

Second Air Analyses in the Denver Region

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A previous bulletin (CFGA 225) reported on a spot air sample analysis in the Denver region. Ethylene concentrations in excess of 100 ppb were reported. Beginning in June of 1970, equipment was obtained for the purpose of analyzing samples for several hydrocarbons often found in polluted air. In February 1971, sample bottles were distributed to growers in the Denver region and the

growers were requested to take outdoor air samples at 0800 hours twice weekly. The bottles were brought to Fort Collins and analyzed for ethylene, ethane, acetylene, and methane. The mean concentrations and extreme ranges of ethylene for the period 28 January through 25 February are given in Figure 1. The data for methane, ethane, and acetylene are shown in Table 1.

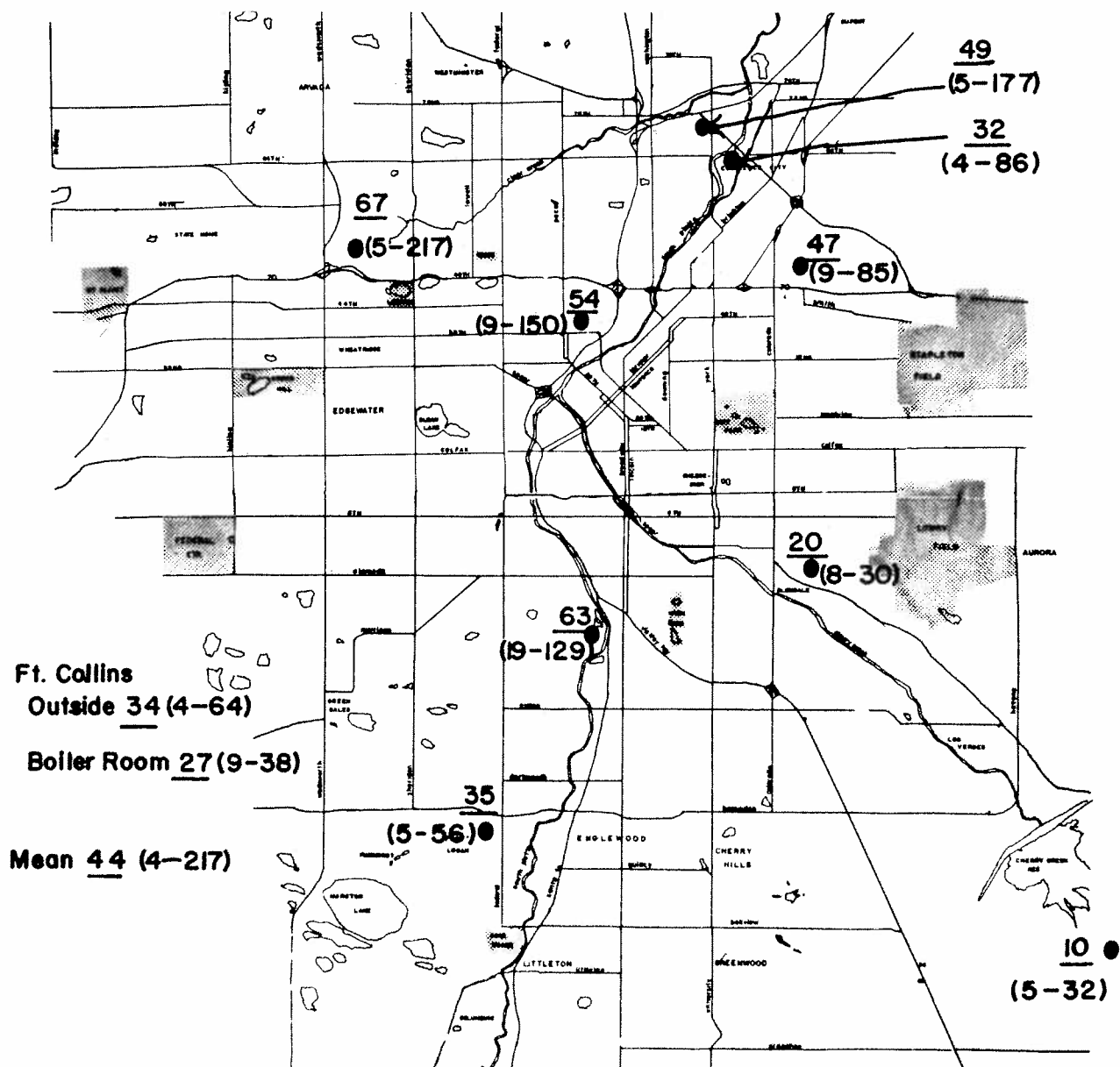


Figure 1. Ethylene concentrations at, or near, 0800 hours for several locations in the Denver region. Underlined figures give mean concentrations; figures in parentheses show extreme values in parts per billion.

The period between 0600 and 0900 hours, approximately, has been shown to be the period when hydrocarbon concentrations are likely to be highest. It should be emphasized that the values are good only for the period at which sampled and say nothing about whether that particular concentration existed for a time sufficient to damage flower crops. Ethylene will reduce carnation keeping life if 50 ppb exist for 24 hours at room temperature. Whether 50 ppb for short periods over a longer time span will reduce keeping life is not known. Ethylene will seriously reduce internode length on carnations, but whether concentrations of 100 or more ppb for short durations, spaced over the life of the crop, will result in an observable stem shortening is not known.

In order to assess the significance of the concentrations reported here, it will be necessary to obtain good weather records for the time at which the samples were taken. We hope to be able to do this starting next fall when the City of Denver will have in operation five weather stations giving wind direction and wind speed. These two factors, in conjunction with temperature profiles above the ground, should give us an idea as to duration. Usually, the stronger a temperature inversion the more likely there are to be high ethylene concentrations, and when this inversion breaks, the hydrocarbon levels will decrease. High concentrations found in this survey were generally associated with inversions and calm weather. Denver's air pollution agency forecasts each day the strength of the inversion and the time when it will break. With the new installations next fall we should obtain hard information as to possible economic loss to the greenhouse industry. This survey has allowed us to determine the problems that will be encountered.

Despite limited value, the data confirms several opinions held previously. First, pollution will be highest in the north Denver region, with best sites for greenhouses situated south-southeast of the city. Second, even with sites close to each other, concentrations may vary significantly; and without continuous analyses, which would be prohibitively expensive, we will not be able to determine a precise level of ethylene exposure for any particular Denver location. We can only indicate general levels for a large area. Third, the relative amounts of ethane and methane, as contrasted to ethylene and acetylene, indicate the source of pollution. Thus, high concentrations of methane and ethane suggest leakage from natural gas sources; this is certainly the source of the high levels found in the boiler room at Colorado State University. High levels of ethylene and acetylene suggest incomplete combustion and automobile emission. In spite of the Fort Collins area's smaller size, and the smaller numbers of cars compared to Denver, ethylene concentrations in the danger level did occur occasionally. Research carried out must take this factor into account. Fourth, ethylene levels inside the greenhouse may not be the same as those outside. At the Colorado State University Lake Street range, ethylene concentrations during pollution episodes were usually lower inside the boiler room than outside. But the concentrations did not drop as low as those sometimes obtained outside. This suggests a low grade source of ethylene inside—either vegetation, decaying materials, or incomplete combustion.

Very close coordination will be required in the fall of 1971 if analyses are to be obtained with ball park figures, upon which the industry can base valid decisions.

Location	No. of samples	Methane ^a		Ethane ^b		Acetylene ^b	
		Mean	Range	Mean	Range	Mean	Range
6011 S. Parker Road	6	1.649	(1.4-1.9)	9	(3-26)	12	(2-40)
6141 Steele Street	6	1.860	(1.5-2.6)	22	(5-47)	39	(5-140)
3651 S. Sheridan	7	1.905	(1.8-2.4)	20	(9-35)	50	(5-105)
5050 Leetsdale	3	1.959	(1.8-2.3)	16	(8-28)	30	(8-51)
3949 Mariposa	7	1.942	(1.7-2.2)	25	(11-48)	90	(13-257)
6495 York Street	8	2.252	(0.7-5.6)	39	(11-150)	102	(4-483)
5190 Marshall	7	2.887	(1.4-6.4)	31	(4-66)	122	(5-366)
852 S. Jason	7	2.299	(1.6-3.4)	36	(12-83)	111	(25-228)
4800 Dahlia	9	2.469	(1.3-8.2)	29	(7-71)	63	(11-118)
Mean	60	2.158		26		72	
Lake Street, Fort Collins	1.795 (1.8-2.1)	19 (5-30)	82 (11-196)				
Lake Street, Boiler Room	7.838 (4.9-10.1)	528 (250-687)	34 (5-67)				

^aConcentration in parts per million

^bConcentration in parts per billion

Table 1. Methane, ethane, and acetylene concentrations in ambient air at, or near, 0800 hours in the Denver region.