

## How UC Laboratory Personnel Perceive Waste Disposal Procedures: Can it be Made Easier?

Michael Duke

### **Introduction**

The Office of Environmental Health and Safety (EH&S) has the responsibility to collect and dispose of the University's hazardous waste. Laboratory personnel also perform a critical function of proper disposal—saving their waste and turning it over to EH&S in a safe and legal manner. Successful compliance with federal and state regulations is not possible without the effort of lab workers in conjunction with EH&S.

To ensure safe collection of chemical and radioactive materials, EH&S has developed a set of requirements that must be complied with before waste can be picked up. The convenience of these procedures is an important matter, because it follows that the easier it is for the researcher to dispose of waste properly, the more likely he or she is to do so. Previous studies have found drain disposal to be a common (but unapproved) method of discarding various forms of regulated waste. This suggests that for many lab workers, the present disposal program is too burdensome. The purpose of this report is to encourage proper hazardous waste disposal by determining which EH&S requirements, if any, laboratory personnel find to be a hindrance, and how they would change the current procedures to make compliance easier.

### **Previous Studies**

Other studies done at UC Berkeley have discussed various problems in campus toxic waste disposal. Jolly and Ujihara (1983) found that presently regulated materials, such as chlorinated hydrocarbons, solvents and inorganic acids, were regularly going down the drain. Schultheis (1984) discovered that laboratory personnel were having trouble complying with EH&S requirements, especially with regard to the labeling of bottles and separation of chemicals by hazard classes. She asserted that the reason for noncompliance was that workers did not generally know what the proper disposal

procedures were. Since that study, EH&S has put out information on what may and may not go down the drain, packing procedures, and chemical waste compatibility.

## **EH&S Disposal Requirements**

The following is an overview of the current hazardous waste disposal procedures, based upon EH&S publications (1985).

**Drain Disposal:** At present, laboratories may dispose of sugar and protein solutions, liquid detergent, and a limited number of dilute acids and bases (pH between 2.5 and 12.5) through the drain. All other chemicals are considered hazardous unless *proven* otherwise.

**Trash Disposal:** Only non-hazardous dry materials, such as sugars and powdered detergent, may be put into the trash.

**Labeling:** Each container to be disposed of must be labeled as to content, amount, and physical state. In addition, incompatible chemicals must be boxed separately for transport, and a packing list must be filled out for each box describing the contents. If the chemical is an unknown, the responsible parties must "make every effort" to identify it.

**Container Packaging:** Glass bottles must have screw caps that are tight-fitting, and be boxed and cushioned so that they do not break. The boxes should be sturdy and large enough that bottle necks do not protrude from the top. Dry waste should be in its own container, and glass and needles should be packed safely.

**Waste Pick-Up:** Once the chemicals and contaminated instruments are separated into compatible groups, identified and labeled, and packed properly, they are ready to be picked up by EH&S. Generally, a lab worker with standard chemical waste will mail a copy of the packing lists to EH&S, and can expect a technician to arrive a week after EH&S receives the lists. For radioactive and volatile chemical waste, one may call EH&S directly, and expect a pick-up within a few days. It is required to have someone on hand in the lab to answer questions the EH&S technician may have. The majority of the pick-ups occur in the lab of origin, but many occur in a place designated by the department.

## **Methodology**

Data for this paper were gathered by distributing a written questionnaire to various laboratories around campus. The questionnaire was designed to elicit opinions about each aspect of the EH&S waste disposal guidelines. The questions fell into six categories: EH&S Communications (to measure information dispersal), Labeling, Container Packing, Chemical Separation, EH&S Response, and a general section asking about overall satisfaction with the present service and ideas for the future. Because of the comprehensiveness of the survey, people who answered it had to have had experience disposing of waste through EH&S. In most cases, these people were lab safety representatives.

The questionnaires were distributed for the most part in departments that had the most EH&S pick-ups between January and September, 1987, based on an EH&S list. These departments included Biochemistry, Chemistry (which had the most pick-ups), Molecular Biology-Virus Lab, Nutritional Sciences, Physics, Physiology-Anatomy, Public Health, and Zoology. A few surveys were also distributed to some labs that were not in the above departments but dealt with EH&S relatively frequently. Most of the questionnaires were put in lab mail boxes with the department's consent. The forms were put together in such a way that they could be returned by campus mail by folding them over so that a pre-printed address was showing.

Since hazardous waste disposal is a sensitive subject, respondents were not asked to give their names or departments (except for Chemistry, the surveys for which were distributed before the others). However, many did write their names on the forms, although they will not be used in this report.

**The Special Case of Chemistry:** The Department of Chemistry is different from the other departments because it is responsible for collecting its own waste and transporting it to the EH&S facility for waste disposal. Thus, a few of the questions in the survey either cannot be answered by those in the Chemistry labs or can be answered only so far as they apply to the Department of Chemistry's disposal procedures. To account for this, the survey results from this department are listed separately in the data section of this paper, but are incorporated in the total results as well.

The following sections present and discuss the results of the questionnaire. The combined data and discussion section lists the questions along with the numerical responses to them. Many of the written comments received with the filled out surveys are utilized to aid in the analysis of the figures. Last, the recommendations section presents ideas for future consideration based on my findings.

## Data and Discussion

The data and discussion are presented in six sections, corresponding to those on the questionnaire. Percentages that add up to over 100 are from questions where multiple answers were allowed. Percentages that add up to less than 100 do not include the percentage of those either not responding to the question or unsure of the answer. The actual number of responses are also listed; they are based on 17 questionnaires completed in the Department of Chemistry and 34 filled out by lab workers in other parts of the campus, for a total of 51 surveys. Slightly under 25 percent of the forms distributed in order to be returned by campus mail were completed.

### EH&S Communications: Is the Information Getting Out?

1. Have you been provided with information regarding what chemicals must be disposed of as hazardous waste?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	18	3	74	25	55	28
NO	82	14	26	9	45	23

2. Have you been provided with procedures and requirements for disposing of hazardous waste through EH&S?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	47	8	88	30	75	38
NO	47	8	12	4	24	12

3. Have you been provided with a chemical waste compatibility guide?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	6	1	53	18	37	19
NO	94	16	38	13	57	29

4. Do you feel that EH&S should provide more information to departments regarding hazardous waste disposal?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	94	16	53	18	67	34
NO	0	0	32	11	22	11

Questions 1 through 4 measure the fraction of labs that have received the information that is essential for proper waste disposal. The overall figures suggest that there are a number of lab personnel who do not have that information. One is especially struck by the extreme figures in the Department of Chemistry; 82 percent are uninformed as to what chemicals must be disposed of as hazardous waste, 94 percent have not been provided with a chemical waste compatibility guide, and less than half even have disposal procedures on hand. One Chemistry respondent explained that such information is available in the Chemistry stockroom, but has not been distributed. The Chemistry department is generally considered ahead of the rest of the campus in the areas of safety and chemical disposal. The results of these four questions would dispute that notion. Some of those who commented even expressed anger at what they perceived to be a departmental apathy as regards waste disposal. The workers in one Chemistry lab group wrote that

*The pervasive feeling in [our] group is that we've received no information as to what can and can't go down the drain. We are not encouraged by the third floor personnel (or the powers that be) to go to the trouble to collect ALL of our solvents and wastes and bring it to them for disposal. In the past, they have taken care of it if we dump it on their doorstep, as though it's an extra job rather than one of their primary functions. If there were a smooth and official disposal station or mechanism within the college, we would go to the trouble to centralize the collection and packing of waste within our group. We generate A LOT of solvent waste and we are concerned about where it goes. We would be happy to put the necessary effort into the disposal process, at our end, if there is support.*

The Chemistry Department does have a safety manual that covers hazardous waste disposal procedures, titled *Who does it and Where to Find it*. Although it does not specify what can and cannot go down the drain, it does list procedures for disposing of what the lab worker perceives to be hazardous waste (one respondent wrote that the people in his lab "try to use common sense," but that a disposal guide would work better).



### Labeling

5. Do you feel that having to label each container as to content, amount and physical state is a major inconvenience, a minor inconvenience, or no inconvenience?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
MAJOR	18	3	15	5	16	8
MINOR	29	5	44	15	39	20
NONE	47	8	41	14	43	22

6. Given that this is required, do you feel the present procedure could be improved?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	41	7	44	15	43	22
NO	41	7	29	10	33	17

7. Would you prefer that EH&S provide standardized labels (i.e., peel and stick) to apply to hazardous waste containers?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	71	12	61	21	65	33
NO	24	4	29	10	27	14

8. Do you feel that having to fill out a packing list for each box of containers in addition to filling out the labels is an inconvenience? How long does it normally take to do?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	41	7	32	11	35	18
NO	47	8	50	17	49	25

Time it takes to fill out list (total numbers only):

"few minutes"	2
five to ten minutes	7
fifteen to thirty minutes	5

9. Who do you feel should be responsible for identifying unknown chemicals to be disposed of?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	%	no.	%	no.	%	no.
a) EH&S	18	3	24	8	22	11
b) Lab personnel, if it can be done easily and in only a few minutes	53	9	32	11	39	20
c) Lab personnel, if at all possible	29	5	38	13	35	18

Although 55 percent of those surveyed were at least somewhat inconvenienced by labeling (question 6), only 15 percent were extremely troubled by it. Many respondents wrote that they understood that proper labeling is necessary. The problems arise when lab workers store different chemicals in the same container. Many wrote that it is often very difficult to figure out the true amount of each component of a compatible mixture in a container, at which point proper labeling becomes inconvenient. Others thought labeling was too time consuming. Presumably, those people were having the same type of problem—trying to figure out what they had in the bottle. Some lab personnel felt that the rules of labeling should be more relaxed. A post-doctoral researcher in Biochemistry feels that EH&S should accept materials labeled as "Solvent: H<sub>2</sub>O 90%. Unknown Solute." He added that "Generally, 90 percent of the material can be identified, 10 percent is complex and unknown. Scintillation fluid, for example, is a complex proprietary mixture. Does it really matter if the precise composition is known? Would the disposal procedure differ for 10 percent xylene or 10 percent toluene?"

Most of those surveyed responded favorably to the idea of standardized, "peel and stick" labels for bottles (question 7). Some of those who did not think that was necessary felt that using masking tape or a piece of paper worked just as well. I feel that standard labels would be an asset in the lab for two reasons. First, the blank labels would instruct the lab worker to write all three of the necessary requisites (content, amount, physical state). Second, glossy labels would probably not corrode as quickly as masking tape does. While visiting several labs, I noted that bottle labels were often difficult or impossible to read because they had corroded.

The current EH&S policy regarding unknown chemicals to be disposed of is that the lab employees must "make every effort" to identify them before calling the EH&S technician. In the survey, only 35 percent agreed with that policy (question 9), but another 39 percent were willing to take on the task if it could be done quickly. However, most do not wish to bear the burden of identifying unknown chemicals left by another researcher some time before. A long-time employee in the Physics Department said that when identification of a chemical is not possible, it may sit indefinitely. A Chemistry respondent described his perception of the problem and his solution: "The transient nature of people in university labs make [it difficult for lab personnel to

identify unknowns]. Lab personnel should be responsible, but provisions should be made for the bottle of 'X' left in the hood for 'Y' years. A pre-departure cleanout of chemicals, samples, etc. might be something each research group should make mandatory."

Some workers also expressed concern that handling unknown chemical materials was too dangerous for the untrained. As one person wrote, "If it is unknown to the employee, then the employee should not have to handle it either!"

### Container Packing

10. Is it difficult to find boxes, screw-top bottles that do not protrude from boxes, or other packing containers or materials that EH&S will approve of?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	59	10	59	20	59	30
NO	35	6	32	11	33	17

11. Would it be easier if EH&S provided standardized sturdy boxes with cushioning material for your bottles?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	71	12	79	27	76	39
NO	29	5	15	5	20	10

12. Would it be easier if EH&S supplied standardized screw-top bottles for you to use?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	76	13	74	25	75	38
NO	24	4	24	8	24	12

13. Would it be easier if EH&S supplied containers suitable for glass, needles, and other sharp objects that have to be disposed as hazardous waste?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	65	11	68	23	67	34
NO	24	4	26	9	25	13



14. Do you feel that the materials mentioned above would improve the overall efficiency of laboratory hazardous waste disposal?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	71	12	82	28	78	40
NO	18	3	15	5	16	8

There is an almost overwhelming positive response to the idea of laboratories being supplied with suitable containers for packing waste. Many lab workers stated that it was difficult to find such material. Although some people wrote that they had problems finding boxes, others complained that they could not find bottles, and one Biochemistry researcher wrote that he spent 30 minutes with an EH&S technician looking for tight fitting caps for his bottles.

Few of the respondents expressed a willingness to pay for the above amenities. A researcher in the Physiology-Anatomy Department feels that there are enough bottles and boxes around the laboratories for all to use, and that if a cooperative network were set up in each building, workers would no longer have difficulties finding containers.

#### Chemical Separation

15. Do you feel that having to separate chemicals into bottles for disposal is a major, minor, or no inconvenience?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
MAJOR	6	1	12	4	10	5
MINOR	53	9	35	12	41	21
NONE	41	7	41	14	41	21

16. Do you feel that having to box the containers/bottles separately based on EH&S groupings (Caustics, Mineral Acids, Organic Acids, Inorganic Poisons, Water Reactives, Oxidizers) is an inconvenience?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	24	4	41	14	35	18
NO	71	12	50	17	57	29

Although 51 percent of those surveyed found that having to separate chemicals into different bottles for disposal to be at least a minor inconvenience (question 15), only 10 percent felt it was a major inconvenience. Many did respond that this is an important function. Those who had difficulties expressed that they could not find containers, and a few thought it was not worthwhile to dispose of one milliliter of a substance separately. A solution to the container problem may be disposable plastic tubes and bottles for the very small samples that must be separated.

Most respondents did not feel that separating the bottles into EH&S groupings (question 16) was an inconvenience, although one person wrote that the policy made little sense to him, since many chemicals fall into more than one hazard category. This comment suggests that EH&S should publish a document explaining how labs should treat such chemicals.

#### EH&S Response

17. Based on your needs and experience, does EH&S respond quickly to calls for hazardous waste pick-up?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	18	3	56	19	43	22
NO	24	4	26	9	25	13

18. If not, how soon should the response be after pick-up request?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
less than 6 hours	0	0	3	1	2	1
less than 24 hours	12	2	6	2	8	4
less than 48 hours	0	0	26	9	18	9
within a week	12	2	24	8	20	10

Note: Chemistry personnel were not given any specific times to choose.

	<u>Total</u>	
	%	no.
19. Would you prefer to have your pick-up point		
In the laboratory	50	17
At a designated site on the same floor as the lab	24	8
At a site designated by department	6	2
At a site designated by the building	18	6

Note: There are no reliable data from the Chemistry Department on this question.

20. Is it easier for you to request frequent pick-ups of small amounts of waste or to save large amounts in order to avoid frequent pick-ups?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
Small Amounts	18	3	44	15	35	18
Large Amounts	35	6	44	15	41	21

A plurality of the lab workers felt that EH&S did respond well to calls for pick-ups (question 17). Many stated that the time EH&S takes to pick up the waste after a request has improved dramatically over the past 9 months. Those who felt EH&S was not quick enough said that the time it takes them to arrive at the lab varies, and the person who packed the waste may not be there. Thus, it is difficult for the EH&S technician to ask any questions about the waste.

There is a split among the respondents as to whether EH&S should come directly to the lab or to some centralized location designated by the department or building. Fifty percent feel that EH&S should come to the lab, and 48 percent want a location outside the lab to bring their waste to. Most people that I personally spoke with wanted the centralized location. However, those people were all in the Life Sciences Building, which has historically had little extra space. Thus, the lab workers in that building were interested in removing space consuming packages from their labs as soon as possible.

Many of those who think EH&S should come to the lab feel that it is dangerous for untrained employees to carry hazardous waste around the building. A researcher in the Biochemistry Department wrote that "scientists should not transfer waste around the building. It is ludicrous to designate *hazardous areas* and then require loosely organized waste transfers...this is how spills occur and how [the common areas] become contaminated."

More people find it easier to save large amounts of waste to avoid frequent pick-ups (question 20) than to follow the EH&S admonition not to allow hazardous waste to accumulate. It is quite possible that the present pick-up request system is not effective for a campus as large as UC Berkeley. One respondent suggests "why not monthly waste visits? If a lab's containers are half full, then out they go. If not, EH&S will be back

next month. The request system is very inefficient. How many times has a request been phoned in 10 minutes after EH&S has made a pick-up (in the same building)?"

### Overall Satisfaction and How to Improve

21. Do you feel that current campus hazardous waste disposal procedures are (choose as many as apply):

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	%	no.	%	no.	%	no.
a) Too time consuming	24	4	21	7	22	11
b) A hindrance because there are too many extra boxes and containers around	24	4	24	8	24	12
c) A hindrance because I cannot find proper containers	-	-	29	10	(29)	-
d) Very difficult to comply with	18	3	6	2	8	4
e) Not a real problem for me to comply with	53	9	59	20	57	29

Note: Response "c" was not offered to the Chemistry respondents; total percent for that response is a projection.

22. Where do you feel the primary responsibility should lie for devising methods to make hazardous waste disposal easier for laboratory personnel?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	%	no.	%	no.	%	no.
a) EH&S	71	12	79	27	76	39
b) The people in the labs	12	2	29	10	24	12
c) Departments	29	5	6	2	14	7
d) The University Administration	6	1	3	1	4	2
e) Safety Committees	-	-	12	4	(12)	-
f) Principal Investigators	-	-	9	3	(9)	-

Note: Responses "e" and "f" were not offered to the Chemistry personnel.

23. Would you be willing to spend time coordinating a plan with your building/department/lab/EH&S, if it would mean you could dispose of your waste properly when you want to (it could take several hours to work out such a plan)?

	<u>Chemistry</u>		<u>Others</u>		<u>Total</u>	
	percent	number	percent	number	percent	number
YES	-	-	44	15	44	15
NO	-	-	32	11	32	11

This question was not asked in the Department of Chemistry.

**Are Hazardous Waste Disposal Procedures Difficult to Comply With?** This is the question that survey question 21 deals with. Fifty-seven percent of those surveyed feel that the current campus hazardous waste disposal procedures are "not a real problem to comply with." The question remains as to whether 57 percent is a high figure or a low one. Apparently, 43 percent have at least some difficulty complying with procedures and 10 percent feel that they are "very difficult to comply with," including 18 percent in the College of Chemistry, where more waste is generated than in any other department.

From the data alone I would say that lab personnel have some difficulties disposing their waste. The reasons for this conclusion are:

1. Fifty-seven percent is not a high figure, considering the seriousness of hazardous waste disposal. Ideally, 100 percent would say they did not have a problem complying; a figure under 90 percent is, in my opinion, unacceptable. If only 10 percent of the hazardous waste generated does not get disposed of properly because the procedures are too difficult, several tons of toxic substances could enter the public waste stream each year. A source in the Physics department with over 30 years experience expressed doubt that even 50 percent of the hazardous waste generated in that department is disposed of properly.

2. The survey results are biased toward seeming compliance with procedures. This bias occurs because the questions on the survey required some experience in hazardous waste disposal. Almost all the people who participated in the survey are laboratory safety representatives or are otherwise responsible for laboratory hazardous waste disposal. These people are generally the most knowledgeable and best trained lab personnel on campus regarding waste disposal procedures.

Therefore, the question is, if 43 percent of the best-trained people on campus have some trouble with waste disposal, what about those who are not so well trained? Several safety representatives explained to me that it is impossible for them to monitor everyone in the lab, and some even do not want to be referred to as "safety reps" because they do not want to be held responsible for the actions (or inactions) of other lab workers. A few questionnaire respondents used phrases such as "the people have to care" in describing how the present waste disposal system might be improved. Several people wrote that stronger enforcement of procedures is necessary; apparently the lab



safety representative working alone is not enough, and many Principal Investigators are disengaged from their labs. A Chemistry researcher wrote that

*In many labs the students don't care about safety and proper chemical disposal. Appointing a safety monitor may have no effect if the students don't feel a responsibility toward this critical issue. In that case it is the responsibility of the faculty in charge of the lab to insure proper procedures are being carried out. However, it is our experience that most faculty are not very concerned, are rarely in their labs and haven't the foggiest idea whether their students are following proper procedures. EH&S and the colleges and departments must apply pressure to the faculty to be actively concerned and involved in lab safety and chemical disposal.*

A safety representative who works in the Molecular Biology-Virus Lab wrote about her experience:

*Safety Reps are appointed by the chairman of the department of principal investigators. We (most of us) do not volunteer for this responsibility. Although I try my best, it is a burden to do extra work for no recognition, and we do get more exposure to radiation and hazardous waste. We are neither rewarded for carrying this responsibility nor recognized in any form. Instead we get humiliated by some of the people in lab. I strongly think it is time that the safety committee take the issue of choosing and giving recognition to safety reps more seriously.*

## **Recommendations**

Although laboratory personnel have some difficulties discarding their hazardous waste, not all of the problems they have come from EH&S procedures. Some problems arise from departmental negligence in enforcing proper procedures. Therefore, I have two sets of recommendations.

**For the Departments:** The departments can do a great deal to encourage hazardous waste disposal and make compliance easier for laboratory personnel. First, the departments must make sure that new graduate students or lab employees are fully trained before they are allowed to work in the labs. Second, lab workers should not be allowed to quit the lab unless and until they account for the hazardous substances they use. Also, the departments can organize a cooperative effort among the laboratories to collect packing materials and distribute them as needed. Although some departments already have one or more of these policies, it is not clear that all the lab personnel are aware of them. Therefore, it is also important that the departments keep the labs informed about all aspects of departmental waste disposal policy.

Most importantly, the departments must find a way to enforce proper procedures within their labs more effectively. Giving more authority and recognition to safety representatives (as well as more money) would be a start, but ultimately, the departments may have to provide additional incentives to those employees or students who fail to follow guidelines after they have been notified of them.

**For EH&S:** EH&S should institute a training program at the beginning of each semester for new graduate students and lab employees. Each person working in the lab should know or be able to find out which chemicals he or she uses are hazardous. In addition, an EH&S representative should visit each lab to go over procedures and arrange for scheduled pick-ups instead of mail requests, except for the very small labs. EH&S should be able to make safe containers available to the laboratories. If it is true that presently the campus is properly disposing of only half of the hazardous waste it generates, then a doubling in volume and increased training expenditures that would accompany a more vigorous disposal program would mean a great increase in the EH&S budget. I feel that the UC campuses ought to go to the state legislature for these funds (as opposed to asking the Principal Investigators for more overhead money), because the costs of disposal were underestimated in the first place.

### References

- Jolly, Jennifer, and A.M. Ujihara, 1983. Discharge of chemical wastes into the University of California, Berkeley, sewer system. In *Berkeley water: issues and resources*: Doris Sloan and Scott Stine, eds.; UC Berkeley Environmental Sciences Senior Seminar report, Berkeley, CA, pp. 281-305.
- Schultheis, Carla, 1984. A guide to the disposal of toxic chemicals in UC Berkeley laboratories. In *Hazardous substances: A community perspective*; Doris Sloan, ed.; UC Berkeley Environmental Sciences Senior Seminar report, Berkeley, CA, pp. 199-207.
- University of California, Berkeley, Department of Chemistry, 1987. *Who does it and where to find it*. Departmental manual, 51 pp.
- University of California, Berkeley, Office of Environmental Health and Safety, 1985. Hazardous waste disposal procedures. Interdepartmental memos, 8pp.