UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA

GILL TRACT

RADIOLOGICAL HISTORICAL USE ASSESSMENT

DRAFT

NOVEMBER 2007

For the

Capital Projects Department
University of California, Berkeley

Prepared By

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1.0 EXECUTIVE SUMMARY

A radiological historical use assessment of Gill Tract was conducted in June and July 2007 for the University of California – Berkeley (UCB). The Gill Tract is a university-owned 10-acre agricultural plot on San Pablo Avenue bounded by Marin Street and Codornices Creek in Albany, California. The tract was used for agricultural research and experimentation. As part of the research radioactive materials were used in trace amounts. Historical research has shown that the use of radioactive materials was limited to the Hybridoma laboratory. Use of radioactive materials at Gill Tract ceased in 1997. A close out survey was performed by the University EH&S group. The information provided in this report was current as of the date of publication.

The results of the assessment indicate that the laboratories located within the Hybridoma Laboratory and the storage shed next to the laboratory are impacted from the use of radioactive materials. In addition, drains and sewage piping and ventilation associated with hoods in the laboratories have been impacted. The laboratories and the drainage system would be considered class 1 areas for closure. While no indication of radioactive material use was found for the planting field areas it is recommended that these areas are included in the final closure survey.

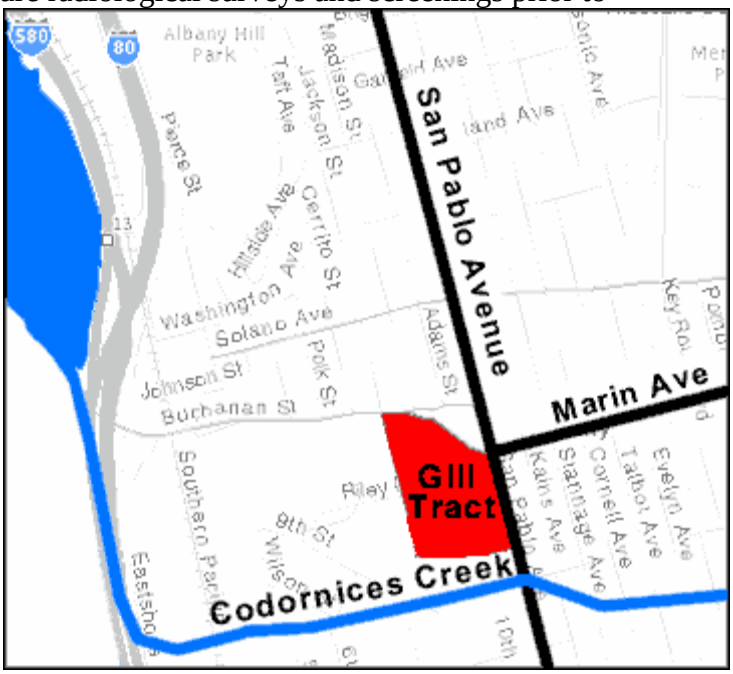
2.0 Purpose

Many of the buildings at Gill Tract are scheduled for demolition in 2008. As a result, there was a need for information relating to historical and current radiological material use or storage in the buildings. The purpose of the radiological historical use assessment is to provide UCB with a comprehensive document detailing the history of radiological material storage and previous radiological surveys conducted within the laboratories at Gill Tract. This document describes the historical and current storage or use of radioactive materials at Gill Tract. It also provides recommendations on areas requiring future radiological surveys and screenings prior to demolition of the building.

3.0 Site Description

This section provides a physical description of the building and information regarding the local environmental setting.

3.1 Physical Characteristics



Gill Tract is located in Albany, California at 37°54' N, 122°18' W (see figure XX). The San Pablo frontage is situated three miles northwest of the campus, next to the city of Albany's southern border with the city of Berkeley. The site is bordered by Buchanan Street to the north, San Pablo Avenue on the east, Codornices Creek to the south, and Jackson Street/Eighth Street to the west. Village Creek

bisects the site from east to west. Monroe Street currently provides the primary access to the site from San Pablo Avenue, and Jackson Street provides a secondary entrance from Buchanan. Tenth Street could potentially provide vehicle access from the south, but has historically been closed to traffic. The site has several significant open space features. It is bordered on the south by Codornices Creek and is bisected by Village Creek. Within the site, both creeks are open.

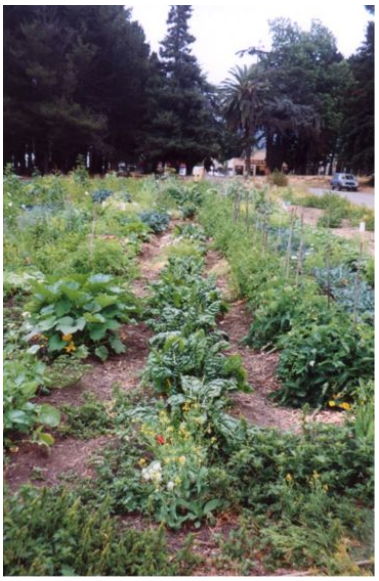


Figure 3-1, Planting Plot at Gill Tract

The Gill Tract is a 10-acre portion of the site that includes a 7-acre growing grounds and a 3-acre stand of trees. Both the growing grounds and the stand of trees have historically been used for research (see figure 3-1). Approximately 30 structures are located on the site, the majority of which are abandoned. Many of the structures are scheduled for demolition early in 2008 while the remaining structures will be used by the UCB.

3.2 Geology

UC Berkeley is located on the western slopes of the Berkeley Hills. Ground elevations in the 2020 Long Range Development Plan (LDRP) area range from about 160 feet above mean sea level (+160 feet msl) in the west to about +1,200 feet msl at the Lawrence Hall of Science, and about +1,600 feet msl at Grizzly Peak Blvd. Elevations at the west end of the Campus Park are about +200 feet msl. Slopes in the Campus Park and adjacent areas are shallow, ranging from less than two percent west of Shattuck Avenue to about five percent west of Gayley Road. East of Gayley Road, slopes rise from about ten percent at the Greek Theatre to more than 50 percent in some areas at the heads of Strawberry and Claremont Creeks.

The Campus Park and Hill Campus can be defined by two distinct landforms: most of the Campus Park is on an alluvial plain, and the Hill Campus (plus a portion of Southside east of the Hayward fault) is in the Berkeley Hills. (*1990 Long Range Development Plan EIR*.)

3.3 Hydrology

UC Berkeley is located at the edge of the Berkeley Hills, near the western edge of the Coast Range physiographic province. The hills are roughly parallel to the northwest southeast trend of the major mountain ridges in the province with spur ridges and canyons oriented perpendicular to main ridges. A ridge of relatively heavy rainfall -- up to 28 inches in an average year -- follows the trend of the hills along their north-south axis. In the local area rainfall is between 24 and 26 inches during an average year. (*1990 Long Range Development Plan EIR*.)

4.0 METHODOLOGY

The following four major efforts went into the preparation of this document:
(1) Research of drawings for Gill Tract;
(2) Historical review of Gill Tract records, previous surveys, and other historical data;
(3) Interviews with persons knowledgeable of the radioactive material history at the building; and

(4) Site walkthrough of Gill Tract conducted for this radiological historical use assessment.

4.1 Historical Review

Existing records that were researched for references to Gill Tract include reports, books, and internet sites relating to the history of radioactive material research usage at UCB, and in particular, Gill Tract. Radiological surveys, memorandums, and room radioactive material inventories for UCB were also reviewed where available.

Among the documents reviewed for this effort were the following:

- Radiation User Authorization Permits, EH&S files
- The Daily Californian, www.dailycalifornian.com
- The Berkeley Daily Planet.com
- University of California Digital Archives
- UC Berkeley Landscape Heritage Plan

4.2 Interviews

A total of 5 interviews were conducted with persons familiar with radioactive materials storage and usage at Gill Tract. Names and contact information of professors who were known for their research with radioactive materials was provided by UCB. Table A-1 in Appendix A lists the persons contacted who provided specific information on radiological material usage in Gill Tract. The inclusion of this list provides a complete record of contacts made during this project.

4.3 Site Walkthrough

Site walkthroughs of Gill Tract were conducted in July and August 2007. Inspection inside of the Hybridoma Center was not performed as the structure was boarded shut due to asbestos containing material (ACM) inside. The outside of the structure and the shed was reviewed during these walk throughs.

4.4 Radiological Scoping Surveys

Radiological scoping surveys have been performed on the remaining structures at the Gill Tract. Results of these surveys have not shown any residual radioactivity.

5.0 HISTORICAL AND CURRENT RADIOLOGICAL MATERIAL USES

Radiological operations at the Gill Tract were authorized under the UCB's state radioactive material license No.1333-01. The license authorizes the UCB to perform research utilizing radioactive material at various university locations. The Gill Tract was one of those locations.

5.1 Site History

In 1890, Edward Gill, an expert, world-renowned horticulturalist, purchased 104 acres and established the Gill Nursery. Mr. Gill became widely known for the antique roses cultivated at the nursery, some of which are still found in the Bay Area. At that time the property extended from what is now I-80 to San Pablo Avenue and from Codornices Creek to Buchanan Street. Although Edward Gill died in 1909, John Gill continued to farm on the land, until 1928 when the University of California purchased the nursery and resumed agricultural activities.

In 1939, the UC gifted 5 acres to the United States Department of Agriculture for the construction of what is now known as the Western Regional Research Center, for the study of products that could be developed from agricultural commodities. In 1945, UC set aside 36 acres fronting on San Pablo Avenue and Buchanan Street, for an agricultural experimental station. This became the home of the northern branch of the University's Division of Biological Control, and later the site of the International Center for Biological Control. Projects pioneered at the Gill Tract included the first major success in controlling weeds with insects in the United States. The Gill Tract became the center for this line of research in the US in cooperation with the United States Department of Agriculture (USDA). The Division is also credited with the control of numerous major insect pests on other California crops and pioneered in predator-prey population studies providing the groundwork for the eventual integration of biological, chemical and cultural methods of pest control.

In 1995, the Division at the Gill Tract was joined with the College of Natural Resources, following which many of the research staff were transferred to the Berkeley campus. By 1997 the administration, funding and future of the station at Gill Tract became unclear and only recently has the University decided to develop the land for student and faculty housing, community activities and retail shops.

In 1969, a portion of the land (adjacent to the present Ocean View Elementary School) was set aside for community gardens. The year 1969 was also the year that People's Park and Ohlone Park and Greenway were founded, which still exist and are widely recognized as having "kicked off" the modern day Ecology Movement by gaining worldwide recognition of the need for parks and open space in crowded urban areas. Today, community farming activities and experimental studies continue along Edward Gill Drive.

Finally, there are approximately 63,000 square feet of agricultural research and agricultural operations facilities. These facilities, which were primarily built in the 1960s, are largely vacant. The site has several significant open space features. It is bordered on the south by Codornices Creek and is bisected by Village Creek. Within the site, both creeks are open. The Gill Tract is a 10-acre portion of the site that includes a 7-acre growing grounds and a 3-acre stand of trees. Both the growing grounds and the stand of trees have historically been used for research.

5.2 Radiological History

Documented use of radioactive materials at Gill Tract began in 1988 and lasted until 1997. Records maintained by UCB and interviews with Principle Investigators (PI) provided information on radionuclides used, radiological survey results, and use and storage locations. These records indicate that use and storage of radioactive material was limited to the Hybridoma Center and the storage shed next to the building. The Hybridoma Center is a single story structure with stucco siding, wooden frame and, asphalt shingle roof. Attached to the rear of the building is a greenhouse and next to the greenhouse is a shed and a connex. Two ventilation systems are located on the roof of the Hybridoma Center. Figures 5-1 to 5-4 show the Hybridoma Center.

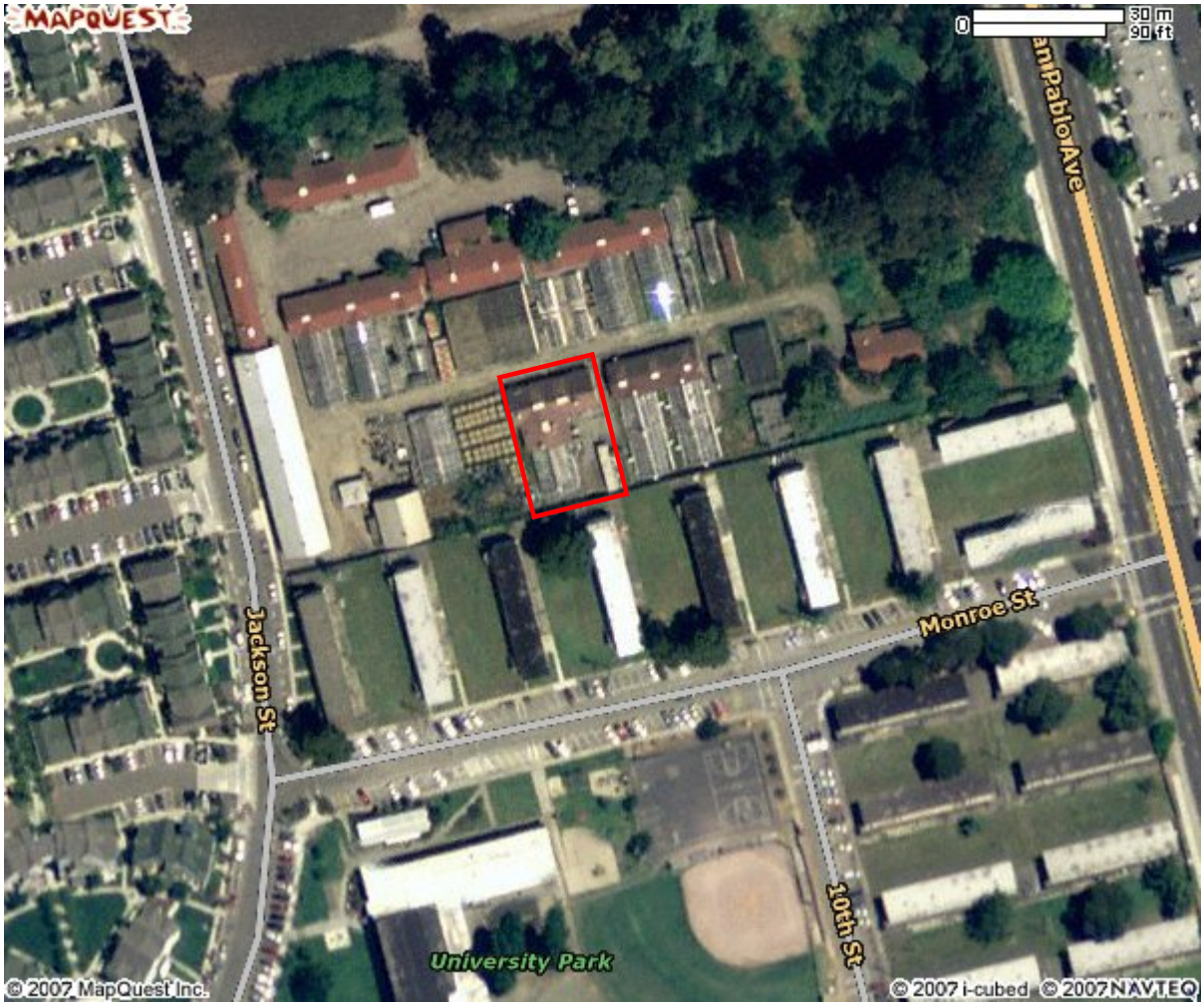


Figure 5-1, The Hybridoma Center (red rectangle) at Gill Tract

Figure 5-2, Hybridoma Center rear entrance showing ventilation exhaust systems and side view

Figure 5-3, Hybridoma Center rear showing greenhouse

Figure 5-4, Shed at Hybridoma used to store radioactive material

Table 5-1 provides information on the type of material stored, used, and shipped at Gill Tract.

Table 5-1. Radiological Material Use at Gill Tract

Radionuclide	RUA	Half Life	Room	Sink Disposal	Comments
Carbon 14	3821 3822	5,730 y	2,7, 11, Culture Room, Shed	Yes	Sink disposal in room 7
Hydrogen 3	3821 3822	12.35 y	2,7, 11, Culture Room, Shed	Yes	Sink disposal in room 7
Phosphorus 32	3821 3822	14.29 d	2,7, 11, Culture Room, Shed	Yes	Sink disposal in room 7
Sulfur 35	3821 3822	87.39 d	2,7, 11, Culture Room, Shed	Yes	Sink disposal in room 7
Selenium 75	3821 3822	119.78 d	2,7, 11, Culture Room, Shed	Yes	Sink disposal in room 7
Iodine 125	3821 3822	60.14 d	2,7, 11, Culture Room, Shed	Yes	Sink disposal in room 7

d – days
y – years

Figure 5-5 shows the floor plan of the Hybridoma Center. The rooms used for radiological work are all located along the length of the building with the greenhouse extended off the back. The building faces northwest. Figure 5-6 shows a rough layout of the rooms used for radiological work. Room 7 contained the only designated sink for disposal of radionuclides. Room 3 was a cold room and later designated as a Culture Room. However, records indicate that there may have been more than one Culture Room in the Hybridoma but that the rooms were not numbered so it is difficult to indicate which Culture Room was used for radioactive material.

In the fall and winter of 1988 use of radioactive material at the Hybridoma Center stopped. Use was reinitiated in June of 1990. At first radiological work was limited to room 7 with waste storage remaining in the shed. In July 1993, use of radiological material was broadened to include rooms 2 and 11. Records indicate that tritium was brought over from Dr. Ames' laboratory in October 1993 that was not under the control of the current RUAs. This material was removed in November 1993. The exact room within the Hybridoma Center where the tritium was used or stored was not identified.

During the record review, there were several occasions where radioactive material was identified in locations other than the primary research laboratories. For example, in 1988 radioactive material was discovered in the refrigerator located in the corridor in the alcove.

Records did not specifically indicate that radioactive materials were used in the greenhouse of the Hybridoma however the research at the facility was largely related to plant pathology. Therefore it is reasonable to conclude that radioactively labeled plants were grown in the

greenhouse. It is not expected that radioactively labeled plants were cultured in the 7 acre planting lot located at the northern end of the Gill Tract.

Use of radioactive material at Gill Tract was officially terminated via a close out survey performed by the EH&S group for the UCB on January 22, 1997. No residual radioactivity was identified during the survey.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the record research and interviews the use of radioactive materials was limited to the Hybridoma Center at Gill Tract. Within the Hybridoma Center radioactive material use was largely limited to rooms 2, 7, 11, the Culture Room, and the shed. However sporadic indications of radioactive material being found outside these rooms in hallways were also noted. Because of these indications and the relatively small size of the building, the entire building including the greenhouse should be included in the surveys.

The records indicated that no spills involving radioactive material occurred at Gill Tract. One sink, located in room 7 was designated for radioactive material disposal. Records were maintained to track the amount of material disposed of in this manner to ensure compliance with license limits. Sink disposal of radioactive material continued until January 1997. Laboratory sinks join the common sewer header under the building. Drain traps and other locations leading to and connecting with the common sewer header should be surveyed by swipe, direct measurement, and by collection of solid samples to determine the amount of residual radioactive.

The number of ventilation hoods where radioactive material was used was not identified except room 7. Photos of the building (Figure 5-2) shows two ventilation exhaust fans located on the roof of the building. There is a potential that small quantities of radioactive material may have deposited close to the plenum exhaust. It is not anticipated that the exhaust would have caused residual radioactivity in quantities that would impact the environment surrounding the building.

Records did not indicate that radioactively labeled plants were grown in the 7 acre planting plot located at the northern end of the site. However, it is recommended that some soil samples are collected and analyzed for carbon 14 as verification.

Generally licensed radioactive material (i.e., smoke detectors, exit signs) may be present in the laboratories. Removal of these sources when permitted should be performed prior to initiation of final status surveys.

The types of radioactive material used at Gill Tract varied but encompassed primarily beta and gamma emitting radionuclides. Radioactive half lives for the radionuclides ranged from 14 days to 5730 years. Due to the length of time since radioactive material use at Gill Tract only those radionuclides with long half lives would still be present. Therefore surveys at Gill Tract should focus on tritium and carbon 14 with carbon 14 being the primary contaminant.

During the record research information was obtained that approximately 3,000 pounds of superphosphate fertilizer was stored in a 40 foot by 40 foot warehouse in room 29 at Gill Tract. Superphonsphate fertilizer is known to contain elevated concentrations of naturally occurring radioactive materials (NORM) in particular uranium and its progeny. While these radionuclides are not consistent with the radionuclides of concern for the Hybridoma, their presence should be noted for any radiation closure surveys.

APPENDIX A

Contact Reports

Table A-1. Interviews Completed for Gill Tract			
Interviewee	**Room Information Provided For**	**Gill Tract Affiliation**	**Interview Date**
Barbara Lane, PhD	Hybridoma Center	Assistant Dean and current UCB Professor	6/19/07
John Andrews, PhD	Hybridoma Center	Former UCB Professor	6/21/07
Lloyd Andrews	Gill Tract	USDA	6/21/07
Lincoln Smith	Gill Tract	USDA	6/21/07
David Schmit	Hybridoma Center	Former UCB Research Assistant	11/13/07
ES&H Staff	Gill Tract	RUA oversight	Various