication as to the location of the remaining tree that was labeled with C-14.

b. **Identify the total quantity of C-14 used in the study:** A total of <2 mCi was used. Each tree received ~100 microcuries. All trees were removed from the site except for one.

c. **Enclose closeout surveys:** Enclosed in ***Attachment III*** are the closeout surveys done both in 2009 and 2013 of the Blodgett indoor space and the remaining tree.

d. **The dose assessment in mrem/year to a member of the public:** The dose to an individual member of the public from the residual contamination in the soil at the base of the tree (within the metal ring) is 0 mrem/year based on the Annual Limit of Intake for C-14 of 2 mCi and assuming an ingestion of soil pathway of soil containing 5 picocuries/gram of C-14. Conservatively assuming a consumption of 500 mg of soil a day from the site (children playing in the dirt scenario) or ~183 grams of soil a year and using the highest soil concentration found (5 picocuries/gram) would result in:
183 grams soil X 5 picocurie/gram= 915 picocuries or 0.0009 microcuries C-14/year intake
5000 mrem/2000 microcuries/year x 0.0009 microcuries= 0.002 mrem /year
A conservative dose estimate from the site is 0 mrem/year.

e. **Identify the locations (distance from the tree) where the soil sample was taken:** The soil sampled at the base of the tree is within a metal ring that is 4 inches out from the base. Laboratory analysis of the soil indicated 5 picocuries/gram of C-14. As noted above, no public exposure would result from this fact. The above ground portions of the tree were exposed when it was a very small tree and housed within a metal ring at its base to C-14 gas within an exposure chamber. After the uptake, it was then planted outside in the soil. The only soil that could have C-14 from the research is the soil within the metal ring and therefore we do not feel that further sampling is needed.

4. Location to be deleted:
Sagehen Creek Field Station-UCB NRS Reserve- PO Box 939, 11616 Sagehen Road, Truckee, CA 96160

Requested information:

a. **What happened to the Ni-63 source in the gas chromatograph:** The Shimadzu Gas Chromatograph-8A 268136YS was shipped to Sagehen Creek field station in June 1998 and the leak test just prior to that shipment showed no leakage. The Gas Chromatograph was returned to the campus inventory in December of 1998 and again it was leak tested and found to be free of contamination. The unit did not return to Sagehen Creek although the PI left the location on their RUA as a possibility for use until 2001 when it was removed. Enclosed in ***Attachment IV*** is the transfer documentation showing that the source arrived at Sagehen Creek on June 24, 1998. We were not able to locate the transfer form that moved the unit back to the campus but we did locate a radiation survey report dated December 16th, 1998 that documents that the source was returned to the campus inventory and a swipe tested taken to confirm it was not leaking. The survey report is also enclosed in ***Attachment IV***.

b. **Enclose a copy of the close out survey.** Enclosed in ***Attachment IV*** is a leak test from the unit before it was shipped and after it returned to the campus showing that it was not leaking at either time. This is the only closeout survey done but it clearly indicates it was not leaking. The researcher confirmed that all postings were removed.

c. **The dose assessment in mrem/year to a member of the public:** The dose assessment to an individual member of the public is 0 mrem/year because the Ni-63 source was not found to be leaking.

5. **Burris Park 6500 Clinton Avenue, Kingsburg, CA 93631**

a. **Is there a written agreement between Kings County and the University?** No. We are in discussions with the Kings County Environmental Health Services department and the DOE – Office of Legacy Management on the topic of roles and responsibilities in relation to the Burris Park Sr-90 plot. Until those roles are defined and the University has a clear understanding with all parties, we would like to put on hold our request to add this location to our radioactive materials license.

b. **Why were the 2 water wells chosen for sampling? Have other wells down gradient from the site been considered for sampling?** The two wells that were sampled were selected because they were the only two wells on the park property and they were previously sampled in 2005 by Kings County Environmental Health Services to determine if there was Sr-90 contamination. No Sr-90 contamination was found in the wells at either sampling. We are currently discussing the site with the County Environmental Health Services department in an attempt to learn more about the hydrology in the area.

c. **Additional vegetation and soil samples are recommended:** The University is planning to work with the Kings County Environmental Health Services department in the next months to perform additional soil and vegetation sampling to assure that the fence is located correctly and to determine if any of the trees within the fence contain Sr-90 above background levels.

d. **Improved monitoring of the site:** The improved monitoring of the site would involve periodic visits to monitor whether that the concrete cap remains in-place without a loss of integrity, the fencing is maintained, and no activities are planned in close proximity to the material that could result in possible exposures (e.g., planting of vegetables, removing of the concrete cap, etc.). The party responsible for implementing the on-going monitoring plan is being addressed through our discussions with the county and the DOE.

e. **The dose assessment in mrem/year to a member of the public:** No external radiation field was detected on the site. The drinking water and irrigation wells on the property were tested and found not to contain Sr-90 contamination above background. The only known pathway for radiation exposure would be from ingesting contaminated soil from within the fenced area. The Annual Limit of Intake by ingestion for Sr-90 is 40 microcuries. Conservatively assuming a consumption of 500 mg of soil a day from the site (children playing in the dirt scenario) or ~183 grams of soil a year and using the highest soil concentration found (2.8 picocuries/gram) would result in:

   183 grams soil X 2.8 picocurie/gram= 512 picocuries or 0.0005 microcuries Sr-90/year intake
   5000 mrem/40 microcuries/year x 0.0005 microcuries= 0.1 mrem /year

   Although the plot is fenced and the public is not allowed in the area, a conservative estimate for someone having routine access to the soil in the plot would be 0.1 mrem/year.

Please feel free to call me at 510-643-7976 or email me at cjmackenzie@berkeley.edu with any further questions you may have on this topic.

Sincerely,

Carolyn MacKenzie
Radiation Safety Officer

Enclosures:
Attachment I, II, III, IV

Cc:
Per Peterson, Chair, Radiation Safety Committee, UCB
Mark Freiberg, Executive Director, Environment, Health & Safety, UCB
Brett Henrikson, UC Office of the President, Office of General Counsel
Jeff Taber, Director, Kings County Environmental Health Services
Mike Widdop, Contractor for the Office of Legacy Management, DOE

CMK/bs
Reviewed by: BS

Final Document Name: 2013.12.LicenseChangeResponses

Files:

CDPH Correspondence File w/o Attachment
Russell Evergreen Tree Farm File w/ Attachment
Hastings Natural History Reservations w/ Attachment
Blodgett Research Station w/ Attachment
Sagehen Creek Field Station w/ Attachment
Burris Park w/ Attachment

UC-B (University of California-Berkeley), 2014. C. Mac Kenzie, UC-B, e-mail to C. Clayton, DOE, “Sr90 results - UC Berkeley samples - Eberline 14-02125,” March 25 [tree core results].

Analysis Date – 6 March 2014

ClientName	SampleType	ClientID	Report Units	Result	< or > MDA	MDA
UC Berkeley	LCS-spike	LCS-spike	pCi/g	43.7	>MDA	0.655
UC Berkeley	MBL	BLANK	pCi/g	0.00863	<MDA	0.58
UC Berkeley	DUP	Tree core-T1	pCi/g	0.119	<MDA	0.137
UC Berkeley	DO	Tree core-T1	pCi/g	0.0887	<MDA	0.142
UC Berkeley	TRG	Tree core-T2	pCi/g	-0.0175	<MDA	0.134
UC Berkeley	TRG	Tree core-T3	pCi/g	2.98	>MDA	0.157
UC Berkeley	TRG	Tree core-T4	pCi/g	0.340	>MDA	0.156
UC Berkeley	TRG	Bkg tree core-B1	pCi/g	0.0055	<MDA	0.129

Analysis Date – 21 March 2014 - Preliminary Results

ClientName	SampleType	ClientID	Report Units	Result	< or > MDA	MDA
UC Berkeley	LCS-spike	LCS-spike	pCi/g	49.8	>MDA	1.18
UC Berkeley	MBL	BLANK	pCi/g	0.012	<MDA	0.18
UC Berkeley	DUP	Tree core-T3	pCi/g	3.40	>MDA	0.150
UC Berkeley	DO	Tree core-T3	pCi/g	3.34	>MDA	0.125
UC Berkeley	TRG	Tree core-T4	pCi/g	0.470	>MDA	0.127