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Hutchison Hall: Noisier Than Other Facilities on the University of Rochester River Campus*

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Noise

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Summary

Sound level measurements of the background noise levels in library, laboratory and classroom space within Hutchison Hall, a new Chemistry-Biology building on the University of Rochester River Campus, show that certain areas are two to eight times noisier than comparable facilities in older buildings. Noise levels in the library, laboratories and certain classrooms exceed recommended standards. Measurements within Hutchison Hall indicate that the sources of the high noise levels are the ventilating hoods, ductwork, and associated machinery.

Background

Hutchison Hall is the new Chemistry-Biology building on the University of Rochester River Campus. The building provides more spacious quarters and improved laboratory facilities compared to the previous facilities. The laboratory areas are equipped with extensive ventilating hood systems and air flow is designed to assure rapid exchange of laboratory air. The library and most of the classrooms located in the center of the building also have ventilation systems providing rapid exchange of air.

It was immediately observed by the occupants of the building that the new quarters are in general substantially noisier than the previous facilities. In some cases classes in noisy rooms were rescheduled to other areas where noise levels were lower. The present bulletin serves to quantify the background noise levels in several areas in Hutchison Hall and provides a comparison with comparable facilities elsewhere on campus and with recommended standards. As the air flow within the building is "balanced" and acoustical treatment is applied to remedy excessive noise levels, the improvement can be evaluated relative to the values reported here.

A discussion of the decibel (db) scale has been presented in Bulletin #146 along with tables of typical values (6).

Methods

A General Radio 1551c Sound Level Meter which meets ASA standard S1.4 was used for all measurements. The unit was calibrated with a General Radio 1562-A Sound Level Calibrator both before and after use. The meter readings were very repeatable, not varying more than two tenths of a db during repeated calibration checks made over a two hour period of use. Both the A and C scale calibration values (the scales used in the measurements) were within two tenths db of the nominal values except for 125 Hertz on the C scale which read 1.5 db low. This calibration is within the acceptable variation of the meter. All measurements except those of the classrooms in Hutchison

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Hall were taken during a two hour period on September 1, 1972; the classroom measurements in Hutchison Hall were taken on September 20, 1972. All measurements were made by locating the meter on a bench top or desk (the meter has rubber vibration isolation feet) and the readings were taken when there were no extraneous sounds (telephones, conversations, etc.). The measured values are therefore typical of the background levels present at each location. Each area (except L 119) contained the normal furniture and equipment, but was essentially empty of its normal school year occupants.

Results

In the Appendix are given individual observations of background noise levels in Hutchison Hall. A summary of typical location values is given in Table 1. The A scale and C scale values in Table 1 are not those found at any one location but are representative of the values observed for general types of areas.

Table 1. Typical values of background noise levels found on the U. of R. River Campus. The recommended values are from Noise and Vibration Control, by L. L. Beranek, McGraw-Hill, p585.

	dba	dbc		dba	dbc
<u>Libraries</u>			<u>Laboratories</u>		
Hutchison	55	78	Hutchison		
others	43	63	undergraduate	65	82
recommended	38-47		research	60	72
			Lattimore	47	62
<u>Corridors</u>			recommended	42-52	
Hutchison	44	71	<u>Classrooms</u>		
others	46	63	Hutchison		
			(central a.c.)	64	77
			(without air ducts)	47	66
			recommended	38-47	

Discussion

The dbA measurements reported here provide the best measure of the loudness of the background noise at each location. This scale is weighted to closely match human ear response, having decreased emphasis of the low frequency end of the spectrum. Also included are measurements on the dbc scale, which has an approximately flat (less than 5db range) response throughout the audible frequency range (1). For most noise sources the C scale will give higher values than the A scale. The difference between the A and C scales provides an approximate measure of the low frequency components and is useful in characterizing noise sources.

Recommended maximum noise levels (2,3) are included in Table 1. The range given in these recommendations goes from the optimum consistent with the intended usage to an upper limit which "should only be used for situations whose economy or the physical situation imposes conditions that make it impractical to achieve lower levels" (2).

In almost every case, the noise levels in Hutchison Hall are at least ten dbA and dbC greater than comparable locations elsewhere on campus. The principal exception to this is in corridors for which the dbA readings are slightly lower but the dbC readings are up to 9 dbC higher. Comparison of the A and C scales shows that in general there is a larger component of low frequency noise in Hutchison Hall compared to other buildings. In most cases the noise levels exceeded recommended maximum levels by as much as 18-19 dbA.

The library in Hutchison Hall (Carlson Library) is particularly noisy. The noise level is typically 24 dbA, greater than five times noisier than parts of Rush Rhees Library and exceeds the upper limit of the recommended maximum levels by 9 dbA. Where the sources of noise can be identified by ear, they are low frequency sounds from the air conditioning system and occasionally vibration of the ductworks. It is interesting to note that it is substantially quieter in the hall outside the library than within the library itself.

The noise levels in classrooms exceeded the maximum recommended levels by 10-14 dbA, except for L 429, which is not equipped with air conditioning vents. Because of excessive noise levels, several classes were rescheduled to other locations on campus.

The laboratories are also very noisy. Typical undergraduate laboratories exceeded preferred levels by 20 dbA, i.e. they are four times noisier than desired. In at least one case, the noise level in front of a hood is only a few dbA less than the maximum 8 hour exposure limits set by Federal labor laws for working conditions (4). Although the noise levels are highest near the hoods, the noise levels in all parts of the labs are substantially in excess of recommended values.

The principal source of the noise in Hutchison Hall is clearly the air conditioning system, since areas not having central air conditioning (perimeter offices, hallways, and certain classrooms) are typically 20 db quieter than adjacent centrally air conditioned areas. In almost all cases these areas have noise levels within the maximum recommended limits. Classical noise reduction techniques including the installation of sound absorbent and isolation joints in the ductwork system and reduction of the air velocity in areas not requiring rapid exchange of air (e.g. classrooms and the library) might reduce the noise levels of these areas (5,6).

References

- (1) A.P.G. Petersen and E.E. Gross Jr., Handbook of Noise Measurement, 7ed., General Radio, 1972 p 8
- (2) L.L. Beranek, Noise and Vibration Control, McGraw-Hill p 585 (1971)
- (3) V.O. Knudsen and C.M. Harris, Acoustical Designing in Architecture, Wiley, 1950, p 221
- (4) Walsh-Healy Act, Federal Register, vol 34, #96, part 2, pp 7946-9
- (5) an overview of the noise pollution problem is given in "The Noise Around Us" The Report of the Panel on Noise Abatement, U.S. Dept. of Commerce, Sept. 1970
- (6) See R. Lee, R.C.S.I. Bulletin #146 and Environmental Quality, the first annual report of the Council on Environmental Quality, 1970, p 125

- (7) Relative loudness, i.e. "How much noisier is sound X than sound Y?" is a subjective question that will vary from observer to observer. The answer also depends for any observer on the frequency spectrum of the noises being compared. In order to give the reader some feeling for the sound levels measured here, a gross simplification is used in determining the "noisiness" of different locations. First, the dbA sound level measurements are taken as the measurement of a simple tone. Then the Steven's Loudness Rule, loudness approximately proportional to the sound pressure raised to the 0.6 power, is used (Petersen and Gross, p.23). See R.C.S.I. Bulletin #146 for a complete discussion of loudness.

Appendix. Listing of all noise measurements.

<u>Location</u>	<u>dbA</u>	<u>dbc</u>	<u>Location</u>	<u>dbA</u>	<u>dbc</u>
<u>Hutchison Hall</u>			<u>Dewey Hall</u>		
lab 119 hood end	65	84	library(fan)	45	61
benchttop	66		<u>Lattimore Hall</u>		
opposite end	62	82	lab 412	48	60
lab 119a hood end	65	81	lab 405	45	60
opposite end	61	76	lab 456	47	67
lab 119d	70	82	hall near library	45	62
lab 107 sink end	70	85	<u>Bausch & Lomb Hall</u>		
*lab 107	65	78	library	45	69
*next to hoods	65	79	corridor	48	64
*at hood	81	96	<u>Rush Rhees Library</u>		
library			card catalog area	40	60
journal room	53	73	main reading room		
center-south end	56	86	(fan noise)	51	60
reference	56	82	stacks (2a)	32	58
corridor outside					
library	44	71			
lab 417					
hoods off	60	72			
hoods on & open	63	76			
*in hood	67	80			
office P 443	43	58			
main lobby	48	63			
classrooms					
*025 far end	66	76			
*025 by air vents	66	78			
*429 (no room vents)	47	66			
*428	62	76			
*430	62	77			

* measurements made on 9-20-72; all others 9-1-72