# IV. AN EXPERIMENTAL INVESTIGATION OF CHAMBER-DEPENDENT RADICAL SOURCES

## A. Introduction

An important aspect of the development of reliable computer models for the formation of photochemical smog is their validation against environmental chamber data. This requires not only a complete understanding of the kinetics and mechanisms of the chemical reactions which occur during the photooxidations of part-per-million (ppm) concentrations of $NO_x$ and organics in air, but also an adequate and quantitative understanding of chamber effects.

At the present time, although detailed mechanisms of the $NO_x$ photooxidations of certain alkanes, alkenes and aromatics are qualitatively or semi-quantitatively accurate, all such recent computer models have invoked the presence of uncharacterized sources of radicals in order to match computer-predicted time-concentration profiles with the data from environmental chamber experiments (Hendry et al. 1978, Falls and Seinfeld 1978, Carter et al. 1979a, Whitten et al. 1979, 1980; Atkinson et al. 1980). To date, modelers have differed on how best to represent this radical source in their mechanisms, although it is generally assumed to be chamber-dependent. In recent studies, Falls and Seinfeld (1978) and Whitten et al. (1979, 1980) have postulated the presence of initial nitrous acid (HONO), presumably formed heterogeneously during the injection of $NO_x$. In contrast, Carter et al. (1979a) and Atkinson et al. (1980) have used a constant radical flux, assumed to be hydroxyl radicals, while Hendry et al. (1978) have used a combination of the two approaches (i.e., initially present HONO and a constant radical source, in their case of $HO_2$ radicals).

These approaches are significantly different. The use of initial HONO leads to a rapidly decreasing radical flux over the time scale ~30-60 min. On the other hand, a constant radical source results in a considerably greater total radical input during a typical 6- to 10-hr environmental chamber irradiation, but with relatively lower radical concentrations during the first 30-60 min. Clearly, aspects of the photochemical mechanisms relating to radical initiation and termination processes cannot be

unambiguously validated using environmental chamber data until this presently poorly characterized radical source is elucidated.

During the past two years, we have developed an approach allowing a systematic investigation of these effects. This involves the irradiation of $NO_x$-air mixtures, with trace levels of organics present to monitor OH radical concentrations. While we have reported much of these data in our previous final report, ARB Contract No. A8-145-31 (Pitts et al. 1981), we have carried out numerous further experiments to (a) validate the experimental technique, (b) to obtain more detailed data for the SAPRC ~6400-ℓ evacuable chamber and (c) to obtain direct measurements of HONO levels both prior to and during these irradiations. In addition, we have carried out a re-analysis of our earlier data and, while the resulting differences do not alter our conclusions, minor changes in the data have occurred. Thus we report here our total data base concerning this important topic. Although these data do not allow the exact nature of the excess radical source to be established, the results of these experiments lead to a better understanding of the characteristics and magnitude of this effect.

## B. Experimental

The experiments consisted of $NO_x$-air irradiations carried out in four different environmental chambers employing differing light sources. Initial NO concentrations ranged from ~0-3.6 ppm and initial $NO_2$ from ~0.04-4.9 ppm. In addition, ~10 ppb each of two organics which react with the hydroxyl radical at significantly different rates were included in the reaction mixture in order to monitor OH radical levels from their relative rates of consumption (see Discussion for details and derivation of this technique). This use of two tracers to monitor OH radical levels has the advantage over using a single tracer in that the OH radical concentration is related only to the changes in their ratios (see Discussion), and not to their absolute concentrations. This eliminates the necessity to correct for dilution due to sample withdrawal from the chamber and avoids errors due to differences in sample sizes, since both species are analyzed on the same gas chromatographic column (Atkinson et al. 1978). Three pairs of organic tracers were used to monitor OH radical concentrations in these $NO_x$-air irradiations: propene/propane, propene/n-butane and

n-butane/neopentane. The propene/propane and propene/n-butane tracers were most frequently employed because of their higher sensitivity.

The chambers and experimental techniques employed in this study were as described below:

(1) The majority of irradiations were carried out in the SAPRC 5800-ℓ evacuable, thermostatted, Teflon-coated environmental chamber equipped with a 25 KW solar simulator. The characteristics and operating procedures of this environmental chamber-solar simulator facility have been described in detail previously (Winer et al. 1980), and only the pertinent details will be briefly discussed here.

The solar simulator, employing a 25 KW point source xenon arc, provides a well-collimated light beam which, to a large extent, does not illuminate the chamber walls, thus minimizing wall photochemistry. In all experiments reported here, a 6.3-mm thick Pyrex pane was used to obtain a spectral distribution which approximates that in the lower troposphere. The light intensity within the chamber was routinely monitored by measuring the rate of photolysis of $NO_2$ in $N_2$ ($k_1$) by the method described by Holmes et al. (1973), but with updated rate constants (Hampson and Garvin 1978).

Between irradiations the chamber was evacuated overnight to $< 2 \times 10^{-5}$ torr. For the majority of experiments, the chamber was initially filled to ~10 torr with dry $N_2$, and then NO and $NO_2$ were flushed by a stream of ultra-high purity nitrogen into the chamber from an ~5-ℓ Pyrex bulb attached to a vacuum line. The NO was purified by passage through a trap containing activated Linde Molecular Sieve 13X, while $NO_2$ was prepared by reaction of this purified NO with $O_2$ which had also been passed through activated Molecular Sieve 13X. After the $NO_x$ injection, the chamber was filled to ~740 torr with purified matrix air (Doyle et al. 1977), and two organic tracers were injected using gas-tight, all-glass syringes.

For certain dry runs and the 100% relative humidity (RH) runs, special procedures were used during the air fill. For the dry runs (EC-439, 443, 444, 449 and 453), the chamber was filled to ~150 torr with the evaporate from liquid $O_2$, and then filled to atmospheric pressure with the evaporate from liquid $N_2$. In order to obtain water saturation in the 100% RH, high-temperature run (EC-450), the requisite quantity of liquid water was injected into the heated, evacuated chamber prior to the pure

air fill. For the 100% RH runs at lower temperatures, the purified matrix air was humidified at a temperature somewhat higher than that of the chamber.

Nitrogen oxide and $NO_2$ were monitored using commercial continuous chemiluminescence $NO-NO_x$ analyzers fitted with a nylon filter in the sample line to remove possible $HNO_3$ interferences in the $NO_2$ analyses. Although $O_3$ was not expected to be formed to any measurable extent in these runs, this was verified for most runs using a commercial ultraviolet absorption $O_3$ monitor. The organic tracers (propane, propene, n-butane and neopentane), benzaldehyde and background levels of other organics and CO were monitored by gas chromatography (Pitts et al. 1979, Winer et al. 1980). Formaldehyde was monitored by an improved chromatropic acid method (Pitts et al. 1979, Winer et al. 1980). In a limited number of experiments, HONO was monitored in situ by differential optical absorption spectroscopy with a multi-pass optical system (see Section III).

(2) A more limited set of irradiations was carried out in the SAPRC ~6400-ℓ indoor all-Teflon (FEP, 2 mil thickness) chamber. Irradiation was provided by two diametrically opposed banks of 40 Sylvania 40-W BL lamps, backed by arrays of Alzak-coated reflectors. The light intensity in the chamber was controlled by switching off sets of lights as previously described (Darnall et al. 1981). The light intensities for the various levels of illumination were determined in separate experiments by measuring the rate of photolysis of $NO_2$ in $N_2$ using the quartz tube, continuous flow technique of Zafonte et al. (1977).

Before each experiment, the chamber was flushed with dry purified air for ~2 hr at a flow rate of ~330 ℓ $min^{-1}$, and then with air at the desired relative humidity for ~1 hr. All starting materials were injected using gas-tight, all-glass gas syringes and were flushed into the chamber using dry ultra-high purity $N_2$. Commercially available NO (Matheson, CP grade, 99.0% purity) was used without further purification, and $NO_2$ was prepared by diluting this NO with dry, pure $O_2$ in a syringe. The analytical procedures employed were the same as those used for the 5800-ℓ evacuable chamber runs (see above), except that HONO was not monitored.

(3) Several irradiations were carried out in ~40,000-ℓ outdoor Teflon (FEP, 2 mil thickness) chambers with natural sunlight irradiation. The techniques used were generally similar to those used for the

indoor all-Teflon chamber described above, except that prior to irradiation the chamber was covered with an opaque tarp. The light intensity was monitored using a UV radiometer, and the $NO_2$ photolysis rate was estimated from these measurements using the empirical formula derived for this purpose by Zafonte et al. (1977).

(4) A few irradiations were also carried out using newly constructed ~100-ℓ Teflon (FEP, 2 mil thickness) bags and an array of fluorescent lamps yielding an $NO_2$ photolysis rate $k_1$ of 0.27 $min^{-1}$. In this system, NO and $NO_2$ and the propane and propene were injected into the bag by gas-tight, all-glass syringes, and the bag was then filled with ultra-high purity dry air. The light intensity was determined by measuring the photolysis rate of $NO_2$ in $N_2$ as described above for the indoor Teflon chamber.

The physical characteristics of the four chambers employed in this study are summarized in Table IV-1.

## C. Results

Standard Tracer-$NO_x$ Experiments: Effects of Chamber, Initial Reactant Levels and Physical Parameters. Tables IV-2 through IV-5 give the experimental conditions, the chamber history (where applicable), the observed NO conversion rates and the initial and final OH radical levels for all of the standard tracer-$NO_x$ experiments carried out in this study. Plots of ln([propane]/[propene]) or of ln([n-butane]/[propene]) versus time, from whose slopes the hydroxyl radical concentrations are derived, are shown in Figures IV-1 and IV-2 for several representative tracer-$NO_x$ runs. In general, as seen from these figures, for runs at $T \lesssim 303$ K, RH $\lesssim$ 50% and $[NO]/[NO_2] > 1$, the OH radical levels remained essentially constant during the 2-hr irradiations, while runs where $T \gtrsim 303$ K, RH > 50% or $[NO]/[NO_2] \lesssim 1$ generally had initially higher OH radical levels which decreased to a constant value after ~30-60 min.

It can be seen from Tables IV-2 through IV-5 that a number of replicate runs were carried out under standard conditions [NO ~0.4 ppm, $NO_2$ ~0.1 ppm, ~50% RH (evacuable chamber and indoor Teflon chamber), < 10% RH (small bags), maximum light intensity] in the various indoor chambers. These tables show that duplicate irradiations gave hydroxyl radical levels

Table IV-1. Physical Characteristics of the Four Chambers Used

| | Evacuable Chamber | Indoor Teflon Chamber | Outdoor Teflon Chamber | Teflon Bag |
|---|---|---|---|---|
| Location | Indoors | Indoors | Outdoors | Indoors |
| Volume (liters) | 5800 | ~6400 | ~40,000 | ~100 |
| Surface Material | Teflon (TFE)-coated aluminum | FEP Teflon | FEP Teflon | FEP Teflon |
| Irradiation Source | Xenon arc | Fluorescent blacklight | Sunlight | Fluorescent blacklights |
| $NO_2$ Photolysis Rate ($k_1$) | 0.49 $min^{-1}$ [a] | ~0.45 $min^{-1}$ [a] | ~0.3 $min^{-1}$ | ~0.27 $min^{-1}$ |
| Intensity Profile | Constant | Constant | Diurnal | Constant |
| $NO_x$ Injection Technique | Vacuum | Syringe | Syringe | Syringe |

[a]Typical value. Other values of $k_1$ used (see Table IV-2).

Table IV-2. Conditions and Selected Results for Evacuable Chamber $NO_x$-Air Irradiations

| Run No. | Run Conditions[a] | T (K) | $k_1$ ($min^{-1}$) | RH (%) | Initial NO (ppm) | Initial $NO_2$ (ppm) | Average [OH] ($10^6$ Radicals $cm^{-3}$)[b] 0-60 min | Average [OH] ($10^6$ Radicals $cm^{-3}$)[b] 60-120 min | Flux (ppb-$min^{-1}$) | -d[NO]/dt[c] (ppb $min^{-1}$) Obs | -d[NO]/dt[c] (ppb $min^{-1}$) Calc | -d[NO]/dt[c] (ppb $min^{-1}$) Obs-Calc | Est.[d] Init. HONO (ppb) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 453 | | 284.5 | 0.49 | dry | 0.403 | 0.109 | 1.4 | 1.6 | 0.12 | 0.16 | 0.17 | -0.01 | 3 |
| 584 | | 283.3 | 0.47 | dry | 0.456 | 0.119 | 0.6* | 0.9 | 0.08 | - | - | - | |
| 601 | | 284.8 | 0.44 | dry | 0.393 | 0.104 | 1.0 | 0.7* | 0.05 | - | - | - | - |
| 505 | P=500 | 282.1 | 0.44 | dry | 0.449 | 0.120 | 1.4 | 1.3 | 0.09 | 0.24 | - | - | |
| 511 | P=500 | 281.2 | 0.44 | dry | 0.392 | 0.115 | 1.0* | 1.1* | 0.07 | 0.20 | - | - | |
| 507 | A,P=500 | 283.3 | 0.44 | dry | 0.814 | 0.191 | 0.3** | 0.9* | 0.10 | 0.35 | - | - | |
| 455 | A | 283.4 | 0.49 | 21 | 0.120 | 0.360 | 2.5* | 1.6* | 0.31 | 0.16 | 0.23 | 0.07 | 16 |
| 452 | | 284.7 | 0.49 | ~50 | 0.375 | 0.091 | 1.9 | 2.1 | 0.14 | 0.18 | 0.19 | -0.01 | 4 |
| 454 | | 284.0 | 0.49 | ~100 | 0.373 | 0.081 | 4.3 | 4.9 | 0.29 | 0.24 | 0.52 | -0.28 | 8 |
| 443 | | 303.0 | 0.49 | dry | 0.411 | 0.099 | 2.4 | 2.6 | 0.16 | 0.15 | 0.24 | -0.09 | 4 |
| 444 | | 303.6 | 0.49 | dry | 0.413 | 0.114 | 2.3 | 2.2 | 0.15 | 0.49 | 0.22 | 0.27 | |
| 534 | | 301.4 | 0.37 | dry | 0.390 | 0.107 | 1.2 | 1.3 | 0.09 | 0.10 | - | - | |
| 574 | | 305.0 | 0.47 | dry | 0.441 | 0.126 | 1.8 | 2.0 | 0.16 | | | | |
| 439 | B | 303.1 | 0.49 | dry | 0.387 | 0.081 | 7.5 | 5.1 | 0.23 | 0.20 | 0.59 | -0.39 | |
| 535 | A | 302.8 | 0.37 | dry | 3.280 | 0.878 | 1.0** | 0.8** | 0.36 | - | | - | - |
| 535 | A,C,D | 302.8 | 0.37 | dry | 3.580 | 3.110 | 1.3** | 1.0** | 0.75 | - | | | |
| 536 | A | 302.7 | 0.37 | dry | 0.0 | 4.880 | 1.0 | 0.4** | 0.63 | | | | |
| 536 | A,C,E | 302.7 | 0.37 | dry | 0.175 | 4.470 | 2.4** | 0.6** | 0.84 | | | | |
| 577 | P=500 | 304.9 | 0.47 | dry | 0.480 | 0.079 | 1.5 | 2.1 | 0.10 | | | | |
| 579 | P=350 | 303.6 | 0.47 | dry | 0.464 | 0.094 | 1.4* | 2.2* | 0.11 | | | | |
| 582 | P=150 $O_2$ + 200 $N_2$ | 304.2 | 0.47 | dry | 0.352 | 0.096 | 1.8 | 1.5* | 0.07 | - | | - | - |
| 434 | | 302.6 | 0.49 | 40 | 0.398 | 0.075 | 4.1 | 4.2 | 0.30 | 0.59 | 0.47 | 0.12 | |
| 435 | | 303.9 | 0.49 | 40 | 0.382 | 0.087 | 4.2 | 4.5 | 0.30 | 0.35 | 0.36 | -0.01 | |
| 441 | | 303.4 | 0.49 | 45 | 0.431 | 0.104 | 5.2 | 3.8 | 0.29 | 0.67 | 0.53 | 0.14 | |
| 457 | | 303.4 | 0.49 | ~45 | 0.403 | 0.093 | 3.8 | 4.2 | 0.26 | 0.45 | - | - | 10 |
| 462 | | 303.4 | 0.49 | ~45 | 0.409 | 0.096 | 3.8 | 3.5 | 0.25 | 0.36 | 0.50 | -0.14 | |
| 600 | | 303.3 | 0.44 | 50 | 0.454 | 0.114 | 2.5 | 3.1 | 0.23 | - | - | - | - |

(continued)

Table IV-2 (continued) - 2

| Run No. | Run Conditions[a] | T (K) | $k_1$ ($min^{-1}$) | RH (%) | Initial NO (ppm) | Initial $NO_2$ (ppm) | Average [OH] ($10^6$ Radicals $cm^{-3}$)[b] 0-60 min | Average [OH] ($10^6$ Radicals $cm^{-3}$)[b] 60-120 min | Flux (ppb-$min^{-1}$) | -d[NO]/dt[c] (ppb $min^{-1}$) Obs | -d[NO]/dt[c] (ppb $min^{-1}$) Calc | -d[NO]/dt[c] (ppb $min^{-1}$) Obs-Calc | Est.[d] Init. HONO (ppb) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 463 | F | 302.1 | 0.49 | ~45 | 0.326 | 0.172 | 2.5 | 2.7 | 0.25 | 0.23 | - | - | |
| 460 | G | 302.2 | 0.49 | ~45 | 0.409 | 0.063 | 8.4 | 5.3 | 0.34 | 0.55 | 0.27 | 0.28 | |
| 458 | C | 302.7 | 0.49 | ~45 | 0.379 | 0.081 | 4.5 | 4.8 | 0.27 | 0.39 | - | - | |
| 459 | H | 303.0 | 0.49 | ~45 | 0.354 | 0.100 | 4.6 | 4.7 | 0.27 | 0.27 | 0.24 | 0.03 | |
| 437 | A | 304.1 | 0.49 | 42 | 0.160 | 0.040 | 4.1 | 5.1 | 0.20 | 0.35 | - | - | 1.5 |
| 464 | A | ~303.0 | 0.49 | ~45 | 0.100 | 0.093 | 5.0 | 4.0 | 0.24 | 0.23 | - | - | 7 |
| 440 | A | 303.0 | 0.49 | 45 | 0.674 | 0.084 | 3.1 | 4.1 | 0.27 | 0.67 | 0.48 | 0.19 | 3 |
| 438 | A | 302.3 | 0.49 | 43 | 0.131 | 0.469 | 3.5* | 2.8* | 0.49 | 0.47 | - | - | |
| 442 | A | 302.9 | 0.49 | 52 | 0.117 | 0.369 | 6.8 | 3.3* | 0.49 | -0.01 | - | - | 50 |
| 465 | A | 302.7 | 0.49 | ~45 | 0.399 | 0.371 | 2.7* | 2.1* | 0.39 | -0.21 | 0.16 | -0.37 | |
| 436 | A | 301.7 | 0.49 | 45 | 1.426 | 0.364 | 2.4 | 2.3 | 0.47 | 0.39 | - | - | 15 |
| 462 | A,C,E | 305.6 | 0.49 | ~45 | 0.356 | 0.117 | 3.2* | 2.5* | 0.42 | 0.01 | - | - | |
| 463 | A,C,D | 302.0 | 0.49 | ~45 | 0.310 | 0.146 | 2.3* | 2.0* | 0.33 | 0.08 | 0.17 | -0.09 | |
| 469 | C,I | 302.8 | 0.50 | ~30 | 0.368 | 0.104 | 3.8 | 3.5 | 0.26 | 0.50 | 0.18 | 0.32 | |
| 458 | J | 302.4 | 0.25 | ~45 | 0.405 | 0.083 | 2.0 | 2.5 | 0.14 | 0.19 | - | - | |
| 457 | C,J | 302.9 | 0.25 | ~45 | 0.371 | 0.095 | 2.4 | 2.5 | 0.18 | 0.24 | - | - | |
| 469 | I,J | 302.8 | 0.25 | ~30 | 0.399 | 0.104 | 2.2 | 2.1 | 0.15 | 0.23 | 0.16 | 0.07 | |
| 538 | K | 302.3 | ~0.40 | 50 | 0.380 | 0.082 | 3.4 | 4.2 | 0.29 | 0.30 | - | - | - |
| 539 | A,K | 303.8 | ~0.40 | 50 | 0.107 | 0.356 | 4.8 | 3.7* | 0.59 | - | - | - | 25 |
| 540 | A,K | 303.4 | ~0.40 | 62 | 0.083 | 0.288 | 7.2 | 5.5 | 0.67 | - | - | - | 25 |
| 541 | A,K | 303.7 | ~0.40 | 50 | 0.378 | 0.324 | 2.8 | 2.2* | 0.34 | - | - | - | 12 |
| 542 | A,K | 303.6 | ~0.40 | 50 | 0.029 | 0.131 | 6.9 | 6.6 | 0.41 | - | - | - | 11 |
| 598 | A | 302.6 | 0.44 | 50 | 0.010 | 1.010 | 3.2** | 1.9** | 0.80 | - | - | - | - |
| 599 | A | 304.8 | 0.44 | 50 | 0.024 | 3.380 | 2.6** | 1.5** | 1.87 | - | - | - | - |
| 599 | A,C,E | 304.8 | 0.44 | 50 | 0.659 | 1.950 | 1.4** | 1.2** | 0.69 | - | - | - | - |
| 608 | A,Q | 302.0 | 0.37 | ~50 | 0.232 | 0.066 | 5.2 | 4.9 | 0.32 | - | - | - | - |
| 612 | A | 299.9 | 0.37 | ~50 | 0.275 | 0.041 | 2.9 | 4.6 | 0.24 | - | - | - | - |
| 613 | A | 301.6 | 0.37 | ~50 | 0.290 | 0.030 | 3.5 | 4.6 | 0.20 | - | - | - | - |
| 446 | | 303.1 | 0.49 | ~80 | 0.387 | 0.059 | 12.1 | 10.6 | 0.71 | 0.62 | 0.89 | -0.27 | |
| 445 | | 304.2 | 0.49 | 100 | 0.411 | 0.049 | 16.7 | 11.9 | 1.19 | 0.67 | 1.54 | -0.87 | 15 |

(continued)

Table IV-2 (continued) - 3

| Run No. | Run Conditions[a] | T (K) | $k_1$ ($min^{-1}$) | RH (%) | Initial NO (ppm) | Initial $NO_2$ (ppm) | Average [OH] ($10^6$ Radicals $cm^{-3}$)[b] 0-60 min | Average [OH] ($10^6$ Radicals $cm^{-3}$)[b] 60-120 min | Flux (ppb-$min^{-1}$) | -d[NO]/dt[c] (ppb $min^{-1}$) Obs | -d[NO]/dt[c] (ppb $min^{-1}$) Calc | -d[NO]/dt[c] (ppb $min^{-1}$) Obs-Calc | Est.[d] Init. HONO (ppb) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 449 | | ~323.0 | 0.49 | dry | 0.450 | 0.110 | 5.5 | 5.5 | 0.33 | 0.28 | 0.37 | -0.09 | 8 |
| 448 | | 323.4 | 0.49 | ~50 | 0.427 | 0.055 | 16.3 | 11.4 | 0.98 | 1.18 | 0.50 | 0.68 | 25 |
| 447 | | 323.0 | 0.49 | ~50 | 0.442 | 0.071 | 13.4 | 12.3 | 1.11 | 1.17 | 0.54 | 0.63 | |
| 451 | A | 325.3 | 0.49 | ~50 | 0.148 | 0.241 | 14.5 | 7.2 | 0.82 | 0.37 | 0.23 | 0.14 | |
| 450 | | 324.5 | 0.49 | 100 | 0.597 | 0.140 | 24.2 | 9.3 | 1.31 | 0.96 | 0.39 | 0.57 | >100 |

[a]Codes for special run conditions are as follows:
A - Nonstandard NO or $NO_2$ levels.
B - Immediately follows evacuated bakeout of chamber.
C - Second 2 hr of a two-part run. (If not specified, for a two-part run, data given is for first 2 hr.)
D - $NO_2$ added to the reaction mixture at the beginning of the second part of this run.
E - $O_3$ added to reaction mixture to convert NO to $NO_2$ at the beginning of the second part of this run.
F - $NO_2$ prepared by reacting $O_3$ with NO in the chamber.
G - NO injected into EC 27 hr prior to run. $NO_2$ not injected.
H - Syringe-injected $NO_x$.
I - Defocussed light source.
J - One-half light intensity.
K - Differential optical absorption system optics in place, causing some obstruction of light beam.
P = 350 - Run carried out at 350 torr total pressure.
P = 500 - Run carried out at 500 torr total pressure.
P = 150 $O_2$ + 200 $N_2$ - Run carried out at 350 torr total pressure, consisting of 150 torr of $O_2$ + 200 torr of $N_2$.
Q = Neopentane and n-butane tracers used (see text).

[b]Rate constants ($cm^3$ $molecule^{-1}$ $sec^{-1}$ units) used for the reaction of OH radicals with the tracers were [Atkinson et al. (1979)]: propane, $1.5 \times 10^{-11} e^{-1349/RT}$; n-butane, $1.76 \times 10^{-11} e^{-1110/RT}$; neopentane, $1.41 \times 10^{-11} e^{-1677/RT}$; propene, $4.1 \times 10^{-12} e^{1080/RT}$. Corrections for the consumption of propene by reaction with $O_3$ and $O(^3P)$ were applied using equation (V) and the $O_3$ + propene, $O(^3P)$ + propene, $O_3$ + NO and O + $O_2$ + M rate constants recommended by Atkinson and Lloyd (1983). Unless indicated as follows, this correction was less than 10% of the OH level given: * - correction between 10-25%, ** = correction greater than 25%.

[c]Rates given are for second hour of run.

[d]Initial HONO values which give best fits to the data in detailed model calculations, or, for runs with constant [OH], the photostationary state levels.

Table IV-3. Conditions and Selected Results for Indoor Teflon Chamber (ITC) $NO_x$-Air Irradiations

| ITC Run No. | Conditions[a] | $k_1$[b] ($min^{-1}$) | RH (%) | Initial NO (ppm) | Initial $NO_2$ (ppm) | Average [OH] ($10^6$ Radicals $cm^{-3}$) 0-60 min | Average [OH] ($10^6$ Radicals $cm^{-3}$) >60 min[c] | Radical Flux (ppb $min^{-1}$) | $-\frac{d[NO]}{dt}$ >60 min (ppb $min^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|
| 382 | | 0.45 | <10 | 0.334 | 0.578 | 1.5 | 0.5 | 0.02 | 0.005 |
| 383 | | 0.45 | <10 | 0.354 | 0.068 | 1.1 | 0.8 | 0.04 | 0.03 |
| 378 | | 0.45 | ~50 | 0.493 | 0.119 | 2.6 | 1.7 | 0.09 | 0.10 |
| 380 | | 0.45 | ~50 | 0.305 | 0.072 | 1.1 | 1.6[d] | 0.08 | 0.01 |
| 379 | A | 0.45 | ~50 | 0.098 | 0.222 | 1.8 | 1.3 | 0.16 | 0.12 |
| 377 | B | 0.45 | ~50 | 0.373 | 0.114 | 2.1 | 2.4 | 0.14 | 0.37 |
| 377 | C | 0.45 | ~50 | 0.266 | 0.098 | - | 1.6 | 0.11 | 0.31 |
| 377 | D | 0.35 | ~50 | 0.246 | 0.109 | - | 1.6 | 0.12 | 0.36 |
| 380 | D | 0.28 | ~50 | 0.312 | 0.076 | - | 1.3 | 0.06 | 0.13 |
| 380 | D | 0.2 | ~50 | 0.305 | 0.078 | - | 1.1 | 0.05 | 0.09 |
| 380 | D | 0.2 | ~50 | 0.300 | 0.080 | - | 0.6 | 0.03 | 0.06 |
| 381 | E | 0.2 | ~50 | 0.245 | 0.088 | - | 0.7[e] | 0.04 | 0.05 |
| 380 | D | 0.2 | ~50 | 0.297 | 0.083 | - | 0.6 | 0.03 | 0.07 |
| 381 | | 0.1 | ~50 | 0.295 | 0.088 | 0.7 | 0.4[f] | 0.02 | 0.01 |
| 526 | A | 0.31 | <10 | 0.481 | 0.729 | | 0.06 | ~0.02 | ~0.08 |
| 527 | | 0.31 | <10 | 0.490 | 0.136 | | 0.26 | 0.025 | 0.081 |
| 528 | A | 0.31 | <10 | 0.487 | 1.268 | | 0.22 | 0.15 | 0.47 |
| 529 | | 0.31 | ~50 | 0.476 | 0.152 | - | 1.1 | 0.10 | 0.33 |
| 530 | A | 0.31 | ~50 | 1.078 | 0.516 | - | 0.5 | 0.16 | 0.51 |
| 531 | A | 0.31 | ~50 | 0.471 | 1.204 | - | 0.5 | 0.29 | 0.93 |
| 537 | A | 0.31 | ~50 | 0.102 | 0.024 | - | 4.5 | 0.10 | 0.31 |
| 539 | A | 0.31 | ~50 | 0.100 | 0.019 | - | 3.4 | 0.09 | 0.29 |

[a]For all runs, T = 303 K. Codes for special conditions are shown below.
A - Nonstandard initial NO and $NO_2$ concentrations.
B - Previously unused bag.
C - Continuation of 4-hr run.
D - Continuation of run in which light intensity was incrementally reduced.
E - Continuation of run in which light intensity was incrementally increased.

[b]$k_1$ = $NO_2$ photolysis rate.

[c]Unless otherwise noted, data given are for a period of 60 minutes.

[d]Data are given for a period of 45 minutes.

[e]Data given are for 135 minutes.

[f]Data given are for 90 minutes.

Table IV-4. Conditions and Selected Results for Large Outdoor Teflon Chamber (OTC) $NO_x$-Air Irradiations

| OTC Run No. | Bag No. | Bag History[a] | T (K) | RH (%) | $k_1$[b] ($min^{-1}$) | Initial NO (ppm) | Initial $NO_2$ (ppm) | Avg. [OH][c] ($10^6$ radical $cm^{-3}$) | Flux (ppb) $min^{-1}$) | -d[NO]/dt (ppb $min^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 15 | N | 39 | ~50 | 0.41 | 0.485 | 0.124 | 2.0 | 0.17 | - |
| 24A[d] | 16 | F | 41 | 52 | 0.35 | 0.479 | 0.139 | 1.8 | 0.20 | 0.86 |
| 24B[d] | 16 | F | 41 | 48 | 0.35 | 0.461 | 0.138 | 1.8 | 0.19 | 0.73 |
| 27 | 17 | N | 36 | ~30 | 0.32 | 0.233 | 0.092 | 0.4 | 0.03 | 0.10 |
| 35 | 17 | F | 26 | 25 | 0.36 | 0.402 | 0.146 | 1.0 | 0.09 | 0.13 |
| 41 | 18 | F | 43 | 43 | 0.34 | 0.398 | 0.139 | 1.5[e] | 0.13[e] | 0.10 |
| 46 | 18 | F | 32 | <10 | 0.34 | 0.368 | 0.149 | 0.9 | 0.08 | 0.10 |
| ARB-1B[d] | 18 | F | 33 | <10 | 0.34 | 0.369 | 0.151 | 1.0 | 0.10 | 0.13 |
| 47 | 19 | N | 32 | <10 | 0.32 | 0.394 | 0.144 | 0.5[e] | 0.04[e] | ~0.0 |
| 51 | 19 | C | 33 | <10 | 0.27 | 0.404 | 0.133 | 0.6[e] | 0.05[e] | 0.03 |
| 61 | 20 | C | 22 | 20 | 0.37 | 0.418 | 0.160 | 0.5 | 0.05 | 0.01 |

[a]Codes for bag history are as follows:
N - New bag.
C - New bag conditioned by propene-$NO_x$ irradiation, $O_3$ dark decay run, then pure air irradiation.
F - Follows aircraft or automotive fuel-$NO_x$-air irradiation carried out for another study.

[b]$k_1$ = $NO_2$ photolysis rates calculated from the radiometric readings using the formula of Zafonte et al. (1977)

[c]Calculated using equation (V) (see text). The correction for consumption of propene by reaction with $O_3$ or $O(^3P)$ was generally <25%.

[d]Divided bag run.

[e]Data highly scattered, value given is uncertain by approximately a factor of two.

Table IV-5. Conditions and Selected Results for Small (~100-ℓ Volume) Teflon Bag (STB) $NO_x$-Air Irradiations

| STB Run No.[a] | Initial NO (ppm) | Initial $NO_2$ (ppm) | Average [OH] ($10^6$ $cm^{-3}$) | Radical Source[b] (ppb $min^{-1}$) | $-\frac{d[NO]}{dt}$[b] (ppb $min^{-1}$) |
|---|---|---|---|---|---|
| 4-1 | 0.460 | 0.155 | 5.1 | 0.75 | 2.73 |
| 4-2 | 0.475 | 0.220 | 3.7 | 0.54 | 1.45 |
| 4-3 | 0.476 | 0.135 | 3.7 | 0.32 | 1.37 |
| 4-4 | 0.503 | 0.120 | 4.9 | 0.54 | 1.97 |
| 4-5 | 0.467 | 0.119 | 4.6 | 0.51 | 1.69 |
| 5-1 | 0.345 | 0.227 | 1.4 | 0.15 | 0.26 |
| 5-2 | 0.269 | 0.100 | 1.5 | 0.09 | 0.21 |
| 6-1 | 0.539 | 0.159 | 1.6 | 0.10 | 0.48 |
| 6-2 | 0.505 | 0.060 | 2.8 | 0.13 | 0.78 |

[a]First number is bag number. Second number is order run was carried out with this bag.

[b]Calculated for t > 60 min.

which were generally reproducible to within ±20% in the evacuable chamber, with the variability in the indoor Teflon chamber and between different small Teflon bags being somewhat greater. The variability in hydroxyl radical levels in the large outdoor chamber was considerably greater (see Table IV-4), with OH radical levels varying by as much as a factor of three. This variability can, however, be attributed in part to variations in temperature and light intensity characteristic of outdoor irradiations, and in part to the chamber history, since the radical levels in $NO_x$-air irradiations carried out after automotive or aircraft fuel runs tended to be somewhat higher than in $NO_x$-air irradiations carried out in new or newly conditioned chambers.

A comparison of the average hydroxyl radical levels observed in comparable runs performed in the four chambers is shown in Table IV-6. Since the light intensities of the various chambers were generally different, a

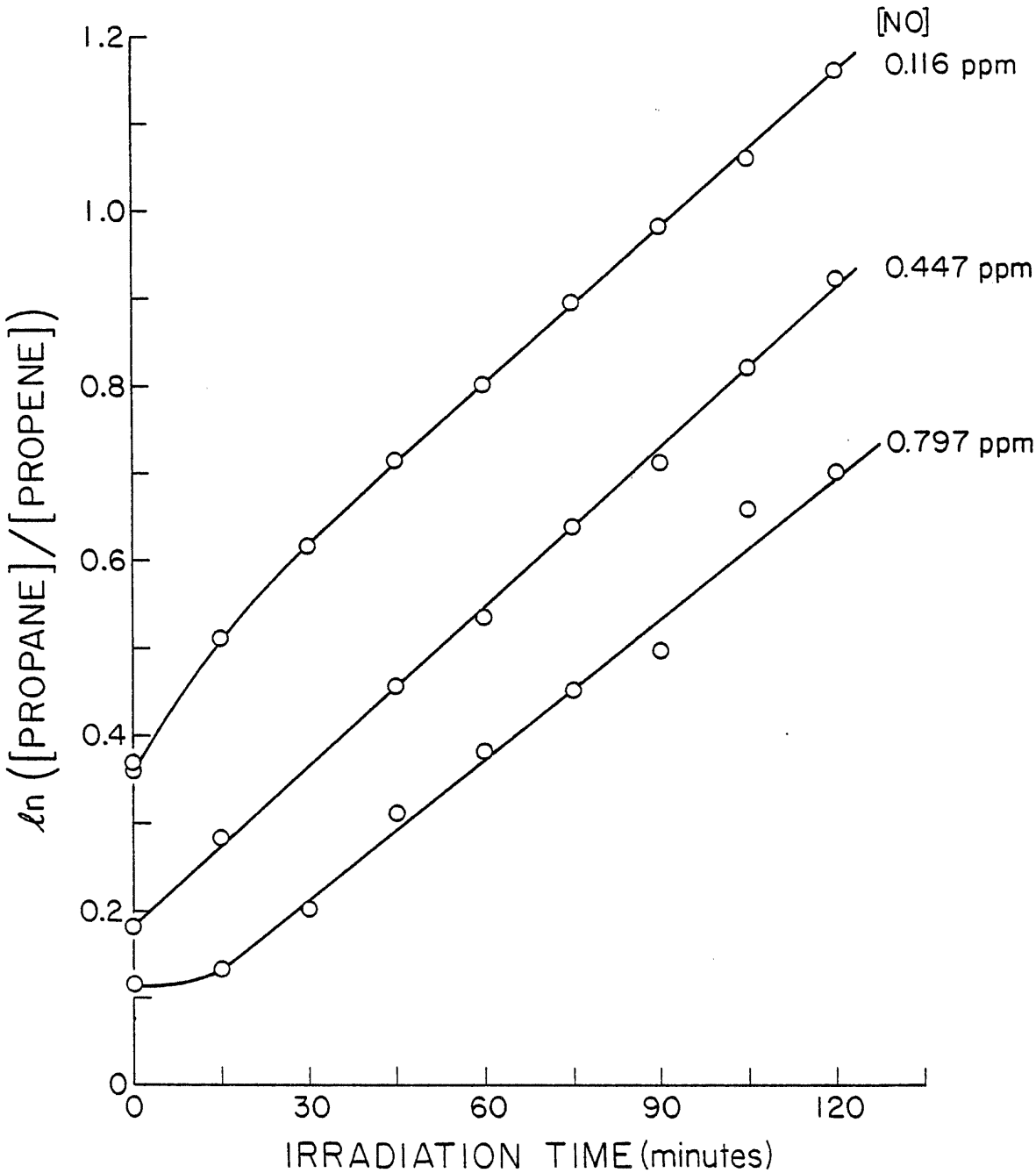


Figure IV-1. Plots of ln([propane]/[propene]) Against Irradiation Time for Evacuable Chamber Runs with $[NO_2]_{initial}$ ~0.1 ppm, and Varying Initial NO Concentration.

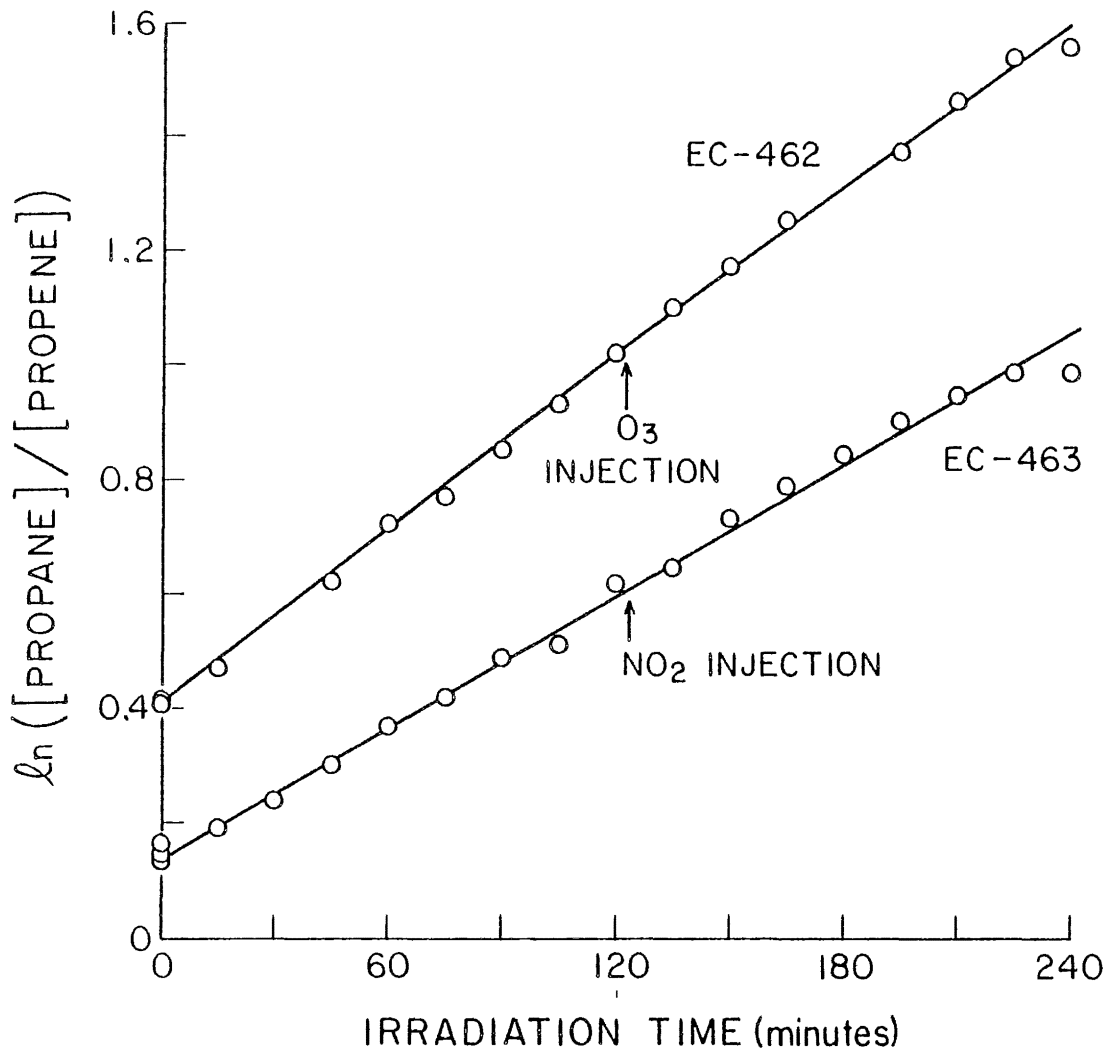


Figure IV-2. Plots of ln([propane]/[propene]) Against Irradiation Time for Evacuable Chamber Runs in Which $O_3$ or $NO_2$ was Injected During the Run.

Table IV-6. Dependence of OH Radical Levels Observed in Comparable[a] $NO_x$-Air Irradiations on Chamber Employed

| Chamber | $k_1$[b] ($min^{-1}$) | [OH] ($10^6$ $cm^{-3}$) | [OH]/$k_1$ (Normalized)[c] |
|---|---|---|---|
| Small Teflon Bag No. 4 | 0.27 | 4.4 ± 0.7 | 3.2 ± 0.5 |
| Small Teflon Bag No. 5 | 0.27 | 1.4 | 1.0 |
| Evacuable | 0.49 | 2.5 ± 0.2 | 1.0 |
| Indoor Teflon | 0.45 | 0.65 ± 0.15 | 0.3 ± 0.1 |
| Outdoor Teflon | ~0.3 ± 0.05[d] | 0.9 ± 0.3 | 0.6 ± 0.2 |

[a]Initial [NO] ≅ 0.1 ppm; RH < 10%, T = 303-308 K.

[b]$k_1$ = $NO_2$ photolysis rate.

[c]Normalized to ratio observed in the evacuable chamber runs.

[d]Estimated from radiometer readings using the empirical relationship derived by Zafonte et al. (1977).

more direct comparison can be obtained from the hydroxyl radical concentration normalized by dividing by the light intensity (since the OH radical concentrations were observed to be proportional to light intensity, as discussed below). These values are also shown in Table IV-6. It can be seen that the intensity-normalized hydroxyl radical levels indeed depend significantly on the chamber employed.

It is interesting to note that the normalized OH radical levels in the Teflon chambers vary as much or more from chamber to chamber (of the same volume) as they do with the size of the chamber. For example, the OH radical levels in the indoor Teflon chamber were, within experimental variability, essentially the same as those observed in the outdoor chamber, despite the much larger volume of the latter. In addition, the difference between the radical levels in the small bags No. 5 and No. 6 and the large Teflon chambers is no greater than the difference between bags No. 5 and No. 6 and bag No. 4. It should be noted that the same roll of Teflon film was used to make all the FEP Teflon chambers employed in this study.

The dependence of the OH radical concentration on temperature and relative humidity for runs in the evacuable chamber, and on humidity for runs in the indoor Teflon chamber, is shown in Table IV-7 for runs with approximately the same initial NO and $NO_2$ concentrations and light intensity. It can be seen that the hydroxyl radical levels increase with both temperature and humidity.

The dependence of hydroxyl radical concentrations on light intensity is shown in Figure IV-3, which shows plots of OH radical levels against the light intensity (as measured by $k_1$, the $NO_2$ photolysis rate) for irradiations in the 5800-ℓ evacuable and 6400-ℓ indoor Teflon chamber runs in which the light intensity was varied during the irradiation (EC-457 and 458, and ITC-380 and 381). It can be seen that within experimental error the radical levels are proportional to light intensity.

The effect of NO levels on the results of the evacuable chamber runs is shown in Figure IV-1, which shows plots of ln([propane]/[propene]) against irradiation time for runs with similar initial $NO_2$ concentrations, but with initial NO concentrations varying from 0.116-0.797 ppm. It can be seen that the final OH radical levels (which are very closely proportional to the slopes of the lines in Figure IV-1 for these conditions) were essentially unaffected by the NO concentration, but that the initial slope apparently increases as the NO level decreases.

The hydroxyl radical levels in the evacuable chamber runs were also not strongly affected by $NO_2$ levels, except in the initial stages of irradiation, where higher $NO_2$ levels resulted in higher initial hydroxyl levels. The relative insensitivity of the subsequent hydroxyl radical levels to $NO_2$ is illustrated by Figure IV-2, which shows the results of two runs in which the $NO_2$ concentrations were increased by a factor of 2 to 2.5 in the middle of the irradiation, either by direct injection of $NO_2$ or by conversion of NO to $NO_2$ by injection of $O_3$. It can be seen that the slope of the ln([propane]/[propene]) versus time plots, and thus the OH radical levels, are essentially unchanged by the sudden increase in $NO_2$. Other similar runs, carried out with higher NO and $NO_2$ levels and at different relative humidities, also showed no significant effect on the OH radical concentrations when the $NO_2$ concentration was changed during an irradiation by addition of either $O_3$ or $NO_2$.

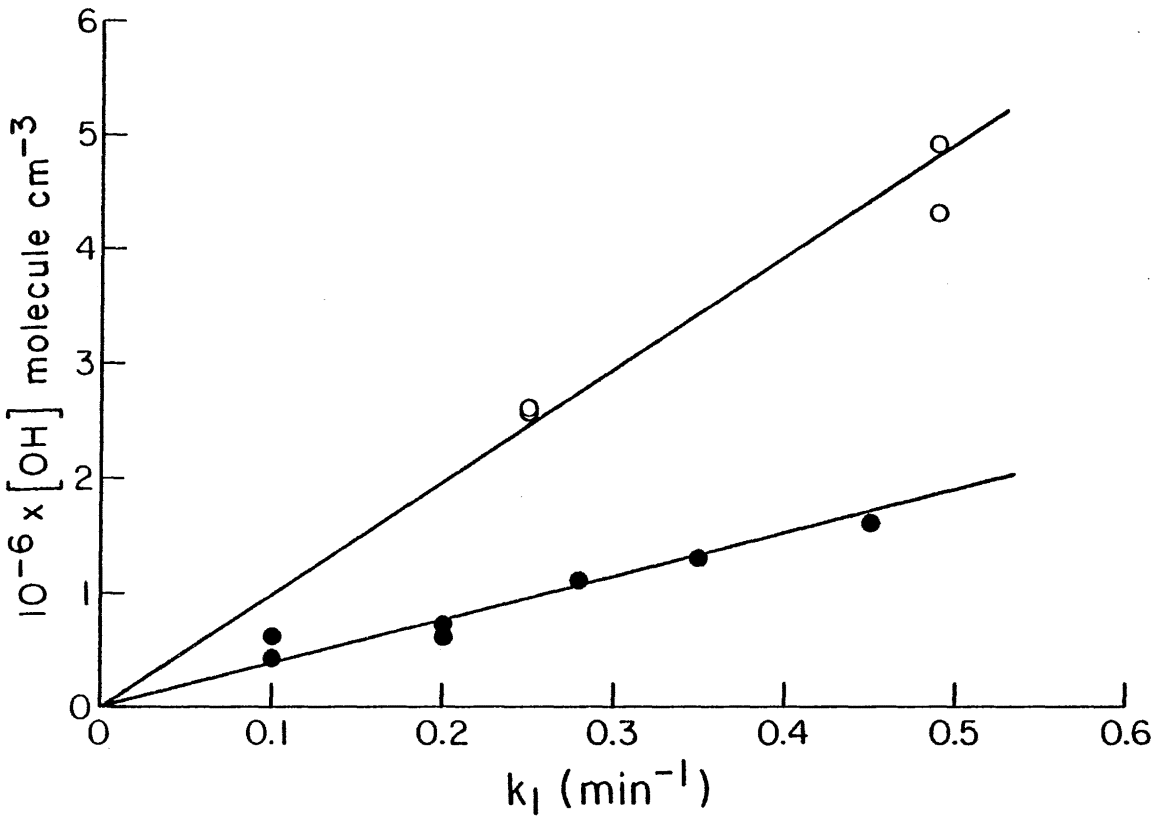


Figure IV-3. Dependence of Average OH Radical Concentrations on the $NO_2$ Photolysis Rate $k_1$ for Irradiations in Which the Light Intensity was Varied. (O - 5800-ℓ Evacuable Chamber; ● - 6400-ℓ All-Teflon Chamber.)

Table IV-7. Dependence of OH Radical Levels Observed in Standard[a] $NO_x$-Air Irradiations on Temperature and Relative Humidity (RH)

| Chamber | T(K) | $10^{-6}$ x [OH] Radical $cm^{-3}$ | | | |
|---|---|---|---|---|---|
| | | <10% RH | 50% RH | 80% RH | 100% RH |
| Evacuable | 284 | 1.6 | 2.1 | - | 4.7 |
| | 303 | 2.5 | 4.4 | 16 → 11[b] | 20 → 12[b] |
| | 323 | 5.7 | 18 → 9[b] | - | 50 → 8[b] |
| Indoor Teflon | 303 | 0.6 | 1.9 | - | - |

[a]Initial [NO] ≅ 0.4 ppm; [$NO_2$] ≅ 0.1 ppm; $NO_2$ photolysis rate $k_1$ = 0.49 $min^{-1}$ (evacuable chamber), 0.45 (indoor Teflon chamber).

[b]OH radical concentrations changed throughout the run; initial and final values given.

Tests of the Tracer Technique. A large majority of the OH radical levels given in Tables IV-2 through IV-5 were derived using the propene/propane or propene/n-butane tracer system, and thus reflect primarily the rates of propene decay, since that tracer was consumed ≥10 times more rapidly than the alkane tracers. In this regard, it should be noted that a gradual buildup of acetaldehyde, a known propene photooxidation product in $NO_x$-air systems (Hendry et al. 1978, Falls and Seinfeld 1978, Carter 1979a, Whitten et al. 1979, 1980; Atkinson and Lloyd 1983), was observed to occur at rates corresponding to the rates of propene decay. (The expected yields of the other major propene photooxidation product, formaldehyde, were below the sensitivity of the chromatropic acid technique used for monitoring formaldehyde (Pitts et al. 1979, Winer et al. 1980).

In order to determine whether there was any problem using propene as the more reactive tracer, a test was carried out by using the two alkane tracers n-butane and neopentane during a standard $NO_x$-air irradiation. The OH radical concentrations derived from this irradiation (EC-608), which are less sensitive by a factor of ~10 than those obtained with the propene/n-butane or propene/propane tracer systems, were identical (within the ±20% variability of the results of these irradiations) with those obtained from the analogous $NO_x$-air irradiations EC-612 and EC-613 conducted using propene and propane as the organic tracers (Table IV-2).

In order to further verify the validity of our tracer technique for monitoring OH radical levels, several tracer-$NO_x$ experiments with added benzaldehyde [a known radical inhibitor (Kuntz et al. 1973, Gitchell et al. 1974)] were carried out in the evacuable chamber. The conditions and measured OH radical levels for these added benzaldehyde runs are given in Table IV-8, and plots of ln([n-butane]/[propene]) against time for two of those runs are shown in Figure IV-4. It can be seen that addition of benzaldehyde, as expected, suppressed the OH radical levels as measured by the rate of decay of the tracers, further indicating the validity of this technique.

Although the hydroxyl radical levels were not measurably affected by added $NO_2$ in the tracer-$NO_x$ experiments, this was not the case when the benzaldehyde radical trap was present. This is shown in Table IV-8 and Figure IV-4, which show the data for an evacuable chamber experiment (EC-647) in which additional $NO_2$ was added to a benzaldehyde-tracer-$NO_x$ mixture. It can be seen that when a radical inhibitor was present, the addition of $NO_2$ actually increased the consumption rate of the tracers. Though some of this increase can be attributed to increased rates of consumption of propene by reaction with $O_3$ and $O(^3P)$ atoms [which become relatively more important as $[NO_2]$ or the $[NO_2]/[NO]$ ratio increases (see Discussion)], the corrected OH radical levels did increase slightly after the addition of $NO_2$ to the $NO_x$-benzaldehyde-air system.

<u>HONO Measurements Before and During $NO_x$-Air Irradiations</u>. A number of tracer-$NO_x$ irradiations in the SAPRC 5800-ℓ evacuable chamber were conducted in which differential optical absorption spectroscopy was employed to monitor HONO either prior to or during the irradiations. A pathlength of ~150 m (40 passes) was employed, yielding a HONO detection limit of ~2-3 ppb. The conditions and results of the $NO_x$-air irradiations in which HONO was monitored prior to the irradiation are summarized in Table IV-9, where it can be seen that HONO was indeed initially present during these irradiations.

The experimental conditions and HONO and OH radical concentrations observed in the experiments where HONO was monitored during the irradiations are given in Table IV-10. During these experiments, HONO concentrations were observed to rise from those initially present to constant levels within 2-3 hr after the start of irradiation, at which time the OH

Table IV-8. Initial Conditions and Selected Results for the $NO_x$-Air Irradiations with Added Benzaldehyde

| EC Run Number | 623 | 638 | 646 | 647 | 647[a] |
|---|---|---|---|---|---|
| Initial | | | | | |
| NO (ppm) | 0.463 | 0.392 | 0.398 | 0.797 | |
| $NO_2$ (ppm) | 0.099 | 0.068 | 0.095 | 0.142 | |
| RH (%) | <10 | ~50 | ~50 | ~50 | |
| 60 Min prior to $C_6H_5CHO$ Addition | | | | | |
| Average $NO_2$ (ppm) | 0.100 | 0.090 | 0.133 | 0.130 | |
| Average OH ($10^6$ $cm^{-3}$)[b] | 1.31 ± 0.06 | 2.75 ± 0.06 | 3.4 ± 0.3 | 2.59 ± 0.10 | |
| After $C_6H_5CHO$ Added | | | | | |
| Average $NO_2$ (ppm) | 0.112 | 0.132 | 0.154 | 0.168 | 0.440 |
| Average $C_6H_5CHO$ (ppm) | ~0.9[c] | 1.20 | 0.63 | 1.09 | 0.94 |
| Average OH ($10^6$ $cm^{-3}$)[b] | 0.10 ± 0.04 | 0.16 ± 0.03 | 0.27 ± 0.07 | 0.27 ± 0.04 | 0.34 ± 0.06 |
| OH Suppression Factor | | | | | |
| Observed[b] | 13 ± 5 | 17 ± 3 | 13 ± 4 | 9.6 ± 1.5 | 7.6 ± 1.4 |
| Calculated[d] | ~12 | 17.2 | 6.8 | 11.2 | 11.9 |

[a]~0.2 ppm $NO_2$ added after benzaldehyde addition (see Figure IV-3).

[b]Indicated errors are one least squares standard deviation.

[c]Not analyzed quantitatively; based on amount injected into the chamber.

[d]Calculated using rate constants for the reaction of OH radicals with $NO_2$ and benzaldehyde of $1.1 \times 10^{-11}$ $cm^3$ $molecule^{-1}$ $sec^{-1}$ (Hampson and Garvin 1978, Atkinson and Lloyd 1983) and $1.3 \times 10^{-11}$ $cm^3$ $molecule^{-1}$ $sec^{-1}$ (Atkinson et al. 1979, Atkinson and Lloyd 1983), respectively.

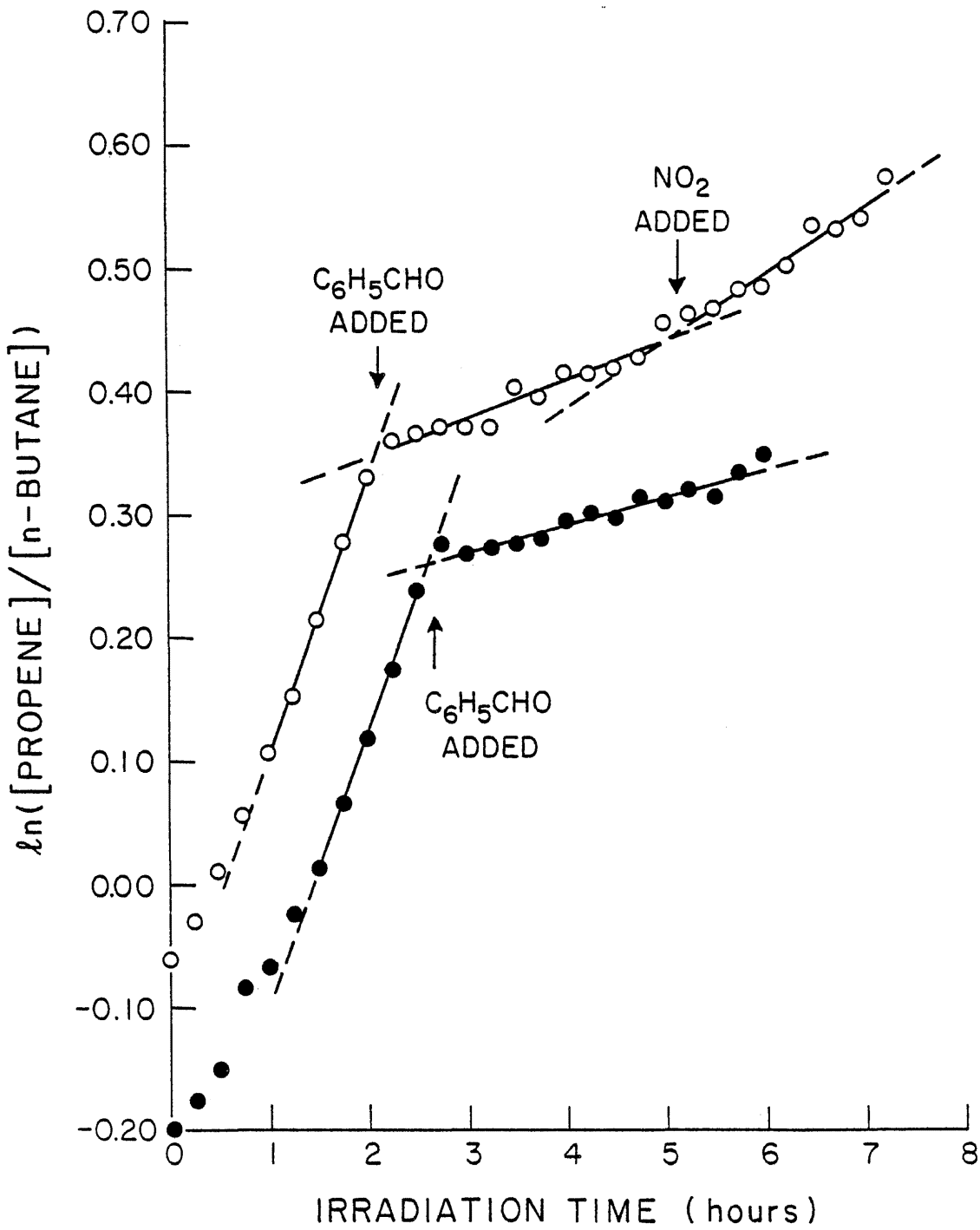


Figure IV-4. Plots of ln([propene]/[n-butane]) Against Irradiation Time for Two Evacuable Chamber Runs in Which Benzaldehyde was Injected During the Run (● - EC-638, O - EC-647).

Table IV-9. Run Conditions and Results for $NO_x$-Air Irradiations Carried Out in the 5800-ℓ Evacuable Chamber in which HONO was Monitored Prior to Irradiation

| EC Run Number | T (K) | $k_1$ ($min^{-1}$) | RH (%) | Initial NO (ppm) | Initial $NO_2$ (ppm) | ($10^6$ [OH] Radicals $cm^{-3}$) 0-60 min | 60-120 min | Radical Flux (ppb $min^{-1}$) | Initial HONO (ppb) Obs[a] | Calc[b] |
|---|---|---|---|---|---|---|---|---|---|---|
| 539 | 303.8 | ~0.40 | 50 | 0.107 | 0.356 | 4.8 | 3.7 | 0.59 | 26 | 25 |
| 540 | 303.4 | ~0.40 | 62 | 0.083 | 0.288 | 7.2 | 5.5 | 0.67 | 27 | 25 |
| 541 | 303.7 | ~0.40 | 50 | 0.378 | 0.324 | 2.8 | 2.2 | 0.34 | 13 | 12 |
| 542 | 303.6 | ~0.40 | 50 | 0.029 | 0.131 | 6.9 | 6.6 | 0.41 | 4 | 11 |

[a]Monitored by differential optical absorption spectroscopy.

[b]Calculated from the time-concentration profiles of OH radicals, as described in the text.

Table IV-10. Experimental Conditions and HONO and OH Radical Data for $NO_x$-Air Irradiations in which HONO was Measured by DOAS

| Run No. | $k_1$ ($min^{-1}$) | NO (ppm) | $NO_2$ (ppm) | $10^{-6}$x[OH] $cm^{-3}$ | [HONO] (ppb) Observed | Calculated[a] (A) | Calculated[a] (B) |
|---|---|---|---|---|---|---|---|
| 567 | 0.31 | 1.45 | 0.467 | 2.77 | 21.0 | 24.4 | 38.0 |
| 568 | 0.31 | 1.032 | 0.772 | 2.01 | 12.0 | 12.6 | 29.0 |
| 569A | 0.39 | 1.058 | 0.100 | 3.33 | >25.0 | 17.0 | 19.8 |
| 569B | 0.39 | 0.668 | 0.450 | 3.00 | 15.0 | 9.7 | 21.0 |
| 570A | 0.36 | 2.464 | 0.370 | 1.96 | 29.0 | 25.3 | 31.9 |
| B | 0.36 | 1.724 | 0.840 | 2.07 | 17.0 | 18.7 | 34.5 |
| 626 | 0.32 | 0.385 | 0.103 | 1.37 | 5.1 | 3.1 | 4.5 |
| 630A | 0.32 | 2.322 | 0.824 | 1.02 | 21.7 | 13.9 | 22.5 |
| B | 0.15 | 2.163 | 0.838 | 0.53 | 28.6 | 14.4 | 24.1 |
| 631A | 0.14 | 1.936 | 1.053 | 0.31 | 16.6 | 8.1 | 15.7 |
| B | 0.31 | 1.950 | 0.898 | 0.41 | 11.8 | 4.9 | 8.7 |
| 632A | 0.32 | 2.198 | 0.794 | 0.81 | 19.4 | 10.5 | 17.1 |
| 633B | 0.32 | 2.189 | 0.806 | 0.87 | 14.6 | 11.2 | 18.4 |

[a]A - Calculated using equation (VII) assuming HONO is not the precursor in the continuous radical source.

B - Calculated using equation (VIII) assuming HONO is the precusor of the continuous radical source (see Discussion).

radical concentrations also had leveled off. In some of the experiments, the system was perturbed at, or after, this time by (a) adding $O_3$ to change the $NO/NO_2$ ratio without affecting the $NO_x$ concentration, (b) adding $NO_2$ or (c) changing the light intensity. In each case, the OH radical and HONO concentrations were monitored until a new equilibrium was reached.

Other Experiments. In order to obtain data concerning the effect of the reactant injection technique and of other experimental conditions on the radical levels, and to further test our radical measurement technique, several evacuable chamber runs were carried out using nonstandard reaction

conditions. The results of these are briefly summarized below (see also Table IV-2).

- In order to monitor hydroxyl radicals from the rate of NO oxidation, one evacuable chamber experiment (EC-624) was carried out in which the tracers were replaced by 50 ppm of CO, as suggested by Killus and Whitten (private communication 1981). The average OH radical level derived from the NO oxidation rate in this run was essentially identical to that derived from a comparable tracer-$NO_x$ experiment (see Discussion).

- One evacuable chamber run (EC-459) was carried out in which NO and $NO_2$ were injected using the syringe injection technique employed on the other chambers, instead of the vacuum injection technique (see Experimental section above). The results of this run were essentially the same as for the standard runs.

- One run was conducted in which $NO_2$ was prepared by reacting NO with $O_3$ in the chamber, rather than by reacting $O_2$ with NO at high concentrations prior to injection into the chamber (the usual procedure). The resulting hydroxyl radical concentration was 35-40% lower than the average of the standard runs; this deviation is somewhat greater than the observed ~ ±15% variability of the standard runs.

- One run was carried out by introducing NO into the chamber ~27 hr prior to the start of the irradiation, with $NO_2$ being formed at approximately its usual pre-irradiation value by the dark NO oxidation reaction. In that run, the initial hydroxyl radical level was approximately 2.5 times higher than in the standard runs, with the hydroxyl radical concentration leveling off to values ~25% higher than those in the standard runs.

- In order to assess the possible role of surface photochemistry, one run was carried out under otherwise standard conditions with the solar simulator beam defocussed so that more light impinged on the Teflon surface. The hydroxyl radical levels observed in both portions of this run (i.e., at both full- and half-light intensity) were within the range of those observed in the full- and half-light intensity standard runs.

- One low humidity run was carried out following an evacuated bake-out of the chamber at 363 K. In that run the hydroxyl radical levels were initially ~1.8 times higher than in the other low humidity runs, though they declined, being ~28% higher by the end of the run. In contrast, the

hydroxyl radical levels in the other low humidity runs were constant throughout the irradiations.

- Several irradiations in the evacuable chamber were carried out at reduced total pressure (350 torr or 500 torr). The results indicate that there is no significant pressure effect on the radical levels in these irradiations, at least over the temperature range 284-303 K and under dry conditions (see Table IV-2).

## D. Discussion

$NO_x$-Air Irradiations. In irradiated $NO_x$-air mixtures, the major gas phase reactions (Carter et al. 1979a, Atkinson et al. 1980, Hampson and Garvin 1978, Baulch et al. 1980, Atkinson and Lloyd 1983) are as follows:

$$NO_2 + h\nu\ (\lambda \geqslant 295\ nm) \rightarrow NO + O(^3P) \quad (1)$$

$$O(^3P) + O_2 + M \rightarrow O_3 + M \quad (2)$$

$$NO + O_3 \rightarrow NO_2 + O_2 \quad (3)$$

$$O(^3P) + NO_2 \rightarrow NO + O_2 \quad (4)$$

$$O(^3P) + NO_2 \xrightarrow{M} NO_3 \quad (5)$$

$$NO + NO + O_2 \rightarrow 2\ NO_2 \quad (6)$$

$$NO_2 + O_3 \rightarrow NO_3 + NO_2 \quad (7)$$

$$NO_3 + NO \rightarrow 2\ NO_2 \quad (8)$$

$$NO_3 + NO_2 \rightarrow NO + NO_2 + O_2 \quad (9)$$

$$NO_3 + NO_2 \xrightarrow{M} N_2O_5 \quad (10)$$

$$N_2O_5 \xrightarrow{M} NO_2 + NO_3 \quad (11)$$

$$NO_3 + h\nu \rightarrow NO + O_2 \quad (12)$$

$$NO_3 + h\nu \rightarrow NO_2 + O(^3P) \tag{13}$$

$$O_3 + h\nu \rightarrow O_2 + O(^3P) \tag{14}$$

$$O_3 + h\nu\ (\lambda \leqslant 310\ \text{nm}) \rightarrow O_2(^1\Delta_g) + O(^1D) \tag{15}$$

$$O(^1D) + M(M = \text{air}) \rightarrow O(^3P) + M \tag{16}$$

$$O(^1D) + H_2O \rightarrow 2\ OH \tag{17}$$

$$OH + NO \overset{M}{\rightarrow} HONO \tag{18}$$

$$HONO + h\nu \rightarrow OH + NO \tag{19}$$

$$OH + NO_2 \overset{M}{\rightarrow} HNO_3 \tag{20}$$

Under the conditions of the experiments described here, where significant concentrations of NO are always present, the $O_3$ concentrations were sufficiently low that reactions (7)-(17) are of minor importance. In particular, the OH radical input rate calculated from the above mechanism for conditions of a typical evacuable chamber run where $[NO] = [NO_2]$ is ~4 x $10^{-6}$ ppm $min^{-1}$, which gives rise to predicted OH radical levels one to two orders of magnitude lower than those actually observed.

The major additional reactions occurring when propene and propane are included in the reaction mixture can be represented overall as follows (Carter et al. 1979a, Atkinson and Lloyd 1983):

$$OH + \text{propene} \xrightarrow{2\ O_2} \begin{cases} \xrightarrow{2\ NO} HCHO + CH_3CHO + OH \\ \downarrow \\ 2\ NO_2 \end{cases} \tag{21}$$

$$OH + \text{propane} \xrightarrow{2\ O_2} \begin{cases} \xrightarrow{2\ NO} H_2O + CH_3COCH_3 + OH \\ \downarrow \\ 2\ NO_2 \end{cases} \tag{22}$$

Propene also reacts to some extent with $O_3$ and $O(^3P)$ atoms (Carter et al. 1979a, Atkinson and Lloyd 1983)

$$O_3 + \text{propene} \rightarrow \text{products} \tag{23}$$

$$O(^3P) + \text{propene} \rightarrow \text{products} \tag{24}$$

though these reactions were much less important than reaction with OH radicals for most of the experiments employed in this study.

Reaction of propene and propane with OH radicals results in no net loss or production of radicals, but causes the conversion of two molecules of NO to $NO_2$. An analogous, but more complex, overall reaction sequence occurs for the reaction of OH radicals with n-butane and neopentane. At the reactant levels employed in these runs, the rate of this NO conversion was minor, being generally less than the conversion caused by the concentrations of CO impurity (0.5-4 ppm) provided by the air purification system:

$$\begin{array}{c} \\ OH + CO \xrightarrow{O_2} \end{array} \begin{array}{c} NO \\ \rightarrow \\ \downarrow \\ NO_2 \end{array} \begin{array}{c} \\ OH + CO_2 \end{array}$$

Although photodissociation of the oxygenated organic tracer reaction products and the reactions of $O_3$ and $O(^3P)$ with propene can lead to radical production, at the reactant levels employed in these runs, these radical sources were also minor as verified from propene-$NO_x$-air computer model calculations (see also below).

<u>OH Radical Monitoring Technique</u>. As indicated above, OH radical levels were monitored by measuring the relative rates of decay of two organic tracers (usually propene and propane or propene and n-butane), which were consumed primarily by reaction with OH radicals. Reaction of the alkane tracers with OH radicals was their only significant sink under the conditions of these experiments, and consumption of propene by species other than OH radicals, $O_3$ and $O(^3P)$ atoms was also negligible (Hendry et al. 1978, Falls and Seinfeld 1978, Carter et al. 1979a, Whitten et al.

1979, 1980; Atkinson and Lloyd 1983). However, for some experiments in which propene is employed as a tracer, consumption of propene by reaction with $O_3$ and $O(^3P)$ had to be taken into account in order to derive hydroxyl radical concentrations from its rate of decay, as described below.

If propene and propane are the tracers employed (as was the case for the great majority of the experiments reported here), the relevant kinetic differential equations are:

$$d\ln[\text{propene}]/dt = -k_{21}[O_3] - k_{24}[O(^3P)] \qquad \text{(I)}$$

$$d\ln[\text{propane}]/dt = -k_{22}[OH] \qquad \text{(II)}$$

where $k_{21}$ and $k_{22}$ are the respective rate constants for the reaction of propene and propane with OH radicals (Atkinson et al. 1979), $k_{23}$ and $k_{24}$ are the rate constants for the reaction of propene with $O_3$ and $O(^3P)$ atoms, respectively, and $[O_3]$ and $[O(^3P)]$ can be estimated based on the following assumptions. Since $O(^3P)$ is formed primarily from $NO_2$ photolysis (reaction 1) and is consumed primarily by its rapid reaction with $O_2$ (reaction 2), it can, to a very good approximation, be considered to be in photostationary state governed by these two reactions, and thus:

$$[O(^3P)] \cong \frac{k_1[NO_2]}{k_2[O_2][M]} \qquad \text{(III)}$$

Likewise, $O_3$ is also formed by $NO_2$ photolysis (reaction 1 followed by reaction 2) and, under the conditions of our experiments, was consumed primarily by its rapid reaction with NO (reaction 3) and thus can also be assumed to be in photostationary state.

$$[O_3] \cong \frac{k_1[NO_2]}{k_3[NO]} \qquad \text{(IV)}$$

Equations (I) through (IV) can be combined and rearranged to yield

$$[OH] = (k_{21}-k_{22})^{-1} \frac{d}{dt} (\ln \frac{[propane]}{[propene]}) - k_1[NO_2](A + \frac{B}{[NO]}) \qquad (V)$$

where
$$A = \frac{k_{24}}{(k_{21}-k_{22})k_2[O_2][M]}$$

and
$$B = \frac{k_{23}}{(k_{21}-k_{22})k_3}$$

Analogous equations can be derived for the other set of tracers. It can be seen from equation (V) that the correction for consumption of propene by reaction with $O_3$ and $O(^3P)$ atoms increases with $[NO_2]$ and $[NO_2]/[NO]$, respectively.

Although the use of two alkane tracers would avoid the need for this correction, the use of propene was preferred for the purposes of this study because of the greater sensitivity afforded by its relatively high OH radical rate constant (Atkinson et al. 1979) and ease of its precise analysis. For the "standard" experiments performed in this study, where $[NO] \cong 0.4$ ppm and $[NO_2] \cong 0.1$ ppm, the corrections for $O(^3P)$ atom and $O_3$ reactions were minor (<10%). However, the correction for reaction with $O_3$ became non-negligible (>10%) in runs where $[NO_2]_{avg} \geq [NO]_{avg}$, and the correction for consumption of propene by $O(^3P)$ atoms became important when $[NO_2]_{avg}$ exceeded ~0.5 ppm, and in some of the lower pressure runs. The experimental OH radical concentrations given in Tables IV-2 through IV-5 which require corrections of between 10-25% and of over 25% are indicated by the symbols "*" and "**", respectively.

In order for equation (V) to be valid for monitoring hydroxyl radicals, it must be shown that the tracers are not also consumed to any significant extent by heterogeneous or other unknown loss processes in these irradiations. Repetitive pre-irradiation sampling showed that there was no significant dark decay of propene (or of other simple hydrocarbons) in these chambers, but this does not necessarily rule out the possibility of light-induced heterogeneous decay. However, there is no evidence that light-induced heterogeneous decay of propene or other simple hydrocarbons is important in environmental chamber systems, and there are a number of reasons to believe it is not.

In the first place, a large number of OH radical rate constant ratios for organics derived from their rates of decay in smog chamber irradiations agree, to within the experimental uncertainties, with values derived using entirely different, absolute techniques (Atkinson et al. 1979). This would not be the case if there were light-induced heterogeneous loss processes occurring in chamber systems at rates sufficiently high to account for the results of the tracer-$NO_x$-air irradiations described here. In addition, the calculated OH radical levels derived from the rate of decay of n-butane relative to that for neopentane agree well with radical levels derived in comparable experiments from rates of propene decay relative to propane decay. This would not be expected to be the case if the tracer loss processes were not via reaction with the OH radical. Furthermore, the observed formation of acetaldehyde in runs with the propene tracer means that if propene is being consumed by some heterogeneous or unknown loss process, it is being converted to the same products as when it reacts with OH radicals (Hendry et al. 1978, Falls and Seinfeld 1978, Carter et al. 1979a, Whitten et al. 1979, 1980), which would seem to be highly improbable. Finally, it should be noted that if light-induced heterogeneous decay of simple alkanes and alkenes were important, then all current alkane- and alkene-$NO_x$-air models (Hendry et al. 1978, Falls and Seinfeld 1978, Carter et al. 1979a, Whitten et al. 1979, 1980) would be incorrect, since the decay rates observed in these $NO_x$-air irradiations are comparable in magnitude to those observed in chamber experiments used for model validation, yet none of the models have taken such a process into account.

The results of our control experiments also indicate the validity of the organic tracer technique employed. One such experiment was based on a suggestion of Killus and Whitten (private communication 1981), and consisted of a $NO_x$-air irradiation (EC-624) in the evacuable chamber (303 K, < 10% RH, initial NO = 0.430 ppm, initial $NO_2$ = 0.073 ppm) in which the standard propene/propane tracers were replaced by 50 ppm of CO. The addition of CO causes the following reactions to be important:

$$OH + CO \xrightarrow{O_2} HO_2 + CO_2 \qquad (25)$$

followed by

$$HO_2 + NO \rightarrow NO_2 + OH$$

The addition of CO thus results in no net change in radical levels, but causes NO to be converted to $NO_2$ at a rate approximately equal to the rate of reaction (25). Thus the OH radical concentration can be derived entirely independently of hydrocarbon decay rates from the following expression:

$$-\frac{d[NO]}{dt} \cong R_{25} = k_{25}[OH][CO]$$

where $k_{25}$ is the rate constant for the reaction of OH radicals with CO. The NO decay rate observed in this CO-$NO_x$-air irradiation was ~0.74 ppb $min^{-1}$, from which [OH] ≅ 0.9 x $10^6$ molecule $cm^{-3}$ can be derived. This is in good agreement with the average OH radical level of 1.1 x $10^6$ molecule $cm^{-3}$ derived from a 2-hr $NO_x$-air irradiation (EC-623) (initial NO = 0.463 ppm, initial $NO_2$ = 0.099 ppm) carried out under the same conditions but with the organic tracers and no added CO. Thus these two independent techniques for measuring OH radical concentrations give consistent results.

A further and even more definitive test to confirm that the observed rates of change of the hydrocarbon tracer ratio reflect OH radical levels was to determine if the addition of known radical inhibitors would suppress these rates. Benzaldehyde was employed as a radical inhibitor, since it has been shown to inhibit $O_3$ formation in chamber irradiations (Kuntz et al. 1973, Gitchell et al. 1974) and the current mechanism for its $NO_x$-air photooxidation predicts that radicals are not regenerated following its reaction with the OH radical (Atkinson et al. 1980, Atkinson and Lloyd 1983). The results of these experiments, summarized in Table IV-8 and illustrated for two representative runs in Figure IV-4, clearly indicate that the addition of 0.6-1.2 ppm of benzaldehyde markedly suppressed the rate of change of the propene/n-butane ratio. The ratios of the OH radical concentrations observed during the hour prior to benzaldehyde addition to those observed after benzaldehyde addition are given in Table IV-8. These observed ratios are also compared in Table IV-8 with those calculated from the known OH + benzaldehyde (Atkinson et al. 1979) and OH + $NO_2$ (Hampson and Garvin 1978, Atkinson and Lloyd 1983) rate

constants, assuming a 100% efficient radical inhibition by benzaldehyde and that reaction with $NO_2$ is the only other significant OH radical sink. It can be seen that the observed effects are in reasonably good agreement, within the experimental error limits, with those calculated, and hence these experiments show that the observed relative disappearance rates of the two hydrocarbons used (propene and n-butane in this case) do indeed behave as expected, with their loss processes being primarily due to reaction with the OH radical and dilution. Furthermore, these experiments confirm our assumption that the major sinks for OH radicals in these systems are via reaction with $NO_2$ and benzaldehyde (when present).

Chamber Radical Sources. Evidence for the existence of unknown radical sources in these experiments comes from the fact that the hydroxyl radical levels observed in all of the runs reported here were significantly higher than expected from the homogeneous gas phase reactions discussed above. This is illustrated in Figures IV-5 and IV-6, which show hydroxyl radical concentration-time profiles derived from the data of a representative standard evacuable chamber run (Figure IV-5) and from a representative high initial-$NO_2$ concentration run (Figure IV-6), and compares them with results of model calculations (curve A) using only the known gas phase chemistry. (It should be noted that the largest single radical source in these calculations was formaldehdye photolysis, and that the calculations used the observed initial formaldehyde levels of 20 ppb and 6 ppb, respectively.) These are taken to be upper limits for the HCHO concentrations, given the uncertainties associated with the chromatropic acid method for formaldehyde analysis (Pitts et al. 1979). It can be clearly seen that the known radical sources are at least an order of magnitude too low to account for the observed radical levels in these runs.

As discussed in the Introduction, previous computer modeling studies have accounted for this excess radical source either by assuming initially present nitrous acid, whose rapid photolysis (reaction 19) can produce radicals at a significant rate even when only low levels of HONO are present, or by assuming a constant radical flux whose source is unspecified. Figures IV-5 and IV-6 show the results of model calculations assuming only initially present HONO [at levels adjusted to fit the initial hydroxyl radical concentrations (curve B)] and of calculations assuming a constant radical flux at rates adjusted to fit the final OH radical levels

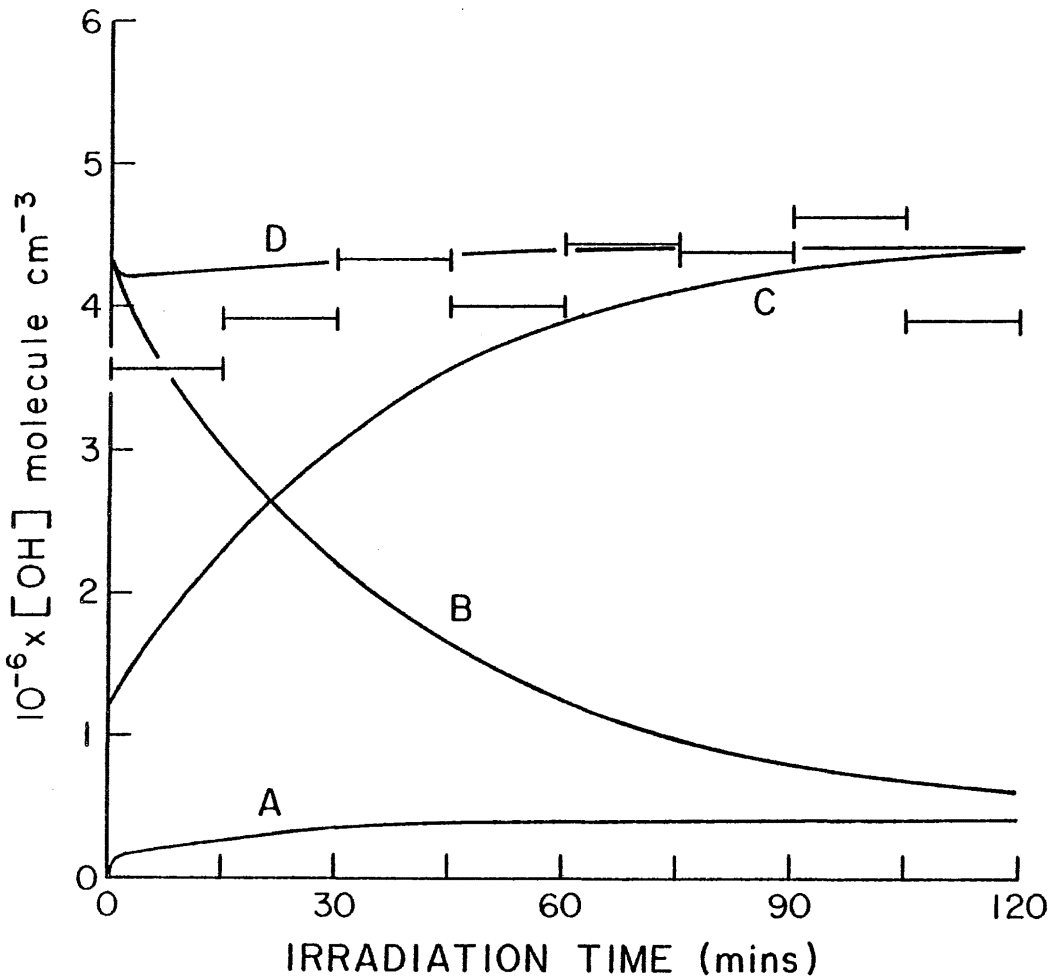


Figure IV-5. Hydroxyl Radical Concentrations as a Function of Irradiation Time. ——— Experimental Data for EC-457 [Uncorrected for Minor Consumption of Propene by Reaction with $O_3$ and $O(^3P)$]; $[NO]_{initial} = 0.499$ ppm, $[NO_2]_{initial} = 0.115$ ppm; $[propane]_{initial} = 0.013$ ppm, $[propene]_{initial} = 0.010$ ppm; $[HCHO]_{initial} \simeq 0.020$ ppm, T = 303 K, RH = 50%, $NO_2$ Photolysis Rate Constant $k_1 = 0.49$ $min^{-1}$; A - Model Calculations with the Homogeneous Gas Phase Chemistry; B - Model Calculations with $[HONO]_{initial} = 0.010$ ppm; C - Model Calculations with a Constant OH Radical Flux of 0.245 ppb $min^{-1}$; D - Model Calculations with $[HONO]_{initial} = 0.010$ ppm and a Constant OH Radical Flux of 0.245 ppm $min^{-1}$.

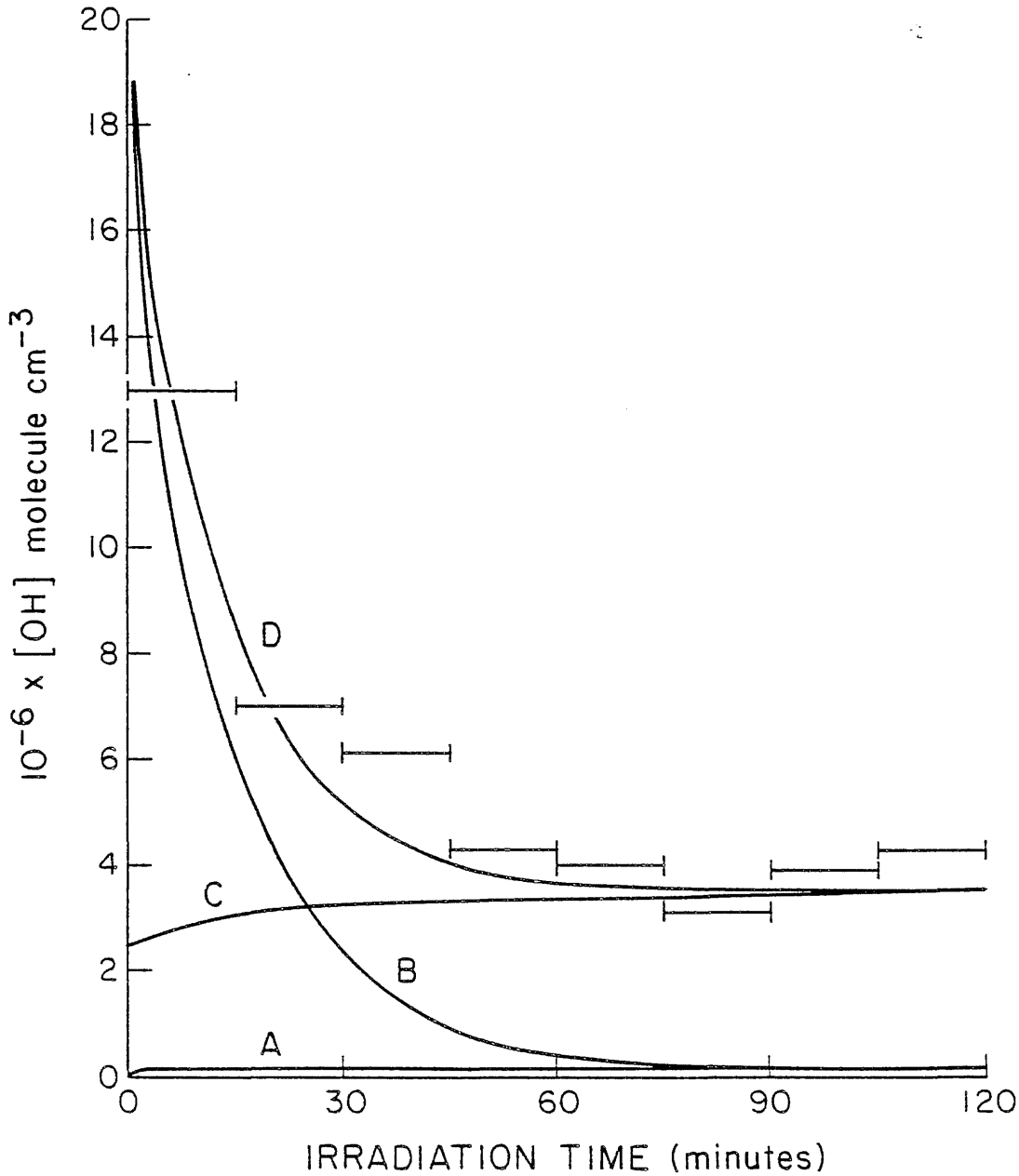


Figure IV-6. Hydroxyl Radical Concentrations as a Function of Irradiation Time. ——— Experimental Data for EC-442 [Uncorrected for Minor Consumption of Propene by Reaction with $O_3$ or $O(^3P)$]; A - Model Calculations with the Homogeneous Gas Phase Chemistry; B - Model Calculations with $[HONO]_{initial}$ = 0.050 ppm; C - Model Calculations with a Constant OH Radical Flux of 0.61 ppb $min^{-1}$; D - Model Calculations with $[HONO]_{initial}$ = 0.050 ppm and a Constant OH Radical Flux of 0.61 ppb $min^{-1}$.

(curve C), together with calculations assuming a combination of both (curve D). It can be seen that assuming only initial HONO greatly underpredicts radical levels after the first ~15 min of the run, and photolysis of initial HONO can be, at best, only a minor contributor to the observed radical source after the first ~30 min of irradiation. On the other hand, using only a constant radical flux in the calculation results in underprediction of initial OH radical levels, especially in the high $[NO_2]/[NO]$ runs, and best fits to the data are obtained if some contribution due to photolysis of initial HONO is assumed. However, in terms of the overall input of radicals during a chamber irradiation (typically $\geq$6 hr for smog simulation runs), the constant radical flux is by far the more important factor.

The radical flux required to fit the data for a given run can be estimated (without the necessity to carry out detailed model calculations) from the fact that radical initiation and radical termination rates must balance. Since the only significant radical termination processes in this system are the reactions of OH radicals with NO and $NO_2$ (reactions 18 and 20), and since the only major known radical initiation process is HONO photolysis (reaction 19), then

$$R_u + k_{19}[HONO] = k_{18}[OH][NO] + k_{20}[OH][NO_2]$$

where $R_u$ is radical initiation from all sources other than HONO photolysis. Since reactions (18) and (19) are the major reactions affecting HONO levels, the above can be rearranged to yield

$$R_u = \frac{d[HONO]}{dt} + k_{20}[OH][NO_2]$$

Furthermore, since the photolytic half-life of HONO in these experiments is $\leq$ 15 min (Stockwell and Calvert 1978), HONO can reasonably be assumed to be in photostationary state after the first hour. Therefore, the radical initiation rates for t > 60 min in these photolyses can be estimated from the equation:

$$R_u\ (t \geqslant 60\ \text{min}) \simeq k_{20}[OH]_{avg}[NO_2]_{avg} \qquad \text{(VI)}$$

where $k_{20}$ is accurately known (Hampson and Garvin 1978, Atkinson and Lloyd 1983) and $[OH]_{avg}$ and $[NO_2]_{avg}$ (the average OH radical and $NO_2$ concentrations for t > 60 min) are experimentally determined. It should be noted that in general the OH radical levels were approximately constant after the first hour.

The radical input rates estimated in this way for the second and subsequent hours of the various runs are summarized in Tables IV-2 through IV-5 for the various chambers. It should be noted that these rates are one to three orders of magnitude greater than the maximum rates of the known homogeneous radical initiation processes such as $O_3$ or oxygenate photolysis and the reactions of propene with $O_3$ or $O(^3P)$ atoms (see above), and thus these values of $R_u$ can be considered to measure the radical flux from unknown sources. Furthermore, in runs with similar reactant levels, and thus similar values of $[NO_2]_{avg}$, the calculated radical flux is approximately proportional to [OH]. Thus, the dependence of [OH] on temperature, humidity (see Table IV-7), light intensity (Figure IV-4) and on the chamber employed (Table IV-6) reflect the corresponding dependence of the radical flux on these parameters (i.e., the unknown radical flux increases significantly with temperature and humidity, appears to be proportional to light intensity and varies when different chambers are employed).

Although the hydroxyl radical levels, and thus the radical flux, were observed to be unaffected by NO levels, the radical flux is significantly affected by $NO_2$ levels. In particular, since the addition of $NO_2$ to the benzaldehyde-$NO_x$ reaction mixture appears to slightly increase the OH radical levels (see data for run EC-647, Table IV-8 and Figure IV-3) despite the fact that reaction with $NO_2$ is a major OH radical sink, then the radical flux must increase with increasing $NO_2$. Furthermore, the fact that addition of $NO_2$ to a $NO_x$-air mixture not containing benzaldehyde (where reaction with $NO_2$ is the only significant OH radical sink) does not cause a significant change in the OH radical levels (Figure IV-2) indicates that the radical source must be approximately proportional to $[NO_2]$.

The dependence of the calculated radical fluxes, normalized for variations in light intensity by dividing by the $NO_2$ photolysis rate constant $k_1$, on the second-hour average $NO_2$ levels for chamber runs at ~303 K at both <10% and ~50% RH are shown in Figure IV-7 for the evacuable chamber

and in Figure IV-8 for the indoor Teflon chamber. While it can be seen that the radical flux increases with the $NO_2$ concentration, it is not clear whether or not the dependence of the radical flux is linear in $[NO_2]$, especially for the runs carried out at $\lesssim$10% RH.

Assuming that the dependence of the normalized radical source on $[NO_2]$ is linear, which appears to be the case for $NO_2$ concentrations in the ~0.1-1.0 ppm range (typical of most environmental chamber irradiations simulating photochemical smog), the evacuable chamber data are fit by the regression lines (shown in Figure IV-7)

$$R_u\ (<10\%\ RH) = k_1\ \{(0.27 \pm 0.17) + (1.02 \pm 0.16)[NO_2]\}\ \text{ppb min}^{-1}$$

and

$$R_u\ (\sim 50\%\ RH) = k_1\ \{(0.39 \pm 0.04) + (1.37 \pm 0.12)\ [NO_2]\}\ \text{ppb min}^{-1}$$

and the indoor Teflon chamber data are fit by the lines (shown in Figure IV-8),

$$R_u(<10\%\ RH) = k_1\ \{(0.004 \pm 0.070) + (0.39 \pm 0.14)[NO_2]\}\ \text{ppb min}^{-1}$$

and

$$R_u\ (\sim 50\%\ RH) = k_1\ \{(0.16 \pm 0.02) + (0.83 \pm 0.08)[NO_2]\}\ \text{ppb min}^{-1}$$

where the $NO_2$ concentrations are in ppm and the error limits are one standard deviation of the least squares analysis of the plots in Figures IV-7 and IV-8. These regression lines show that the radical source in this 6400-ℓ Teflon chamber is a factor of ~2-3 lower than that in the 5800-ℓ evacuable chamber, and that the effect of relative humidity is quanlitatively the same.

The dependence of the radical source on the instantaneous $NO_2$ concentrations, and the fact that rapid changes in $NO_2$ levels cause equally rapid changes in the apparent radical source, tends to rule out the radical flux being due primarily to offgassing of contaminants absorbed from previous experiments. In this regard, it should be noted that in the runs at T $\lesssim$303 K, the total $NO_x$ levels were observed to decline at rates corresponding to the calculated rate of $NO_x$ removal via the reaction of OH radicals with $NO_2$, based on the observed OH radical and $NO_2$ levels. Thus there is no evidence that the radical source is accompanied by offgasing

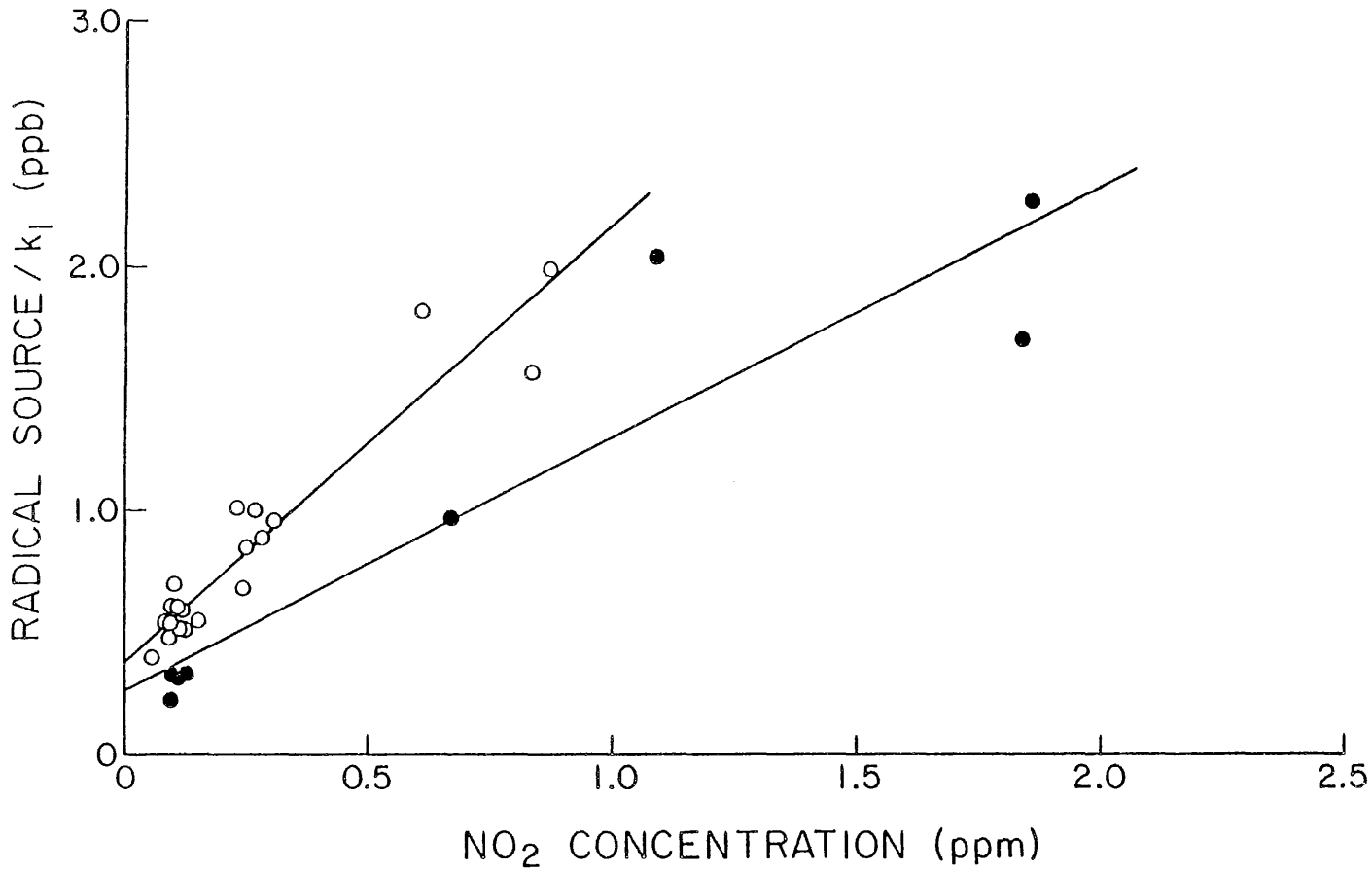


Figure IV-7. Plot of (Radical Source/$k_1$) Against the Average $NO_2$ Concentration for t > 60 Min in Evacuable Chamber Irradiations at 303 K.
● - ~0% Relative Humidity, O - ~50% Relative Humidity.

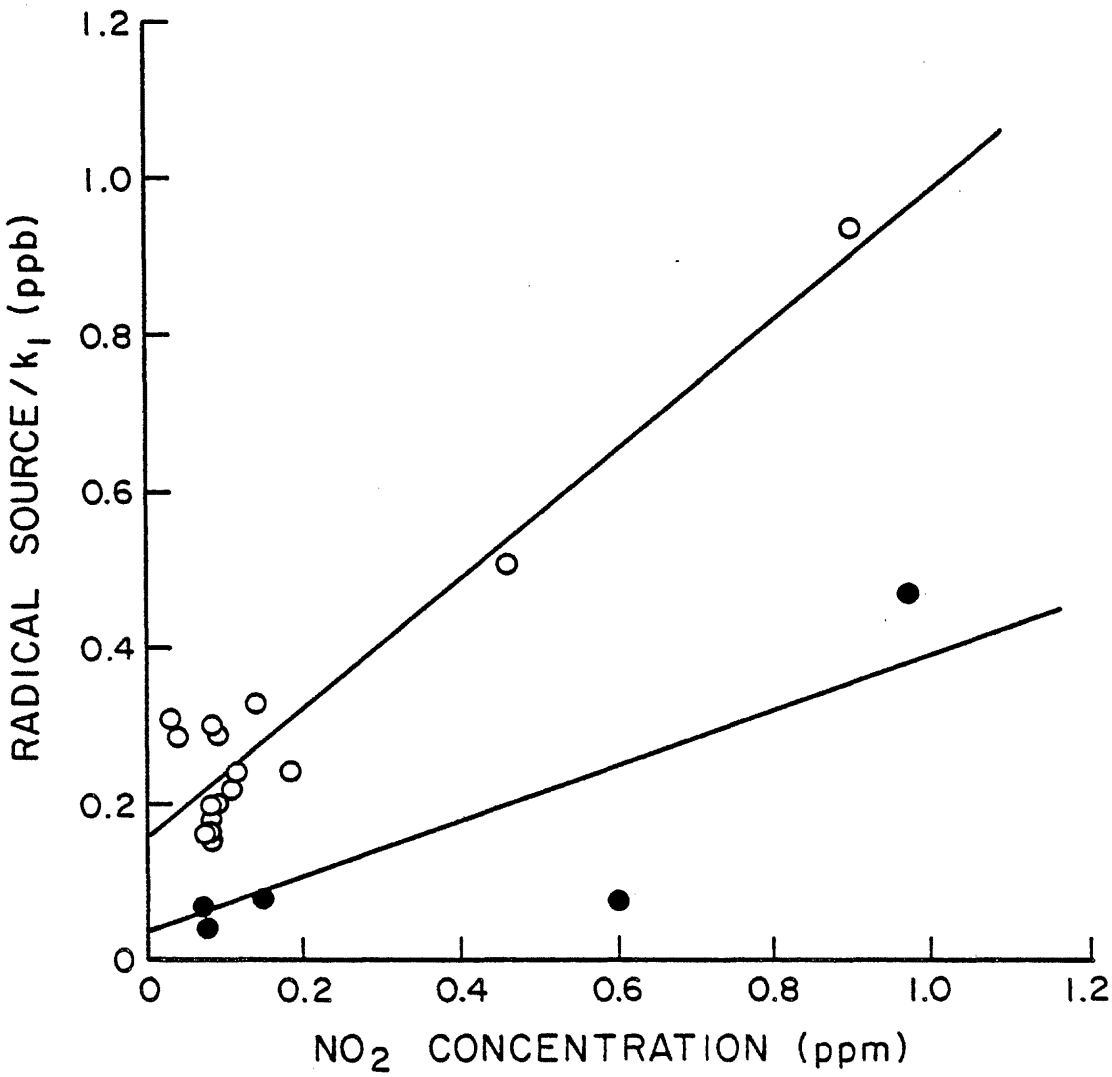


Figure IV-8. Plot of (Radical Source/$k_1$) Against Average $NO_2$ Concentration for the Indoor Teflon Chamber Irradiations. ● - ~0% Relative Humidity, O - ~50% Relative Humidity.

of nitrogenous species, as would be the case if it were due, for instance, to HONO offgassing.

NO Conversion Rates. In principle, it may also be possible to obtain some indication as to the nature of the radical source from the rate of NO consumption observed in these runs. Nitric oxide consumption is caused by dilution, by reactions with peroxy radicals (formed in the photooxidations of the organic tracers, CO, HCHO and other organic contaminants), by the dark oxidation to $NO_2$ (reaction 6) and by reaction with $NO_3$ formed from the reaction of $O(^3P)$ with $NO_2$ (reaction 5, followed by reaction 8). This is balanced in part by $NO_2$ to NO conversion resulting from the reaction of $O(^3P)$ atoms with $NO_2$ (reaction 4).

If the unknown radical flux is due to the initial formation of $HO_2$ radicals, as postulated by Hendry et al. (1978), then this would cause additional NO consumption due to the reaction of $HO_2$ radicals with NO. If the radical flux is due to the initial formation of OH radicals, as postulated by Carter et al. (1979a), then it would have no effect on NO consumption. If, however, the radical flux is due to a process which involves the conversion of $NO_2$ to NO, then the radical source would reduce the rate of NO consumption.

The observed NO conversion rates for the second hour of the evacuable chamber runs are summarized in Table IV-2, along with (for runs where CO data are available) rates calculated from the known processes (Carter et al. 1979a, Atkinson and Lloyd 1983). It should be noted that, if there are undetected organic contaminants, the observed conversion rates would be larger than the calculated values, and thus the latter should be considered to be lower limits. In general, except for the high temperature, high humidity runs where probable contamination effects cause the observed conversion rates to be consistently high, it can be seen that the observed conversion rates are either approximately equal to, or lower than, the calculated values. This suggests that the radical source is unlikely to involve formation of $HO_2$ or any other radical which consumes NO. In fact, the data appear to be most consistent with the assumption that some net NO formation from $NO_2$ may be involved in the radical flux.

Initial HONO Levels. Finally, as mentioned above, the observed initial hydroxyl radical levels suggest that HONO is initially present.

This has been confirmed by using differential optical absorption spectroscopy. HONO was observed to be present after $NO_2$ was injected into the evacuable chamber, and to subsequently increase slowly in the dark. In the runs with constant OH radical levels, the initially present HONO should be approximately equal to the photostationary state value. However, for the other runs, the initially present HONO is most reliably estimated by adjusting the initial HONO concentration and the radical flux to fit the data in detailed model calculations. Tables IV-2 and IV-9 summarize the initial HONO levels which are necessary to fit the observed OH radical concentrations for selected evacuable chamber runs, and a comparison of the observed and calculated initial HONO levels for the runs in which it was directly monitored are given in Table IV-9. It can be seen from that table that the observed and calculated initial HONO levels are in reasonably good agreement, thus validating the results of our model calculations.

The observed and calculated initial HONO levels are quite variable, but in general they increase with temperature, humidity and $NO_2$, with initial $NO_2$ having the largest effect, at least for $T \lesssim 303$ K. Surprisingly, it also appears that high levels of initial NO tend to suppress the calculated initial HONO (compare run EC-434 with EC-435). This then rules out the reaction

$$NO + NO_2 + H_2O \rightarrow 2\ HONO$$

as being the major source of the initial HONO in the chamber, but suggests that the hydrolysis of $NO_2$:

$$2\ NO_2 + H_2O \xrightarrow{\text{wall}} HONO + HNO_3$$

may be occurring. Additional direct studies of the dark formation of HONO in the evacuable chamber and its dependence on NO, $NO_2$ and $H_2O$ are being carried out under funding from other agencies and the results from these studies are totally consistent with the inferences drawn above.

<u>HONO Levels During Irradiation.</u> The gas phase photochemistry of HONO during $NO_x$-air irradiations is dominated by the following known reactions:

$$OH + NO \rightarrow HONO \quad (18)$$

$$HONO + h\nu \rightarrow NO + OH \quad (19)$$

Since reaction (19) is relatively fast ($J_{19} \sim 10^{-3}$ $sec^{-1}$ in the chamber), a photostationary HONO concentration is established after about 1 hr of photolysis. If reaction (18) is the only significant HONO source, the HONO concentration should be given by

$$[HONO] \cong (k_{18}[OH][NO])/J_{19} \quad \text{(VII)}$$

However, if the continuous radical source is due to the photolysis of HONO produced by a process other than reaction (18),

$$\text{(unknown process)} \rightarrow HONO \quad (26)$$

the photostationary state HONO concentration would then be higher, and would be given by

$$[HONO] \cong (k_{18}[OH][NO] + R_{26})/J_{19} \quad \text{(VIII)}$$

where $R_{26}$ is the rate of HONO formation in reaction (26). Thus the observed HONO levels during these irradiations should give an indication as to whether HONO is the intermediate involved in the continuous radical source or whether the radical source is due to the photolyses of some other species.

Table IV-10 gives the photostationary state HONO values calculated using both equations (VII) and (VIII) for the experiments in which HONO was monitored during the irradiations. For the purposes of calculating the photostationary state HONO levels using equation (VIII), $R_{26}$ was assumed to be equal to the net radical input rate calculated from the measured OH radical levels using equation (VI), as discussed above. Plots of observed HONO against photostationary state HONO calculated using equations (VII) and (VIII) are given in Figures IV-9 and IV-10, respectively.

It can be seen from Table IV-10 and Figures IV-9 and IV-10 that the data are somewhat ambiguous in that HONO levels for some runs are better predicted by equation (VII), while those for others are better fit by

equation (VIII). However, some of this ambiguity can be resolved if it is realized that these experiments fall into two classes: (1) those runs where the OH radical levels were within the range generally observed in $NO_x$-air irradiations performed previously in the SAPRC evacuable chamber (open circles in Figures IV-9 and IV-10), and (2) those runs (specifically EC-567 through 570) where the OH radical levels were significantly higher than expected, indicating possible contamination effects (closed circles).

It can be seen that, within the experimental uncertainties, the observed HONO levels in the "normal" experiments agreed reasonably well with the values calculated using equation (VIII) (Figure IV-10), suggesting that in these runs the radical source indeed involved HONO formation (reaction 26) and subsequent photolysis. On the other hand, in the runs with unusually high radical levels, Figure IV-9 shows that the observed HONO values were much closer to HONO levels calculated, assuming HONO is formed only from the reaction of OH with NO, indicating that the contaminant(s) causing the higher radical levels in those experiments was probably not HONO. However, additional experiments are required to more adequately resolve this apparent ambiguity.

## E. Conclusions

The results of the experiments reported here show conclusively that radical input from unknown sources is an important process in smog chamber systems and that, in terms of the total number of radicals produced in a typical smog simulation irradiation of $\geq$6-hr duration, photolysis of initial HONO is at most a minor contributor to this process. Thus, it is clear that photochemical smog models validated against chamber data assuming only initial HONO as the radical source must be re-evaluated. However, it is also clear that assuming only a constant radical flux during an irradiation is also an oversimplification, particularly in view of the fact that this assumption generally leads to an underprediction of radical levels in the initial stages of the irradiation, especially for mixtures with high $NO_2/NO$ ratios. Furthermore, the assumption of a constant radical source does not take into account the dependence of the radical flux on $NO_2$ levels, which in general vary during typical smog chamber irradiations.

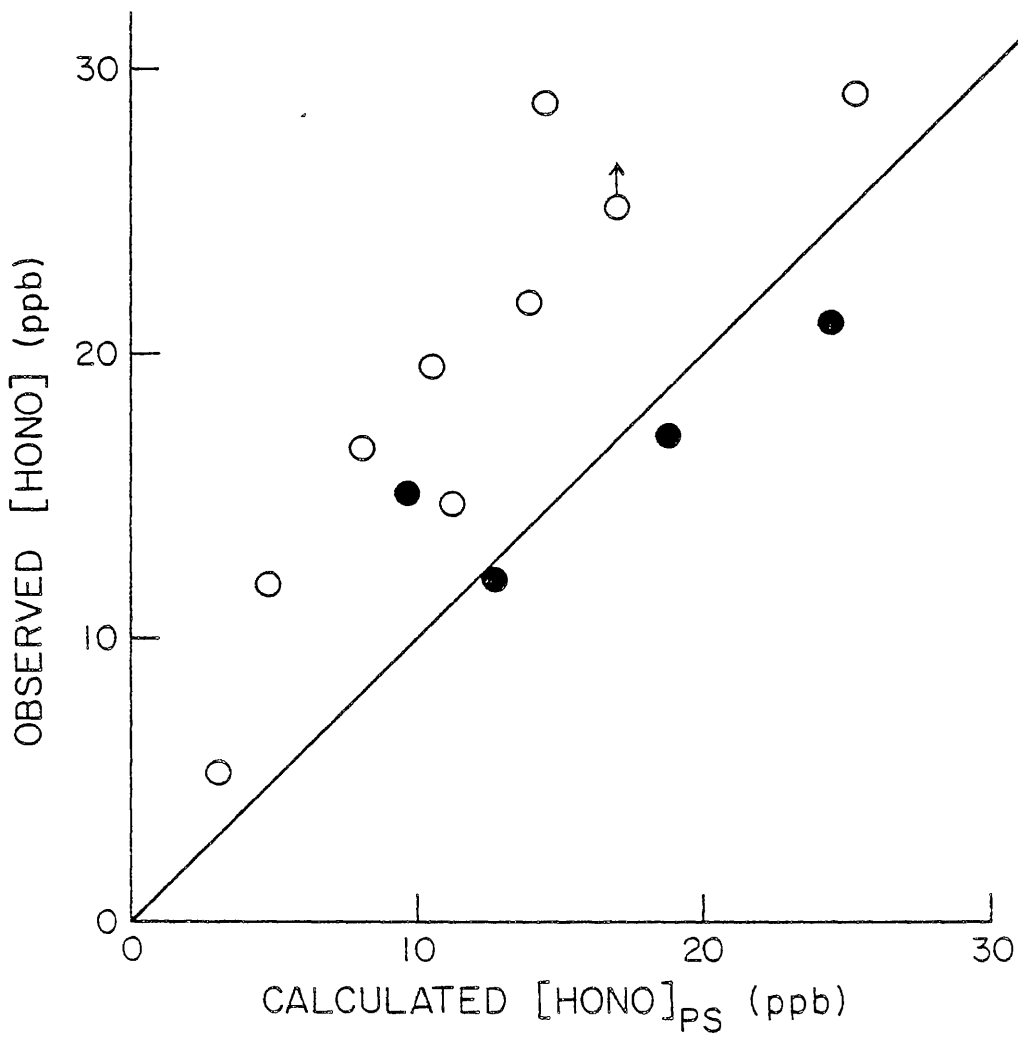


Figure IV-9. Plot of Observed [HONO] Against [HONO] Calculated for $NO_x$-Air Irradiations in the SAPRC Evacuable Chamber, Assuming HONO is Not the Radical Precursor Involved in the Continuous Radical Source (Equation VII).

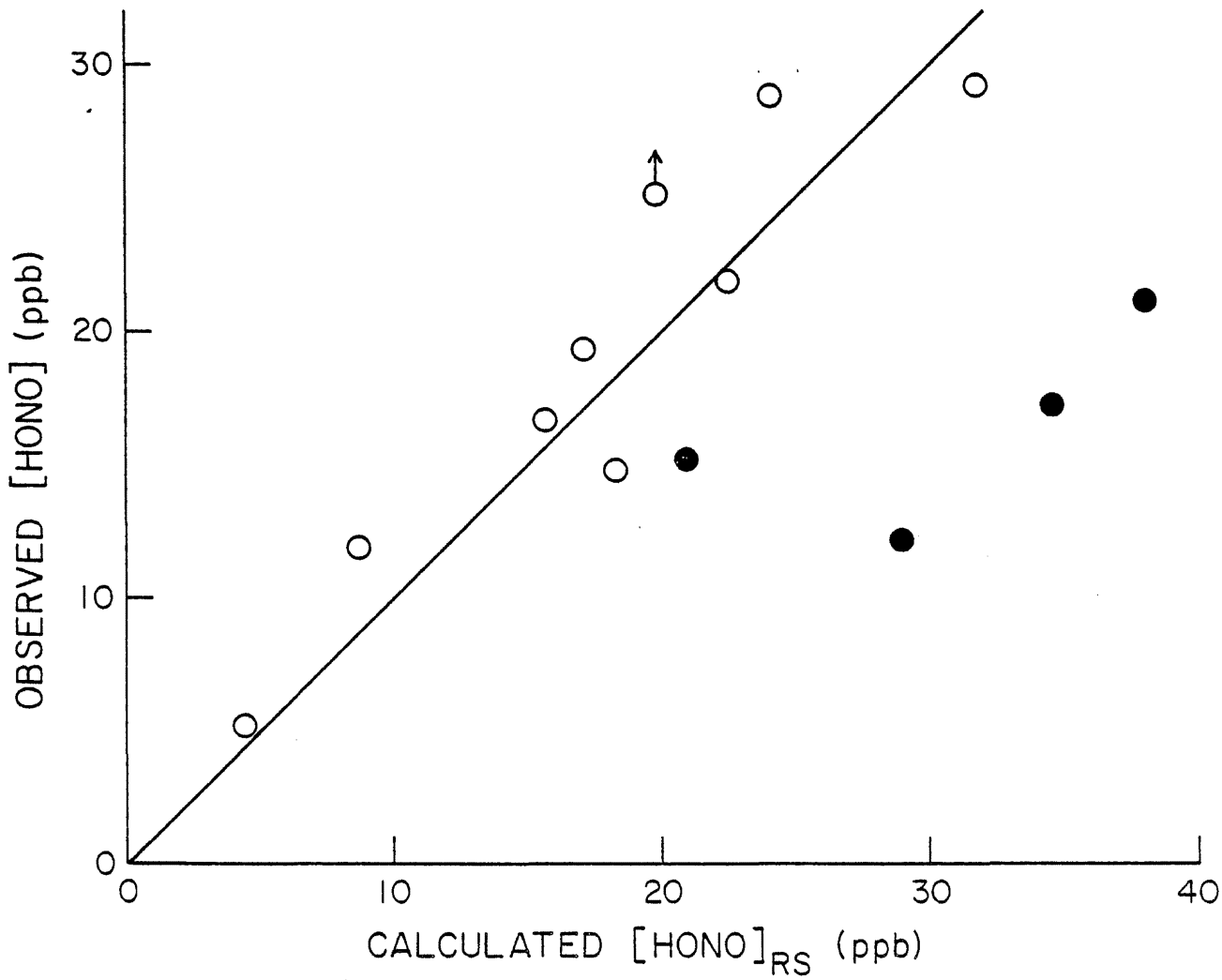


Figure IV-10. Plot of Observed [HONO] Against [HONO] Calculated for $NO_x$-Air Irradiations in the SAPRC Evacuable Chamber, Assuming HONO is the Radical Precursor Involved in the Continuous Radical Source (Equation VIII).

Radical input from unknown sources is strongly influenced by both temperature and relative humidity. This fact should be taken into account when using smog chamber data to assess the effects of these parameters on photochemical smog formation. In particular, the apparent strong dependence of smog-forming potential on temperature previously reported from these laboratories (Carter et al. 1979b) and by Countess et al. (1979) may be wholly or partially a result of this radical source effect. Clearly, extrapolation of environmental chamber data to ambient atmospheric conditions must be carried out with caution, especially until it can be established whether or not such radical sources are present in the atmosphere.

This work has shown that the radical input from unknown sources is highly dependent on the chamber employed. Thus, the radical source must be considered to be another chamber effect which (like $O_3$ wall destruction) must be measured periodically by appropriate control experiments in order for the data obtained during experimental runs to be adequately characterized. Irradiations of $NO_x$-air such as those described here appear to be useful in measuring this effect, and it is strongly recommended that all future experimental protocols involving smog chamber irradiations include $NO_x$-air irradiations among the associated characterizations and control experiments.

Although the results of the experiments reported here are not adequate to establish the exact mechanism causing this effect, they have given some indication as to its nature and allowed a number of possibilities to be ruled out. As mentioned previously, photolysis of HONO formed during $NO_x$ injection cannot be the only radical source, although it obviously does contribute in the initial stages of the irradiations, and its continuous formation during irradiations may be an important contribution to the radical flux. However, if this is the case, the reaction forming HONO cannot be

$$NO + NO_2 + H_2O \rightarrow 2\ HONO$$

since NO seems to have no effect on the radical flux.

The fact that the radical flux appears to be proportional to light intensity means that contaminant offgassing also cannot be a rate determining step. In addition, the facts that (1) the radical flux depends on

the chamber employed, (2) previously unused Teflon chambers have a significant radical flux, (3) the radical flux is higher in the evacuable chamber after it is "pumped and baked" than it is following standard evacuable chamber runs, (4) the flux depends on humidity, (5) the flux responds "instantaneously" (i.e., within the 15-min time resolution of our radical measurement technique) to sudden changes in $NO_2$ levels and (6) there is no evidence that the radical input is accompanied by an input of $NO_2$ or other species, all suggest that this effect is due, at least in part, to a heterogeneous reaction and is not a result of contamination.

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# APPENDIX A

## Detailed Data Tabulations for the $NO_x$-Air and $CH_3ONO$-Air Irradiations of n-Hexane, n-Heptane, n-Octane and Benzene

0847: THIRD AND FINAL FILL. 50% R.H.
0907: INJECTIONS: 6.1 ML. PROPENE, 3.6 ML. NO, AND 0.91 ML. NO2.
0930: LIGHTS ON 70%.
1557: DUMP AND REFILL.

T=0 AT 930 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 28.4 | 1.4 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.360 | PPM |
| NO2-UNC | T 14B-1 | 0.143 | PPM |
| PROPENE | DMS-2 | 0.9117 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 2290 | DMS-2 | RM-103; DIMETHYLSULFOLANE GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | PROPENE PPM DMS-2 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | ACETONE PPM 10'C-600 | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 850 | -40 | ------ | ------ | ------ | ------ | 0.0010 | 0.000 | ------ | 0.0014 | 0.0007 | ------ |
| 1 900 | -30 | 0.000 | 0.006 | 0.009 | 0.010 | ------ | ------ | ------ | ------ | ------ | 24.8 |
| 1 915 | -15 | 0.000 | 0.422 | 0.140 | 0.557 | 0.8938 | ------ | ------ | ------ | ------ | 25.2 |
| 1 920 | -10 | ------ | ------ | ------ | ------ | ------ | ------ | 0.008 | ------ | ------ | ------ |
| 1 930 | 0 | 0.000 | 0.360 | 0.143 | 0.569 | 0.9117 | 0.000 | ------ | 0.0000 | 0.0005 | 25.3 |
| 1 945 | 15 | 0.000 | 0.404 | 0.164 | 0.565 | ------ | ------ | ------ | ------ | ------ | 30.2 |
| 1 1000 | 30 | 0.000 | 0.369 | 0.205 | 0.569 | ------ | ------ | ------ | ------ | ------ | 32.3 |
| 1 1015 | 45 | 0.003 | 0.329 | 0.243 | 0.568 | ------ | ------ | ------ | ------ | ------ | 28.1 |
| 1 1030 | 60 | 0.009 | 0.289 | 0.282 | 0.566 | 0.7991 | 0.001 | 0.004 | ------ | ------ | 28.6 |
| 1 1045 | 75 | 0.004 | 0.248 | 0.321 | 0.563 | ------ | ------ | ------ | 0.0920 | 0.0009 | 28.2 |
| 1 1100 | 90 | 0.012 | 0.203 | 0.352 | 0.554 | ------ | ------ | ------ | ------ | ------ | 28.0 |
| 1 1115 | 105 | 0.019 | 0.158 | 0.382 | 0.542 | ------ | ------ | ------ | ------ | ------ | 27.9 |
| 1 1130 | 120 | 0.033 | 0.132 | 0.426 | 0.548 | 0.6697 | 0.008 | 0.013 | ------ | ------ | 29.0 |
| 1 1135 | 125 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.1602 | 0.0016 | ------ |
| 1 1145 | 135 | 0.021 | 0.090 | 0.451 | 0.536 | ------ | ------ | ------ | ------ | ------ | 27.6 |
| 1 1200 | 150 | 0.074 | 0.069 | 0.476 | 0.534 | ------ | ------ | ------ | ------ | ------ | 29.0 |
| 1 1215 | 165 | 0.120 | 0.046 | 0.475 | 0.516 | ------ | ------ | ------ | ------ | ------ | 28.4 |
| 1 1230 | 180 | 0.163 | 0.032 | 0.468 | 0.498 | 0.4637 | 0.037 | 0.023 | 0.2341 | 0.0032 | 28.7 |
| 1 1245 | 195 | 0.208 | 0.024 | 0.457 | 0.480 | ------ | ------ | ------ | ------ | ------ | 29.1 |
| 1 1300 | 210 | 0.264 | 0.022 | 0.445 | 0.463 | ------ | ------ | ------ | ------ | ------ | 29.3 |
| 1 1315 | 225 | 0.313 | 0.016 | 0.428 | 0.443 | ------ | ------ | ------ | ------ | ------ | 29.2 |
| 1 1330 | 240 | 0.353 | 0.013 | 0.411 | 0.424 | 0.2498 | 0.102 | 0.065 | 0.2943 | 0.0049 | 29.3 |
| 1 1345 | 255 | 0.394 | 0.011 | 0.398 | 0.408 | ------ | ------ | ------ | ------ | ------ | 28.8 |
| 1 1400 | 270 | 0.431 | 0.015 | 0.386 | 0.395 | ------ | ------ | ------ | ------ | ------ | 28.5 |
| 1 1415 | 285 | 0.457 | 0.006 | 0.362 | 0.372 | ------ | ------ | ------ | ------ | ------ | 28.2 |
| 1 1430 | 300 | 0.497 | 0.014 | 0.360 | 0.368 | 0.1078 | 0.194 | ------ | 0.2879 | 0.0046 | 28.2 |
| 1 1445 | 315 | 0.525 | 0.014 | 0.345 | 0.352 | ------ | ------ | ------ | ------ | ------ | 28.3 |
| 1 1500 | 330 | 0.549 | 0.010 | 0.329 | 0.335 | ------ | ------ | ------ | ------ | ------ | 28.3 |
| 1 1515 | 345 | 0.573 | 0.009 | 0.317 | 0.323 | ------ | ------ | ------ | ------ | ------ | 28.4 |
| 1 1530 | 360 | 0.586 | 0.008 | 0.306 | 0.312 | 0.0436 | 0.256 | 0.119 | 0.2692 | 0.0040 | 28.2 |
| 1 1545 | 375 | 0.613 | 0.002 | 0.291 | 0.297 | ------ | ------ | ------ | ------ | ------ | 28.5 |

------ NO DATA TAKEN

0843: THIRD AND FINAL FILL. 50% R.H.
0910: INJECTIONS: 18.6 ML. N-BUTANE, THEN SUPPLEMENTAL INJECTION
OF N-BUTANE = 2.6 ML., 0.72 ML. NO, AND 0.18 ML. NO2.
0930: LIGHTS ON 70%.
1650: DUMP AND FILL.

T=0 AT 930 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 29.9 | 2.1 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.091 | PPM |
| NO2-UNC | T 14B-1 | 0.028 | PPM |
| N-C4 | C-20M | 2.9546 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C4 PPM C-20M | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | MEK PPM 10'C-600 | C4-N-2 PPM 10'C-600 | C4-N-1 PPM 10'C-600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 845 | -45 | ------ | ------ | ------ | ------ | 0.0000 | 0.000 | ------ | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 1 906 | -24 | ------ | ------ | ------ | ------ | 2.607 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 915 | -15 | 0.000 | 0.060 | 0.030 | 0.120 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 917 | -13 | ------ | ------ | ------ | ------ | 2.949 A | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 927 | -3 | ------ | ------ | ------ | ------ | ------ | ------ | 0.061 | ------ | ------ | ------ | ------ |
| 1 930 | 0 | 0.000 | 0.091 | 0.028 | 0.118 | 2.955 | 0.000 | ------ | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 1 945 | 15 | 0.001 | 0.085 | 0.035 | 0.119 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1000 | 30 | 0.009 | 0.075 | 0.044 | 0.119 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1015 | 45 | 0.010 | 0.067 | 0.053 | 0.119 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1030 | 60 | 0.011 | 0.059 | 0.062 | 0.120 | 2.921 | 0.001 | 0.040 | 0.0054 | 0.0069 | ------ | 0.0000 |
| 1 1045 | 75 | 0.013 | 0.052 | 0.069 | 0.120 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1100 | 90 | 0.020 | 0.046 | 0.075 | 0.121 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1115 | 105 | 0.015 | 0.042 | 0.079 | 0.120 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1130 | 120 | 0.028 | 0.037 | 0.083 | 0.119 | 2.915 | 0.001 | 0.027 | 0.0128 | 0.0133 | 0.0024 | 0.0001 |
| 1 1145 | 135 | 0.030 | 0.035 | 0.087 | 0.121 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1200 | 150 | 0.038 | 0.031 | 0.089 | 0.120 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1215 | 165 | 0.040 | 0.028 | 0.091 | 0.119 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1230 | 180 | 0.050 | 0.026 | 0.094 | 0.120 | 2.882 | 0.001 | 0.029 | 0.0187 | 0.0184 | 0.0035 | 0.0004 |
| 1 1245 | 195 | 0.052 | 0.024 | 0.096 | 0.119 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1300 | 210 | 0.060 | 0.023 | 0.098 | 0.120 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1315 | 225 | 0.071 | 0.021 | 0.098 | 0.119 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1330 | 240 | 0.073 | 0.020 | 0.100 | 0.119 | 2.865 | 0.001 | 0.021 | 0.0228 | 0.0225 | 0.0046 | 0.0004 |
| 1 1345 | 255 | 0.075 | 0.019 | 0.100 | 0.118 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1400 | 270 | 0.092 | 0.018 | 0.101 | 0.117 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1415 | 285 | 0.100 | 0.017 | 0.102 | 0.118 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1430 | 300 | 0.101 | 0.016 | 0.102 | 0.117 | 2.859 | 0.003 | 0.013 | 0.0277 | 0.0326 | 0.0056 | 0.0006 |
| 1 1445 | 315 | 0.104 | 0.015 | 0.103 | 0.117 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1500 | 330 | 0.115 | 0.014 | 0.103 | 0.116 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1515 | 345 | 0.131 | 0.013 | 0.102 | 0.115 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1530 | 360 | 0.132 | 0.014 | 0.103 | 0.115 | 2.842 | 0.004 | 0.010 | 0.0330 | 0.0365 | 0.0067 | 0.0008 |
| 1 1545 | 375 | 0.143 | 0.013 | 0.103 | 0.115 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1600 | 390 | 0.152 | 0.012 | 0.103 | 0.114 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1615 | 405 | 0.156 | 0.012 | 0.102 | 0.113 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1630 | 420 | 0.165 | 0.012 | 0.104 | 0.115 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

------ NO DATA TAKEN

| CLOCK TIME DAY | HR. | ELAPSED TIME (MIN) | T DEG C DORIC-1 |
|---|---|---|---|
| 1 | 915 | -15 | 23.2 |
| 1 | 930 | 0 | 22.6 |
| 1 | 945 | 15 | 27.2 |
| 1 | 1000 | 30 | 28.6 |
| 1 | 1015 | 45 | 29.5 |
| 1 | 1030 | 60 | 30.1 |
| 1 | 1045 | 75 | 29.8 |
| 1 | 1100 | 90 | 30.1 |
| 1 | 1115 | 105 | 30.2 |
| 1 | 1130 | 120 | 30.2 |
| 1 | 1145 | 135 | 30.3 |
| 1 | 1200 | 150 | 30.2 |
| 1 | 1215 | 165 | 30.4 |
| 1 | 1230 | 180 | 30.5 |
| 1 | 1245 | 195 | 30.5 |
| 1 | 1300 | 210 | 31.0 |
| 1 | 1315 | 225 | 31.4 |
| 1 | 1330 | 240 | 31.8 |
| 1 | 1345 | 255 | 32.2 |
| 1 | 1400 | 270 | 32.6 |
| 1 | 1415 | 285 | 30.5 |
| 1 | 1430 | 300 | 30.9 |
| 1 | 1445 | 315 | 31.2 |
| 1 | 1500 | 330 | 30.5 |
| 1 | 1515 | 345 | 30.2 |
| 1 | 1530 | 360 | 30.0 |
| 1 | 1545 | 375 | 30.1 |
| 1 | 1600 | 390 | 30.1 |
| 1 | 1615 | 405 | 30.1 |
| 1 | 1630 | 420 | 30.3 |

------- NO DATA TAKEN

NOTES

A SUPPLEMENTAL INJECTION OF N-BUTANE MADE PRIOR TO THIS SAMPLE.

0845: THIRD AND FINAL FILL. 50% R.H.
0911: INJECTIONS: 55 MICROLITERS TOLUENE, 3.6 ML. NO, 0.91 ML. NO2.
0931: 15 MICROLITERS SUPPLEMENTAL TOLUENE ADDED.
1000: LIGHTS ON 70%.

T=0 AT 1000 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 28.2 | 3.9 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.408 | PPM |
| NO2-UNC | T 14B-1 | 0.135 | PPM |
| TOLUENE | 10'C-600 | 1.960 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |

ITC-534
TOLUENE-NOX
1982 NOV. 11



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | PAN PPM ECD-1 | HCHO PPM CA | TOLUENE PPM 10'C-600 | BZALD RAW DATA 5' C-600 | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 850 | -70 | ------ | ------ | ------ | ------ | ------ | ------ | 0.005 | ------ | ------ |
| 1 900 | -60 | 0.000 | 0.011 | 0.009 | 0.014 | ------ | ------ | ------ | ------ | 14.2 |
| 1 915 | -45 | 0.019 | 0.403 | 0.124 | 0.530 | ------ | ------ | 1.515 | ------ | 21.4 |
| 1 928 | -32 | ------ | ------ | ------ | ------ | ------ | 0.042 | ------ | ------ | ------ |
| 1 930 | -30 | 0.000 | 0.409 | 0.132 | 0.539 | ------ | ------ | ------ | ------ | 20.8 |
| 1 940 | -20 | ------ | ------ | ------ | ------ | ------ | ------ | 1.948 A | ------ | ------ |
| 1 945 | -15 | 0.000 | 0.407 | 0.135 | 0.539 | ------ | ------ | ------ | ------ | 24.2 |
| 1 1000 | 0 | 0.000 | 0.408 | 0.135 | 0.540 | 0.000 | ------ | 1.960 | ------ | 24.5 |
| 1 1015 | 15 | 0.001 | 0.400 | 0.144 | 0.541 | ------ | ------ | ------ | ------ | 29.0 |
| 1 1030 | 30 | 0.006 | 0.366 | 0.173 | 0.536 | ------ | ------ | ------ | ------ | 30.1 |
| 1 1045 | 45 | 0.020 | 0.296 | 0.227 | 0.520 | ------ | ------ | ------ | ------ | 30.4 |
| 1 1100 | 60 | 0.024 | 0.211 | 0.295 | 0.508 | 0.003 | ------ | 1.881 | 0.4640 | 30.4 |
| 1 1115 | 75 | 0.052 | 0.129 | 0.362 | 0.489 | ------ | ------ | ------ | ------ | 30.6 |
| 1 1124 | 84 | ------ | ------ | ------ | ------ | ------ | 0.017 | ------ | ------ | ------ |
| 1 1130 | 90 | 0.100 | 0.068 | 0.388 | 0.456 | ------ | ------ | ------ | ------ | 30.2 |
| 1 1145 | 105 | 0.156 | 0.042 | 0.372 | 0.410 | ------ | ------ | ------ | ------ | 30.2 |
| 1 1200 | 120 | 0.231 | 0.025 | 0.326 | 0.348 | 0.035 | 0.021 | 1.699 | ------ | 30.4 |
| 1 1215 | 135 | 0.302 | 0.020 | 0.274 | 0.290 | ------ | ------ | ------ | ------ | 30.5 |
| 1 1230 | 150 | 0.380 | 0.008 | 0.215 | 0.226 | ------ | ------ | ------ | ------ | 29.7 |
| 1 1245 | 165 | 0.454 | 0.011 | 0.176 | 0.185 | ------ | ------ | ------ | ------ | 29.2 |
| 1 1300 | 180 | 0.484 | 0.008 | 0.145 | 0.153 | 0.093 | 0.027 | 1.502 | 2.384 | 29.2 |
| 1 1315 | 195 | 0.494 | 0.012 | 0.133 | 0.140 | ------ | ------ | ------ | ------ | 29.5 |
| 1 1330 | 210 | 0.487 | 0.003 | 0.115 | 0.122 | ------ | ------ | ------ | ------ | 29.6 |
| 1 1345 | 225 | 0.482 | 0.009 | 0.118 | 0.125 | ------ | ------ | ------ | ------ | 29.8 |
| 1 1400 | 240 | 0.474 | 0.007 | 0.112 | 0.119 | 0.107 | 0.031 | 1.438 | 2.576 | 29.8 |
| 1 1415 | 255 | 0.463 | 0.009 | 0.113 | 0.120 | ------ | ------ | ------ | ------ | 29.5 |
| 1 1430 | 270 | 0.447 | 0.003 | 0.104 | 0.112 | ------ | ------ | ------ | ------ | 29.8 |
| 1 1445 | 285 | 0.444 | 0.008 | 0.106 | 0.113 | ------ | ------ | ------ | ------ | 29.5 |
| 1 1450 | 290 | ------ | ------ | ------ | ------ | ------ | 0.038 | ------ | ------ | ------ |
| 1 1500 | 300 | 0.427 | 0.007 | 0.104 | 0.110 | 0.099 | ------ | 1.395 | 2.384 | 29.7 |
| 1 1515 | 315 | 0.423 | 0.009 | 0.103 | 0.110 | ------ | ------ | ------ | ------ | 29.4 |
| 1 1530 | 330 | 0.412 | 0.006 | 0.096 | 0.104 | ------ | ------ | ------ | ------ | 29.6 |

------ NO DATA TAKEN

NOTES

A SUPPLEMENTAL INJECTION OF TOLUENE MADE PRIOR TO THIS SAMPLE.

0048: THIRD AND FINAL FILL. 50% R.H.
0915: INJECTIONS: 0.061 ML. PROPENE, 0.061 ML. N-BUTANE,
3.6 ML. NO, AND 0.91 ML. NO2.
0945: LIGHTS ON 70%.
1146: DUMP AND FILL.

T=0 AT 945 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 29.3 | 1.4 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.421 | PPM |
| NO2-UNC | T 14B-1 | 0.147 | PPM |
| PROPENE | DMS-2 | 0.00846 | PPM |
| N-C4 | DMS-2 | 0.00835 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 2290 | DMS-2 | RM-103; DIMETHYLSULFOLANE GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |

ITC-535
NOX-AIR IRRADIATION
1982 NOV. 12



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | LNC4/C3= RAW DATA | HYDROXYL PPT | PROPENE PPM DMS-2 | N-C4 PPM DMS-2 | ACETONE PPM 10'C-600 | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 900 | -45 | 0.000 | 0.005 | 0.008 | 0.015 | ------ | ------ | 0.00082 | 0.00018 | 0.0005 | 28.1 |
| 1 915 | -30 | 0.000 | 0.006 | 0.055 | 0.063 | ------ | ------ | ------ | ------ | ------ | 27.7 |
| 1 920 | -25 | ------ | ------ | ------ | ------ | -0.0670 | ------ | 0.00861 | 0.00839 | ------ | ------ |
| 1 930 | -15 | 0.000 | 0.231 | 0.137 | 0.552 | ------ | ------ | ------ | ------ | ------ | 28.5 |
| 1 945 | 0 | 0.000 | 0.421 | 0.147 | 0.566 | -0.0550 | 0.117 | 0.00846 | 0.00835 | ------ | 28.7 |
| 1 1000 | 15 | 0.000 | 0.430 | 0.145 | 0.571 | 0.0020 | 0.129 | 0.00792 | 0.00828 | ------ | 31.8 |
| 1 1015 | 30 | 0.000 | 0.434 | 0.141 | 0.570 | ------ | ------ | ------ | ------ | ------ | 31.5 |
| 1 1016 | 31 | ------ | ------ | ------ | ------ | 0.0690 | 0.081 | 0.00750 | 0.00837 | ------ | ------ |
| 1 1030 | 45 | 0.000 | 0.432 | 0.140 | 0.570 | 0.1060 | 0.133 | 0.00721 | 0.00835 | ------ | 30.3 |
| 1 1045 | 60 | 0.000 | 0.434 | 0.138 | 0.568 | 0.1710 | 0.115 | 0.00674 | 0.00834 | ------ | 30.1 |
| 1 1100 | 75 | 0.000 | 0.434 | 0.137 | 0.568 | 0.2270 | 0.119 | 0.00633 | 0.00828 | ------ | 29.1 |
| 1 1115 | 90 | 0.000 | 0.432 | 0.134 | 0.564 | 0.2850 | 0.125 | 0.00598 | 0.00830 | ------ | 28.8 |
| 1 1130 | 105 | 0.000 | 0.437 | 0.132 | 0.561 | 0.3460 | 0.090 | 0.00552 | 0.00814 | ------ | 28.4 |
| 1 1145 | 120 | 0.000 | 0.443 | 0.133 | 0.560 | 0.3900 | ------ | 0.00530 | 0.00816 | ------ | 28.1 |

------ NO DATA TAKEN

ITC-536
NOX-AIR IRRADIATION
1982 NOV. 15

0849: THIRD AND FINAL FILL. 50% R.H.
0911: INJECTIONS: 0.061 ML. PROPENE, 0.061 ML. N-BUTANE,
3.6 ML. NO; AND 0.91 ML. NO2.
0945: LIGHTS ON 70%.
1156: DUMP AND FILL.

T=0 AT 945 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 26.9 | 1.2 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | COL-1600 | 0.474 | PPM |
| NO | T 14B-1 | 0.430 | PPM |
| NO2-UNC | COL-1600 | 0.133 | PPM |
| NO2-UNC | T 14B-1 | 0.137 | PPM |
| PROPENE | DMS-2 | 0.0094 | PPM |
| N-C4 | DMS-2 | 0.0088 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 2290 | DMS-2 | RM-103; DIMETHYLSULFOLANE GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | B-3378 | DASIBI 3378 OZONE MONITOR |
| 1625 | COL-1600 | COLUMBIA 1600 NO-NOX ANALYZER |

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM COL-1600 | NO PPM T 14B-1 | NO2-UNC PPM COL-1600 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | NOX-UNC PPM COL-1600 | LNC4/C3= RAW DATA | HYDROXYL PPT | PROPENE PPM DMS-2 | N-C4 PPM DMS-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 830 | -75 | 0.011 | 0.027 | 0.012 | 0.039 | 0.016 | 0.021 | 0.067 | ------ | ------ | ------ | ------ |
| 1 845 | -60 | 0.012 | 0.000 | 0.004 | 0.005 | 0.011 | 0.011 | 0.000 | ------ | ------ | ------ | ------ |
| 1 900 | -45 | 0.000 | 0.005 | 0.007 | 0.001 | 0.013 | 0.020 | 0.007 | ------ | ------ | 0.0009 | 0.0002 |
| 1 915 | -30 | 0.000 | 0.477 | 0.429 | 0.126 | 0.134 | 0.559 | 0.606 | ------ | ------ | ------ | ------ |
| 1 920 | -25 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | -0.1210 | ------ | 0.0095 | 0.0088 |
| 1 930 | -15 | 0.000 | 0.475 | 0.433 | 0.130 | 0.143 | 0.569 | 0.606 | ------ | ------ | ------ | ------ |
| 1 945 | 0 | 0.000 | 0.474 | 0.430 | 0.133 | 0.137 | 0.565 | 0.607 | -0.1050 | 0.049 | 0.0094 | 0.0088 |
| 1 1000 | 15 | 0.000 | 0.474 | 0.434 | 0.132 | 0.136 | 0.569 | 0.607 | -0.0810 | 0.086 | 0.0091 | 0.0088 |
| 1 1015 | 30 | 0.000 | 0.477 | 0.433 | 0.126 | 0.132 | 0.567 | 0.604 | -0.0390 | 0.101 | 0.0088 | 0.0088 |
| 1 1030 | 45 | 0.000 | 0.477 | 0.438 | 0.127 | 0.134 | 0.569 | 0.604 | 0.0100 | 0.072 | 0.0082 | 0.0086 |
| 1 1045 | 60 | 0.000 | 0.477 | 0.439 | 0.121 | 0.133 | 0.569 | 0.600 | 0.0450 | 0.121 | 0.0081 | 0.0089 |
| 1 1100 | 75 | 0.000 | 0.475 | 0.439 | 0.125 | 0.132 | 0.568 | 0.602 | 0.1040 | 0.057 | 0.0075 | 0.0087 |
| 1 1115 | 90 | 0.000 | 0.475 | 0.440 | 0.122 | 0.129 | 0.568 | 0.598 | 0.1320 | 0.125 | 0.0073 | 0.0087 |
| 1 1130 | 105 | 0.000 | 0.462 | 0.441 | 0.116 | 0.130 | 0.569 | 0.580 | 0.1930 | 0.074 | 0.0069 | 0.0088 |
| 1 1145 | 120 | 0.000 | 0.461 | 0.441 | 0.115 | 0.132 | 0.569 | 0.579 | 0.2290 | ------ | 0.0066 | 0.0086 |

------ NO DATA TAKEN

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | METHANE PPM PN-1 | ETHENE PPM PN-1 | ETHANE PPM PN-1 | ACETYLEN RAW DATA PN-1 | ACETYLEN RAW DATA DMS-2 | PROPANE PPM DMS-2 | I-C4 PPM DMS-2 | HCHO PPM CA | ACETALD PPM 10'C-600 | ACETONE PPM 10'C-600 | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 830 | -75 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 25.7 |
| 1 845 | -60 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 26.1 |
| 1 900 | -45 | 1.33 | 0.0051 | 0.0034 | 0.0094 | 1.040 | 0.0060 | 0.0006 | ------ | 0.0015 | 0.0009 | 26.0 |
| 1 915 | -30 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 25.6 |
| 1 929 | -16 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.010 | ------ | ------ | ------ |
| 1 930 | -15 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 25.6 |
| 1 945 | 0 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 25.3 |
| 1 1000 | 15 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 27.6 |
| 1 1015 | 30 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 26.9 |
| 1 1030 | 45 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 27.4 |
| 1 1045 | 60 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 27.4 |
| 1 1100 | 75 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 28.4 |
| 1 1115 | 90 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 28.2 |
| 1 1130 | 105 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 28.5 |
| 1 1135 | 110 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.038 | ------ | ------ | ------ |
| 1 1145 | 120 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 28.1 |

------ NO DATA TAKEN

1244: THIRD AND FINAL FILL. 85 DEGREES F.
1254: FILLED AND READY.
1330: INJECTIONS: 0.061 ML. PROPENE, 0.061 ML. N-BUTANE,
0.72 ML. NO, AND 0.18 ML. NO2.
1400: LIGHTS ON 70%.
1610: DUMP AND REFILL.

T=0 AT 1400 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 28.3 | 1.3 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | COL-1600 | 0.103 | PPM |
| NO | T 14B-1 | 0.097 | PPM |
| NO2-UNC | COL-1600 | 0.024 | PPM |
| NO2-UNC | T 14B-1 | 0.035 | PPM |
| PROPENE | DMS-2 | 0.0092 | PPM |
| N-C4 | DMS-2 | 0.0099 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 2290 | DMS-2 | RM-103; DIMETHYLSULFOLANE GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 1625 | COL-1600 | COLUMBIA 1600 NO-NOX ANALYZER |

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM COL-1600 | NO PPM T 14B-1 | NO2-UNC PPM COL-1600 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM COL-1600 | NOX-UNC PPM T 14B-1 | LNC4/C3= RAW DATA | HYDROXYL PPT | PROPENE PPM DMS-2 | N-C4 PPM DMS-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 1300 | -60 | 0.024 | 0.007 | 0.001 | 0.012 | 0.031 | 0.019 | 0.032 | ------ | ------ | ------ | ------ |
| 1 1315 | -45 | 0.040 | 0.008 | 0.001 | 0.014 | 0.032 | 0.021 | 0.032 | ------ | ------ | ------ | ------ |
| 1 1318 | -42 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.0009 | 0.0003 |
| 1 1330 | -30 | 0.000 | 0.008 | 0.008 | 0.002 | 0.012 | 0.010 | 0.020 | ------ | ------ | ------ | ------ |
| 1 1345 | -15 | 0.000 | 0.102 | 0.097 | 0.024 | 0.035 | 0.127 | 0.132 | 0.0250 | ------ | 0.0095 | 0.0102 |
| 1 1400 | 0 | 0.000 | 0.103 | 0.097 | 0.024 | 0.035 | 0.127 | 0.132 | 0.0370 | 0.105 | 0.0092 | 0.0099 |
| 1 1415 | 15 | 0.000 | 0.105 | 0.099 | 0.023 | 0.035 | 0.129 | 0.134 | 0.0880 | 0.140 | 0.0087 | 0.0100 |
| 1 1430 | 30 | 0.000 | 0.103 | 0.098 | 0.025 | 0.036 | 0.129 | 0.133 | 0.1560 | 0.177 | 0.0081 | 0.0099 |
| 1 1445 | 45 | 0.000 | 0.102 | 0.096 | 0.026 | 0.037 | 0.128 | 0.132 | 0.2420 | 0.185 | 0.0073 | 0.0097 |
| 1 1500 | 60 | 0.000 | 0.099 | 0.094 | 0.028 | 0.039 | 0.127 | 0.132 | 0.3320 | 0.177 | 0.0067 | 0.0098 |
| 1 1515 | 75 | 0.000 | 0.098 | 0.092 | 0.029 | 0.039 | 0.127 | 0.131 | 0.4180 | 0.195 | 0.0061 | 0.0097 |
| 1 1530 | 90 | 0.000 | 0.095 | 0.090 | 0.031 | 0.041 | 0.127 | 0.130 | 0.5130 | 0.205 | 0.0055 | 0.0096 |
| 1 1545 | 105 | 0.000 | 0.093 | 0.089 | 0.032 | 0.042 | 0.125 | 0.130 | 0.6130 | 0.181 | 0.0049 | 0.0094 |
| 1 1600 | 120 | 0.001 | 0.091 | 0.086 | 0.033 | 0.043 | 0.124 | 0.129 | 0.7010 | ------ | 0.0045 | 0.0094 |

------ NO DATA TAKEN

ITC-537
NOX-AIR IRRADIATION
1982 NOV. 15



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | METHANE PPM PN-1 | ETHENE PPM PN-1 | ETHANE PPM PN-1 | ACETYLEN RAW DATA PN-1 | ACETYLEN RAW DATA DMS-2 | PROPANE PPM DMS-2 | I-C4 PPM DMS-2 | HCHO PPM CA | ACETONE PPM 10'C-600 | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 1300 | -60 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 27.3 |
| 1 1315 | -45 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 26.4 |
| 1 1318 | -42 | 1.33 | 0.0053 | 0.0036 | 0.0066 | 0.7440 | 0.0073 | 0.0007 | ------ | 0.0009 | ------ |
| 1 1330 | -30 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 26.7 |
| 1 1345 | -15 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 26.4 |
| 1 1356 | -4 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.008 | ------ | ------ |
| 1 1400 | 0 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 26.5 |
| 1 1415 | 15 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 29.0 |
| 1 1430 | 30 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 29.4 |
| 1 1445 | 45 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 29.1 |
| 1 1500 | 60 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 29.4 |
| 1 1515 | 75 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 29.1 |
| 1 1530 | 90 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 29.5 |
| 1 1545 | 105 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 29.1 |
| 1 1600 | 120 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 29.3 |

------ NO DATA TAKEN

0851: THIRD AND FINAL FILL. 50% R.H.
0927: INJECTIONS (IN ML.): 381 N-HEPTANE, 0.72 NO, AND 0.18 NO2.
1000: T=0. 70% LIGHTS.
1622: DUMP AND FILL.

T=0 AT 1000 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 28.3 | 1.5 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | COL-1600 | 0.102 | PPM |
| NO | T 14B-1 | 0.092 | PPM |
| NO2-UNC | COL-1600 | 0.012 | PPM |
| NO2-UNC | T 14B-1 | 0.030 | PPM |
| N-C7 | C-20M | 8.6154 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 3378 | B-3378 | DASIBI 3378 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 1625 | COL-1600 | COLUMBIA 1600 NO-NOX ANALYZER |

ITC-538
N-HEPTANE/NOX
1982 NOV. 16



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM COL-1600 | NO PPM T 14B-1 | NO2-UNC PPM COL-1600 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM COL-1600 | NOX-UNC PPM T 14B-1 | NOX-CORR PPM T 14B-1 | NOX-CORR PPM COL-1600 | N-C7 PPM C-20M | C7-N-3 PPM 5' C-600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 830 | -90 | 0.005 | 0.200 | 0.176 | 0.044 | 0.058 | 0.200 | 0.200 | ------ | ------ | ------ | ------ |
| 1 845 | -75 | 0.010 | 0.041 | 0.184 | 0.009 | 0.045 | 0.050 | 0.200 | ------ | ------ | ------ | ------ |
| 1 900 | -60 | 0.000 | 0.011 | 0.007 | 0.002 | 0.009 | 0.013 | 0.015 | ------ | ------ | 0.0000 | ------ |
| 1 915 | -45 | 0.000 | 0.011 | 0.007 | 0.002 | 0.007 | 0.013 | 0.014 | ------ | ------ | ------ | ------ |
| 1 930 | -30 | 0.000 | 0.103 | 0.093 | 0.016 | 0.020 | 0.120 | 0.113 | ------ | ------ | ------ | ------ |
| 1 945 | -15 | 0.000 | 0.103 | 0.093 | 0.012 | 0.031 | 0.115 | 0.123 | ------ | ------ | 8.615 | ------ |
| 1 1000 | 0 | 0.000 | 0.102 | 0.092 | 0.012 | 0.030 | 0.114 | 0.123 | ------ | ------ | 8.615 | ------ |
| 1 1015 | 15 | 0.000 | 0.095 | 0.088 | 0.020 | 0.039 | 0.116 | 0.126 | ------ | ------ | ------ | ------ |
| 1 1030 | 30 | 0.002 | 0.086 | 0.080 | 0.030 | 0.049 | 0.116 | 0.128 | ------ | ------ | ------ | ------ |
| 1 1045 | 45 | 0.002 | 0.078 | 0.071 | 0.037 | 0.057 | 0.115 | 0.128 | ------ | ------ | ------ | ------ |
| 1 1100 | 60 | 0.009 | 0.069 | 0.063 | 0.047 | 0.067 | 0.116 | 0.130 | 0.069 | 0.049 | 8.615 | 0.0038 |
| 1 1115 | 75 | 0.004 | 0.061 | 0.056 | 0.055 | 0.074 | 0.116 | 0.129 | ------ | ------ | ------ | ------ |
| 1 1130 | 90 | 0.013 | 0.053 | 0.049 | 0.064 | 0.081 | 0.117 | 0.131 | ------ | ------ | ------ | ------ |
| 1 1145 | 105 | 0.016 | 0.048 | 0.045 | 0.069 | 0.087 | 0.118 | 0.132 | ------ | ------ | ------ | ------ |
| 1 1200 | 120 | 0.028 | 0.041 | 0.039 | 0.077 | 0.094 | 0.118 | 0.132 | 0.096 | 0.079 | 8.550 | 0.0079 |
| 1 1215 | 135 | 0.025 | 0.036 | 0.035 | 0.081 | 0.099 | 0.117 | 0.133 | ------ | ------ | ------ | ------ |
| 1 1230 | 150 | 0.038 | 0.033 | 0.031 | 0.084 | 0.103 | 0.118 | 0.133 | ------ | ------ | ------ | ------ |
| 1 1245 | 165 | 0.049 | 0.029 | 0.028 | 0.089 | 0.106 | 0.118 | 0.134 | ------ | ------ | ------ | ------ |
| 1 1300 | 180 | 0.053 | 0.027 | 0.026 | 0.091 | 0.109 | 0.118 | 0.134 | 0.110 | 0.092 | 8.485 | 0.0107 |
| 1 1315 | 195 | 0.062 | 0.025 | 0.022 | 0.094 | 0.111 | 0.118 | 0.133 | ------ | ------ | ------ | ------ |
| 1 1330 | 210 | 0.064 | 0.023 | 0.021 | 0.096 | 0.113 | 0.119 | 0.134 | ------ | ------ | ------ | ------ |
| 1 1345 | 225 | 0.078 | 0.023 | 0.021 | 0.094 | 0.114 | 0.117 | 0.135 | ------ | ------ | ------ | ------ |
| 1 1400 | 240 | 0.089 | 0.021 | 0.019 | 0.097 | 0.116 | 0.117 | 0.135 | 0.114 | 0.095 | 8.408 | 0.0152 |
| 1 1415 | 255 | 0.093 | 0.018 | 0.019 | 0.097 | 0.117 | 0.115 | 0.135 | ------ | ------ | ------ | ------ |
| 1 1430 | 270 | 0.095 | 0.017 | 0.018 | 0.097 | 0.119 | 0.114 | 0.137 | ------ | ------ | ------ | ------ |
| 1 1445 | 285 | 0.102 | 0.016 | 0.018 | 0.098 | 0.119 | 0.113 | 0.136 | ------ | ------ | ------ | ------ |
| 1 1500 | 300 | 0.110 | 0.015 | 0.017 | 0.100 | 0.120 | 0.115 | 0.137 | 0.117 | 0.096 | 8.376 | 0.0190 |
| 1 1515 | 315 | 0.122 | 0.015 | 0.016 | 0.100 | 0.122 | 0.114 | 0.137 | ------ | ------ | ------ | ------ |
| 1 1530 | 330 | 0.130 | 0.015 | 0.015 | 0.105 | 0.121 | 0.119 | 0.136 | ------ | ------ | ------ | ------ |
| 1 1545 | 345 | 0.140 | 0.015 | 0.015 | 0.103 | 0.122 | 0.118 | 0.137 | ------ | ------ | ------ | ------ |
| 1 1600 | 360 | 0.150 | 0.015 | 0.015 | 0.104 | 0.125 | 0.118 | 0.138 | 0.123 | 0.103 | 8.354 | 0.0235 |

------ NO DATA TAKEN

ITC-538
N-HEPTANE/NOX
1982 NOV. 16



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | C7-N-2 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | ACETONE PPM 10'C-600 | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|
| 1 830 | -90 | ------ | ------ | ------ | ------ | ------ | 26.9 |
| 1 845 | -75 | ------ | ------ | ------ | ------ | ------ | 26.4 |
| 1 900 | -60 | ------ | ------ | ------ | 0.0022 | 0.0000 | 26.3 |
| 1 915 | -45 | ------ | ------ | ------ | ------ | ------ | 25.5 |
| 1 930 | -30 | ------ | ------ | ------ | ------ | ------ | 25.1 |
| 1 945 | -15 | ------ | 0.000 | ------ | ------ | ------ | 25.2 |
| 1 950 | -10 | ------ | ------ | 0.006 | ------ | ------ | ------ |
| 1 1000 | 0 | ------ | 0.000 | ------ | 0.0000 | 0.0000 | 25.0 |
| 1 1015 | 15 | ------ | ------ | ------ | ------ | ------ | 27.5 |
| 1 1030 | 30 | ------ | ------ | ------ | ------ | ------ | 28.5 |
| 1 1045 | 45 | ------ | ------ | ------ | ------ | ------ | 28.8 |
| 1 1100 | 60 | 0.0020 | 0.000 | 0.008 | 0.0000 | 0.0006 | 29.0 |
| 1 1115 | 75 | ------ | ------ | ------ | ------ | ------ | 28.7 |
| 1 1130 | 90 | ------ | ------ | ------ | ------ | ------ | 28.7 |
| 1 1145 | 105 | ------ | ------ | ------ | ------ | ------ | 29.1 |
| 1 1200 | 120 | 0.0061 | 0.000 | 0.006 | ------ | 0.0010 | 29.2 |
| 1 1215 | 135 | ------ | ------ | ------ | ------ | ------ | 29.3 |
| 1 1230 | 150 | ------ | ------ | ------ | ------ | ------ | 29.1 |
| 1 1245 | 165 | ------ | ------ | ------ | ------ | ------ | 29.2 |
| 1 1300 | 180 | 0.0098 | 0.000 | ------ | 0.0053 | 0.0018 | 29.3 |
| 1 1315 | 195 | ------ | ------ | ------ | ------ | ------ | 29.1 |
| 1 1330 | 210 | ------ | ------ | ------ | ------ | ------ | 29.4 |
| 1 1345 | 225 | ------ | ------ | ------ | ------ | ------ | 29.3 |
| 1 1400 | 240 | 0.0168 | 0.000 | 0.010 | 0.0053 | 0.0022 | 29.5 |
| 1 1415 | 255 | ------ | ------ | ------ | ------ | ------ | 29.4 |
| 1 1430 | 270 | ------ | ------ | ------ | ------ | ------ | 29.4 |
| 1 1445 | 285 | ------ | ------ | ------ | ------ | ------ | 29.0 |
| 1 1500 | 300 | 0.0220 | 0.000 | 0.013 | 0.0062 | 0.0027 | 29.2 |
| 1 1515 | 315 | ------ | ------ | ------ | ------ | ------ | 29.0 |
| 1 1530 | 330 | ------ | ------ | ------ | ------ | ------ | 29.1 |
| 1 1545 | 345 | ------ | ------ | ------ | ------ | ------ | 29.0 |
| 1 1600 | 360 | 0.0245 | 0.001 | ------ | 0.0066 | 0.0033 | 29.1 |
| 1 1610 | 370 | ------ | ------ | 0.008 | ------ | ------ | ------ |

---- NO DATA TAKEN

0854: THIRD AND FINAL FILL.
0915: INJECTIONS: 0.061 ML. PROPENE, 0.061 ML. N-BUTANE,
0.72 ML. NO, AND 0.18 ML. NO2.
0945: T=0. 70% LIGHTS.
1200: DUMP AND FILL.

T=0 AT 945 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 27.7 | 1.6 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | COL-1600 | 0.101 | PPM |
| NO | T 14B-1 | 0.094 | PPM |
| NO2-UNC | COL-1600 | 0.019 | PPM |
| NO2-UNC | T 14B-1 | 0.028 | PPM |
| PROPENE | DMS-2 | 0.0091 | PPM |
| N-C4 | DMS-2 | 0.0085 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 2290 | DMS-2 | RM-103; DIMETHYLSULFOLANE GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 1625 | COL-1600 | COLUMBIA 1600 NO-NOX ANALYZER |

ITC-539
NOX-AIR IRRADIATION
1982 NOV. 17



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM COL-1600 | NO PPM T 14B-1 | NO2-UNC PPM COL-1600 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM COL-1600 | NOX-UNC PPM T 14B-1 | LNC4/C3= RAW DATA | HYDROXYL PPT | PROPENE PPM DMS-2 | N-C4 PPM DMS-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 815 | -90 | 0.009 | 0.136 | 0.117 | 0.065 | 0.070 | 0.200 | 0.187 | ------ | ------ | ------ | ------ |
| 1 830 | -75 | 0.011 | 0.171 | 0.142 | 0.068 | 0.093 | 0.200 | 0.200 | ------ | ------ | ------ | ------ |
| 1 845 | -60 | 0.010 | 0.200 | 0.212 | 0.068 | 0.048 | 0.200 | 0.200 | ------ | ------ | ------ | ------ |
| 1 855 | -50 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.0011 | 0.0006 |
| 1 900 | -45 | 0.000 | 0.011 | 0.009 | 0.004 | 0.012 | 0.015 | 0.019 | ------ | ------ | ------ | ------ |
| 1 915 | -30 | 0.000 | 0.054 | 0.084 | 0.017 | 0.000 | 0.072 | 0.015 | ------ | ------ | ------ | ------ |
| 1 920 | -25 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | -0.1240 | ------ | 0.0093 | 0.0086 |
| 1 930 | -15 | 0.000 | 0.102 | 0.094 | 0.022 | 0.028 | 0.124 | 0.121 | ------ | ------ | ------ | ------ |
| 1 945 | 0 | 0.000 | 0.101 | 0.094 | 0.019 | 0.028 | 0.120 | 0.121 | -0.1090 | 0.131 | 0.0091 | 0.0085 |
| 1 1000 | 15 | 0.000 | 0.099 | 0.094 | 0.022 | 0.029 | 0.123 | 0.123 | -0.0450 | 0.136 | 0.0084 | 0.0084 |
| 1 1015 | 30 | 0.000 | 0.096 | 0.091 | 0.028 | 0.032 | 0.123 | 0.123 | 0.0210 | 0.181 | 0.0080 | 0.0085 |
| 1 1030 | 45 | 0.000 | 0.091 | 0.087 | 0.032 | 0.036 | 0.123 | 0.123 | 0.1090 | 0.164 | 0.0072 | 0.0084 |
| 1 1045 | 60 | 0.000 | 0.088 | 0.084 | 0.032 | 0.039 | 0.121 | 0.122 | 0.1890 | 0.177 | 0.0065 | 0.0082 |
| 1 1100 | 75 | 0.002 | 0.085 | 0.081 | 0.036 | 0.042 | 0.121 | 0.122 | 0.2750 | 0.152 | 0.0059 | 0.0081 |
| 1 1115 | 90 | 0.001 | 0.081 | 0.077 | 0.038 | 0.044 | 0.120 | 0.121 | 0.3490 | 0.103 | 0.0056 | 0.0083 |
| 1 1130 | 105 | 0.008 | 0.077 | 0.074 | 0.043 | 0.046 | 0.120 | 0.121 | 0.3990 | 0.164 | 0.0052 | 0.0081 |
| 1 1145 | 120 | 0.005 | 0.076 | 0.072 | 0.044 | 0.047 | 0.120 | 0.119 | 0.4790 | ------ | 0.0048 | 0.0081 |
| 1 1200 | 135 | 0.007 | 0.072 | 0.069 | 0.045 | 0.049 | 0.118 | 0.118 | ------ | ------ | ------ | ------ |

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | HCHO PPM CA | N-C7 PPM C-20M | ACETONE PPM 10'C-600 | T DEG C DORIC-1 |
|---|---|---|---|---|---|
| 1 815 | -90 | ------ | ------ | ------ | 27.6 |
| 1 830 | -75 | ------ | ------ | ------ | 27.3 |
| 1 845 | -60 | ------ | ------ | ------ | 25.8 |
| 1 855 | -50 | ------ | 0.0009 | 0.0004 | ------ |
| 1 900 | -45 | ------ | ------ | ------ | 25.9 |
| 1 915 | -30 | ------ | ------ | ------ | 25.6 |
| 1 930 | -15 | 0.015 | ------ | ------ | 25.6 |
| 1 945 | 0 | ------ | ------ | ------ | 25.1 |
| 1 1000 | 15 | ------ | ------ | ------ | 27.8 |
| 1 1015 | 30 | ------ | ------ | ------ | 28.2 |
| 1 1030 | 45 | ------ | ------ | ------ | 29.0 |
| 1 1045 | 60 | ------ | ------ | ------ | 28.7 |
| 1 1100 | 75 | ------ | ------ | ------ | 29.2 |
| 1 1115 | 90 | ------ | ------ | ------ | 28.5 |
| 1 1130 | 105 | ------ | ------ | ------ | 29.5 |
| 1 1135 | 110 | 0.008 | ------ | ------ | ------ |
| 1 1145 | 120 | ------ | ------ | ------ | 29.3 |
| 1 1200 | 135 | ------ | ------ | ------ | 29.4 |

------ NO DATA TAKEN

0850: THIRD AND FINAL FILL. 50% R.H. 85 DEGREES F.
0901: INJECTIONS: 0.72 ML. NO, 0.18 ML. NO2, AND 2000 MICROLITERS N-HEPTANE.
0930: T=0. 70% LIGHTS.
1609: DUMP AND FILL.

T=0 AT 930 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 84.2 | 1.6 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.085 | PPM |
| NO2-UNC | T 14B-1 | 0.028 | PPM |
| N-C7 | C-20M | 39.2602 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C7 PPM C-20M | C7-N-3 PPM 5' C-600 | C7-N-2 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | ACETONE PPM 10'C-600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 855 | -35 | ------- | ------- | ------- | ------- | 0.0000 | 0.0036 | 0.0000 | 0.000 | ------- | 0.0000 | 0.0000 |
| 1 920 | -10 | ------- | ------- | ------- | ------- | 39.26 | 0.0018 | 0.0000 | ------- | ------- | ------- | ------- |
| 1 924 | -6 | ------- | ------- | ------- | ------- | ------- | ------- | ------- | ------- | 0.002 | ------- | ------- |
| 1 930 | 0 | 0.000 | 0.085 | 0.028 | 0.114 | 39.26 | 0.0004 | 0.0000 | 0.000 | ------- | 0.0000 | 0.0000 |
| 1 938 | 8 | ------- | ------- | ------- | ------- | 43.65 | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 945 | 15 | 0.007 | 0.074 | 0.042 | 0.115 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1000 | 30 | 0.003 | 0.056 | 0.061 | 0.117 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1015 | 45 | 0.014 | 0.042 | 0.079 | 0.118 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1030 | 60 | 0.041 | 0.026 | 0.092 | 0.117 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1045 | 75 | 0.068 | 0.021 | 0.102 | 0.121 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1100 | 90 | 0.092 | 0.016 | 0.104 | 0.119 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1115 | 105 | 0.123 | 0.015 | 0.108 | 0.120 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1130 | 120 | 0.149 | 0.011 | 0.106 | 0.117 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1145 | 135 | 0.165 | 0.011 | 0.107 | 0.118 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1200 | 150 | 0.189 | 0.011 | 0.107 | 0.117 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1215 | 165 | 0.201 | 0.010 | 0.107 | 0.116 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1230 | 180 | 0.220 | 0.010 | 0.107 | 0.116 | ------- | ------- | ------- | ------- | 0.004 | ------- | ------- |
| 1 1245 | 195 | 0.228 | 0.010 | 0.107 | 0.116 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1300 | 210 | 0.250 | 0.008 | 0.105 | 0.113 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1315 | 225 | 0.262 | 0.011 | 0.106 | 0.115 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1330 | 240 | 0.274 | 0.009 | 0.105 | 0.113 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1345 | 255 | 0.291 | 0.009 | 0.102 | 0.110 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1400 | 270 | 0.297 | 0.010 | 0.102 | 0.111 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1415 | 285 | 0.314 | 0.009 | 0.100 | 0.109 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1430 | 300 | 0.324 | 0.009 | 0.100 | 0.108 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1445 | 315 | 0.332 | 0.008 | 0.098 | 0.106 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1500 | 330 | 0.340 | 0.008 | 0.098 | 0.106 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1515 | 345 | 0.345 | 0.008 | 0.097 | 0.105 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1520 | 350 | ------- | ------- | ------- | ------- | ------- | ------- | ------- | ------- | 0.002 | ------- | ------- |
| 1 1530 | 360 | 0.353 | 0.008 | 0.096 | 0.104 | ------- | ------- | ------- | ------- | ------- | 0.0208 | 0.0115 |
| 1 1545 | 375 | 0.360 | 0.008 | 0.095 | 0.103 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1600 | 390 | 0.357 | 0.008 | 0.095 | 0.103 | 40.95 A | 0.0498 A | 0.0630 B | 0.002 | ------- | ------- | ------- |

------- NO DATA TAKEN

ITC-540
N-HEPTANE/NOX
1982 NOV. 18



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | T DEG C DORIC-1 |
|---|---|---|
| 1 930 | 0 | 77.3 |
| 1 945 | 15 | 82.6 |
| 1 1000 | 30 | 83.3 |
| 1 1015 | 45 | 82.3 |
| 1 1030 | 60 | 83.8 |
| 1 1045 | 75 | 84.0 |
| 1 1100 | 90 | 84.4 |
| 1 1115 | 105 | 84.1 |
| 1 1130 | 120 | 84.6 |
| 1 1145 | 135 | 84.1 |
| 1 1200 | 150 | 85.1 |
| 1 1215 | 165 | 84.3 |
| 1 1230 | 180 | 85.0 |
| 1 1245 | 195 | 84.6 |
| 1 1300 | 210 | 85.1 |
| 1 1315 | 225 | 84.5 |
| 1 1330 | 240 | 85.0 |
| 1 1345 | 255 | 84.4 |
| 1 1400 | 270 | 85.3 |
| 1 1415 | 285 | 84.5 |
| 1 1430 | 300 | 85.5 |
| 1 1445 | 315 | 84.4 |
| 1 1500 | 330 | 85.4 |
| 1 1515 | 345 | 85.0 |
| 1 1530 | 360 | 85.7 |
| 1 1545 | 375 | 84.8 |
| 1 1600 | 390 | 84.4 |

------- NO DATA TAKEN

NOTES

A THIS IS 1/10 DILUTION OF SAMPLE FROM THE ITC. BASELINE UNCERTAIN--
. STRAIGHT BASELINE ASSUMED.
B BASELINE HIGHLY UNCERTAIN--VALUE PROBABLY HIGH.

1000: THIRD AND FINAL FILL. 85 DEGREES F.
1015: INJECTIONS: 438 MICROLITERS N-HEPTANE.
0.5 PPM METHYLNITRITE (2.43 LITER-TORR).
1045: T=0. 70% LIGHTS.
1600: DUMP AND FILL.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 1045 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 28.2 | 2.6 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO2-UNC | T 14B-1 | 0.449 | PPM |
| N-C7 | C-20M | 0.1683 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |

ITC-541
N-HEPTANE/METHYLNITRITE
1982 NOV. 19



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C7 PPM C-20M | C7-N-3 PPM 5' C-600 | C7-N-2 PPM 5' C-600 | PAN PPM ECD-1 | ACETALD PPM 10'C-600 | ACETONE PPM 10'C-600 | ME-N PPM ECD-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 945 | -60 | 0.002 | 0.000 | 0.000 | 0.000 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1000 | -45 | 0.012 | 0.000 | 0.000 | 0.000 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1005 | -40 | ------ | ------ | ------ | ------ | 0.0269 | 0.0000 | 0.0000 | 0.000 | 0.0000 | 0.0006 | ------ |
| 1 1015 | -30 | 0.000 | 0.000 | 0.000 | 0.001 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1025 | -20 | ------ | ------ | ------ | ------ | 8.168 | 0.0000 | 0.0000 | 0.000 | ------ | ------ | ------ |
| 1 1030 | -15 | 0.025 | 0.003 | 0.449 A | 0.449 A | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1045 | 0 | 0.030 | 0.001 | 0.449 | 0.449 | 8.168 | 0.0000 | 0.0000 | 0.000 | 0.0000 | 0.0009 | ------ |
| 1 1100 | 15 | 0.392 | 0.009 | 0.401 | 0.404 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1115 | 30 | 0.636 | 0.006 | 0.384 | 0.388 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1130 | 45 | 0.757 | 0.009 | 0.399 | 0.402 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1145 | 60 | 0.820 | 0.006 | 0.392 | 0.396 | 7.667 | 0.0205 | 0.0142 | 0.002 | 0.0119 | 0.0177 | ------ |
| 1 1200 | 75 | 0.885 | 0.006 | 0.386 | 0.390 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1215 | 90 | 0.927 | 0.006 | 0.381 | 0.384 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1230 | 105 | 0.969 | 0.010 | 0.376 | 0.380 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1245 | 120 | 1.003 | 0.007 | 0.371 | 0.376 | 7.563 | ------ | 0.0663 | 0.005 | 0.0212 | 0.0224 | ------ |
| 1 1300 | 135 | 1.030 | 0.009 | 0.369 | 0.374 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1315 | 150 | 1.052 | 0.007 | 0.368 | 0.373 | 7.525 | 0.1137 | 0.0681 | 0.008 | ------ | ------ | ------ |
| 1 1330 | 165 | 1.069 | 0.006 | 0.367 | 0.372 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1345 | 180 | 1.084 | 0.008 | 0.370 | 0.375 | 7.470 | 0.1226 | 0.0734 | 0.010 | 0.0264 | 0.0258 | ------ |
| 1 1400 | 195 | 1.094 | 0.009 | 0.371 | 0.376 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1415 | 210 | 1.101 | 0.002 | 0.370 | 0.375 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1430 | 225 | 1.102 | 0.012 | 0.376 | 0.382 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1445 | 240 | 1.085 | 0.006 | 0.377 | 0.383 | 7.416 | 0.1187 | 0.0730 | 0.013 | 0.0285 | 0.0278 | ------ |
| 1 1500 | 255 | 1.091 | 0.013 | 0.383 | 0.388 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1515 | 270 | 1.074 | 0.011 | 0.387 | 0.392 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1530 | 285 | 1.073 | 0.006 | 0.380 | 0.386 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1545 | 300 | 1.069 | 0.009 | 0.387 | 0.394 | 7.383 | 0.1115 | 0.0676 | 0.013 | 0.0277 | 0.0270 | 0.0032 |

------ NO DATA TAKEN

ITC-541
N-HEPTANE/METHYLNITRITE
1982 NOV. 19



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | T DEG C DORIC-1 |
|---|---|---|
| 1 945 | -60 | 22.7 |
| 1 1000 | -45 | 22.8 |
| 1 1015 | -30 | 22.7 |
| 1 1030 | -15 | 24.2 |
| 1 1045 | 0 | 23.9 |
| 1 1100 | 15 | 27.4 |
| 1 1115 | 30 | 28.1 |
| 1 1130 | 45 | 29.2 |
| 1 1145 | 60 | 28.9 |
| 1 1200 | 75 | 29.7 |
| 1 1215 | 90 | 29.3 |
| 1 1230 | 105 | 29.5 |
| 1 1245 | 120 | 29.3 |
| 1 1300 | 135 | 29.8 |
| 1 1315 | 150 | 29.5 |
| 1 1330 | 165 | 29.7 |
| 1 1345 | 180 | 29.5 |
| 1 1400 | 195 | 29.8 |
| 1 1415 | 210 | 29.5 |
| 1 1430 | 225 | 30.0 |
| 1 1445 | 240 | 29.5 |
| 1 1500 | 255 | 29.8 |
| 1 1515 | 270 | 29.5 |
| 1 1530 | 285 | 30.0 |
| 1 1545 | 300 | 29.6 |

-------- NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.

0914: THIRD AND FINAL DRY AIR FILL.
0922: INJECTIONS: ~0.5 PPM METHYLNITRITE (2.43 LITER-TORR).
0945: T=0. 70% LIGHTS.
1039: NYLON FILTER INLINE.
1207: DUMP AND REFILL.
1526: DUMP AND REFILL.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 945 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 78.9 | 4.4 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO2-UNC | T 14B-1 | 0.438 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 2290 | DMS-2 | RM-103; DIMETHYLSULFOLANE GC; FID |

ITC-542
METHYLNITRITE
1982 NOV. 22



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3370 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | PROPENE PPM DMS-2 | N-C4 PPM DMS-2 | HCHO PPM CA | N-C7 PPM C-20M | N-C7 M.VOLTS 10'C-600 | ACETONE PPM 10'C-600 | T DEG C DURIC-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 830 | -75 | 0.008 | 0.125 | 0.070 | 0.194 | ------ | ------ | ------ | ------ | ------ | ------ | 72.3 |
| 1 845 | -60 | 0.000 | 0.108 | 0.072 | 0.179 | ------ | ------ | ------ | ------ | ------ | ------ | 73.2 |
| 1 900 | -45 | 0.007 | 0.109 | 0.074 | 0.186 | ------ | ------ | ------ | ------ | ------ | ------ | 74.1 |
| 1 915 | -30 | 0.009 | 0.134 | 0.080 | 0.207 | ------ | ------ | ------ | ------ | ------ | ------ | 73.9 |
| 1 920 | -25 | ------ | ------ | ------ | ------ | 0.0008 | 0.0003 | ------ | ------ | 8.000 | 0.0003 | ------ |
| 1 930 | -15 | 0.017 | 0.003 | 0.424 A | 0.425 A | ------ | ------ | ------ | 0.0048 | ------ | ------ | 71.8 |
| 1 940 | -5 | ------ | ------ | ------ | ------ | ------ | ------ | 0.000 | ------ | ------ | ------ | ------ |
| 1 945 | 0 | 0.015 | 0.006 | 0.438 | 0.440 | ------ | ------ | ------ | ------ | ------ | ------ | 74.6 |
| 1 1000 | 15 | 0.215 | 0.006 | 0.252 | 0.257 | ------ | ------ | ------ | ------ | ------ | ------ | 79.9 |
| 1 1015 | 30 | 0.338 | 0.006 | 0.188 | 0.193 | ------ | ------ | ------ | ------ | ------ | ------ | 80.4 |
| 1 1030 | 45 | 0.356 | 0.006 | 0.211 | 0.217 | ------ | ------ | ------ | ------ | ------ | ------ | 82.2 |
| 1 1045 | 60 | 0.371 | 0.014 | 0.197 | 0.202 | ------ | ------ | 0.048 | ------ | ------ | ------ | 81.9 |
| 1 1100 | 75 | 0.373 | 0.007 | 0.184 | 0.188 | ------ | ------ | ------ | ------ | ------ | ------ | 83.2 |
| 1 1115 | 90 | 0.381 | 0.010 | 0.180 | 0.184 | ------ | ------ | ------ | ------ | ------ | ------ | 81.6 |
| 1 1130 | 105 | 0.380 | 0.004 | 0.173 | 0.177 | ------ | ------ | ------ | ------ | ------ | ------ | 83.5 |
| 1 1145 | 120 | 0.382 | 0.001 | 0.164 | 0.168 | ------ | ------ | ------ | ------ | ------ | ------ | 83.3 |
| 1 1150 | 125 | ------ | ------ | ------ | ------ | ------ | ------ | 0.038 | ------ | ------ | ------ | ------ |
| 1 1200 | 135 | 0.392 | 0.008 | 0.172 | 0.175 | ------ | ------ | ------ | ------ | ------ | ------ | 84.0 |

------ NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.

0858: THIRD AND FINAL FILL.
0932: INJECTIONS: 220 MICROLITERS N-HEPTANE,
~0.5 PPM (2.468 LITER-TORR) METHYLNITRITE.
1000: T=0. 70% LIGHTS.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 1000 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 84.4 | 3.5 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| N-C7 | C-20M | 4.2859 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C7 PPM C-20M | C7-N-3 PPM 5' C-600 | C7-N-2 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | ACETONE PPM 10'C-600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 905 | -55 | ------- | ------- | ------- | ------- | 0.0017 | 0.0040 | 0.0000 | 0.000 B | ------- | 0.0000 | 0.0008 |
| 1 940 | -20 | ------- | ------- | ------- | ------- | 4.259 | 0.0019 | 0.0000 | 0.000 | ------- | ------- | ------- |
| 1 944 | -16 | 0.030 | 0.002 | 0.458 A | 0.459 A | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 950 | -10 | ------- | ------- | ------- | ------- | ------- | ------- | ------- | ------- | 0.000 | ------- | ------- |
| 1 959 | -1 | 0.030 | 0.004 | 0.462 | 0.463 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1000 | 0 | ------- | ------- | ------- | ------- | 4.286 | 0.0018 | 0.0000 | 0.000 | ------- | 0.0000 | 0.0008 |
| 1 1014 | 14 | 0.355 | 0.003 | 0.402 | 0.404 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1029 | 29 | 0.626 | 0.005 | 0.387 | 0.390 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1044 | 44 | 0.736 | 0.008 | 0.393 | 0.397 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1059 | 59 | 0.798 | 0.014 | 0.398 | 0.401 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1100 | 60 | ------- | ------- | ------- | ------- | 3.855 | 0.0775 | 0.0795 | 0.005 | 0.159 | 0.0150 | 0.0082 |
| 1 1114 | 74 | 0.847 | 0.007 | 0.385 | 0.388 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1129 | 89 | 0.896 | 0.000 | 0.371 | 0.374 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1144 | 104 | 0.938 | 0.005 | 0.375 | 0.379 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1159 | 119 | 0.976 | 0.006 | 0.375 | 0.379 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1200 | 120 | ------- | ------- | ------- | ------- | 3.801 | 0.0908 | 0.0701 | 0.009 | 0.134 | 0.0203 | 0.0074 |
| 1 1214 | 134 | 1.000 | 0.004 | 0.372 | 0.376 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1229 | 149 | 1.025 | 0.005 | 0.378 | 0.377 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1244 | 164 | 1.050 | 0.009 | 0.386 | 0.385 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1259 | 179 | 1.068 | 0.005 | 0.381 | 0.381 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1300 | 180 | ------- | ------- | ------- | ------- | 3.730 | 0.1052 | 0.0715 | 0.014 | 0.128 | 0.0238 | 0.0067 |
| 1 1314 | 194 | 1.080 | 0.015 | 0.391 | 0.392 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1329 | 209 | 1.090 | 0.008 | 0.388 | 0.387 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1344 | 224 | 1.100 | 0.007 | 0.379 | 0.380 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1350 | 230 | ------- | ------- | ------- | ------- | ------- | ------- | ------- | ------- | 0.107 | ------- | ------- |
| 1 1359 | 239 | 1.109 | 0.000 | 0.380 | 0.381 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1400 | 240 | ------- | ------- | ------- | ------- | 3.681 | 0.0908 | 0.0584 | 0.018 | ------- | 0.0432 | 0.0090 |
| 1 1415 | 255 | 1.102 | 0.005 | 0.389 | 0.389 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1430 | 270 | 1.100 | 0.010 | 0.394 | 0.393 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1445 | 285 | 1.094 | 0.006 | 0.390 | 0.390 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1500 | 300 | 1.093 | 0.016 | 0.401 | 0.401 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |
| 1 1515 | 315 | 1.089 | 0.006 | 0.391 | 0.391 | ------- | ------- | ------- | ------- | ------- | ------- | ------- |

------- NO DATA TAKEN

ITC-544
N-HEPTANE/METHYLNITRITE
1982 NOV. 23



| CLOCK TIME DAY | HR. | ELAPSED TIME (MIN) | ME-N PPM ECD-1 | T DEG C DORIC-1 |
|---|---|---|---|---|
| 1 | 944 | -16 | ------- | 76.2 |
| 1 | 959 | -1 | ------- | 75.8 |
| 1 | 1014 | 14 | ------- | 82.1 |
| 1 | 1029 | 29 | ------- | 84.5 |
| 1 | 1044 | 44 | ------- | 84.8 |
| 1 | 1059 | 59 | ------- | 86.6 |
| 1 | 1114 | 74 | ------- | 86.4 |
| 1 | 1129 | 89 | ------- | 87.8 |
| 1 | 1144 | 104 | ------- | 87.5 |
| 1 | 1159 | 119 | ------- | 88.3 |
| 1 | 1214 | 134 | ------- | 85.7 |
| 1 | 1229 | 149 | ------- | 85.1 |
| 1 | 1244 | 164 | ------- | 85.0 |
| 1 | 1259 | 179 | ------- | 85.5 |
| 1 | 1314 | 194 | ------- | 84.7 |
| 1 | 1329 | 209 | ------- | 85.3 |
| 1 | 1344 | 224 | ------- | 84.3 |
| 1 | 1359 | 239 | ------- | ------- |
| 1 | 1400 | 240 | 0.0030 | ------- |
| 1 | 1415 | 255 | ------- | ------- |
| 1 | 1430 | 270 | ------- | ------- |
| 1 | 1445 | 285 | ------- | ------- |
| 1 | 1500 | 300 | ------- | ------- |
| 1 | 1515 | 315 | ------- | ------- |

------- NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.
B SEVERAL OTHER NITRATE PEAKS DETECTED ON THE PANALYZER IN ADDITION TO PAN INCLUDING METHYLNITRITE.

0842: THIRD AND FINAL FILL WITH DRY AIR. 85 DEGREES F.
0857: INJECTIONS: 44 MICROLITERS N-HEPTANE,
~0.5 PPM (2.457 LITER-TORR) METHYLNITRITE.
0930: T=0. 70% LIGHTS.
1449: DUMP AND REFILL.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 930 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 82.8 | 3.5 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO2-UNC | T 14B-1 | 0.469 | PPM |
| N-C7 | C-20M | 0.9133 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |

ITC-545
N-HEPTANE/METHYLNITRITE
1982 NOV. 24



| CLOCK TIME DAY | HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C7 PPM C-20M | C7-N-3 PPM 5' C-600 | C7-N-2 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | ACETONE PPM 10'C-600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 815 | -75 | 0.001 | 0.004 | 0.082 | 0.087 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 830 | -60 | 0.005 | 0.006 | 0.068 | 0.072 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 845 | -45 | 0.004 | 0.004 | 0.042 | 0.044 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 855 | -35 | ------ | ------ | ------ | ------ | 0.0051 | 0.0079 | 0.0047 | 0.000 B | ------ | 0.0000 | 0.0004 |
| 1 | 900 | -30 | 0.020 | 0.000 | 0.463 A | 0.464 A | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 915 | -15 | 0.020 | 0.005 | 0.472 | 0.474 | 0.9133 | 0.0028 | 0.0016 | ------ | ------ | ------ | ------ |
| 1 | 925 | -5 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.008 | ------ | ------ |
| 1 | 930 | 0 | 0.013 | 0.001 | 0.469 | 0.470 | 0.9133 | 0.0020 | 0.0007 | 0.000 | ------ | 0.0000 | 0.0004 |
| 1 | 945 | 15 | 0.361 | 0.010 | 0.389 | 0.392 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1000 | 30 | 0.566 | 0.006 | 0.355 | 0.360 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1015 | 45 | 0.645 | 0.002 | 0.358 | 0.362 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1030 | 60 | 0.684 | 0.009 | 0.376 | 0.381 | 0.6393 | 0.0423 | 0.0304 | 14.40 | 0.134 | 0.0185 | 0.0059 |
| 1 | 1045 | 75 | 0.710 | 0.004 | 0.382 | 0.387 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1100 | 90 | 0.747 | 0.007 | 0.393 | 0.398 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1115 | 105 | 0.774 | 0.009 | 0.400 | 0.405 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1120 | 110 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.123 | ------ | ------ |
| 1 | 1130 | 120 | 0.797 | 0.006 | 0.401 | 0.406 | 0.6087 | 0.0552 | 0.0327 | 21.00 | ------ | 0.0196 | 0.0050 |
| 1 | 1145 | 135 | 0.819 | 0.006 | 0.403 | 0.408 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1200 | 150 | 0.845 | 0.008 | 0.407 | 0.412 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1215 | 165 | 0.864 | 0.004 | 0.404 | 0.409 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1230 | 180 | 0.883 | 0.005 | 0.405 | 0.410 | 0.5862 | 0.0559 | 0.0322 | 26.80 | 0.100 | 0.0221 | 0.0056 |
| 1 | 1245 | 195 | 0.900 | 0.007 | 0.410 | 0.414 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1300 | 210 | 0.912 | 0.014 | 0.417 | 0.422 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1315 | 225 | 0.927 | 0.008 | 0.409 | 0.414 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1330 | 240 | 0.942 | 0.007 | 0.409 | 0.414 | 0.5603 | 0.0627 | 0.0346 | 34.70 | ------ | 0.0238 | 0.0050 |
| 1 | 1340 | 250 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.075 | ------ | ------ |
| 1 | 1345 | 255 | 0.958 | 0.000 | 0.400 | 0.405 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1400 | 270 | 0.966 | 0.005 | 0.406 | 0.410 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1415 | 285 | 0.978 | 0.002 | 0.404 | 0.408 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1430 | 300 | 0.979 | 0.007 | 0.408 | 0.413 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1445 | 315 | 0.981 | 0.000 | 0.401 | 0.405 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

------ NO DATA TAKEN

ITC-545
N-HEPTANE/METHYLNITRITE
1982 NOV. 24



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | ME-N PPM ECD-1 | T DEG C DORIC-1 |
|---|---|---|---|
| 1 815 | -75 | ------- | 73.5 |
| 1 830 | -60 | ------- | 73.2 |
| 1 845 | -45 | ------- | 79.0 |
| 1 900 | -30 | ------- | 78.7 |
| 1 915 | -15 | ------- | 78.6 |
| 1 930 | 0 | ------- | 78.1 |
| 1 945 | 15 | ------- | 82.8 |
| 1 1000 | 30 | ------- | 83.0 |
| 1 1015 | 45 | ------- | 83.1 |
| 1 1030 | 60 | ------- | 84.1 |
| 1 1045 | 75 | ------- | 83.9 |
| 1 1100 | 90 | ------- | 84.0 |
| 1 1115 | 105 | ------- | 84.6 |
| 1 1130 | 120 | ------- | 85.3 |
| 1 1145 | 135 | ------- | 84.8 |
| 1 1200 | 150 | ------- | 85.4 |
| 1 1215 | 165 | ------- | 84.5 |
| 1 1230 | 180 | ------- | 84.8 |
| 1 1245 | 195 | ------- | 84.7 |
| 1 1300 | 210 | ------- | 85.0 |
| 1 1315 | 225 | ------- | 84.4 |
| 1 1330 | 240 | 0.0025 | 85.1 |
| 1 1345 | 255 | ------- | 84.8 |
| 1 1400 | 270 | ------- | 85.4 |
| 1 1415 | 285 | ------- | 84.6 |
| 1 1430 | 300 | ------- | 85.1 |
| 1 1445 | 315 | ------- | 84.4 |

------- NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.
B SEVERAL OTHER NITRATE PEAKS DETECTED ON THE PANALYZER IN ADDITION TO PAN INCLUDING METHYLNITRITE.

0856: SECOND FILL WITH DRY AIR AT 85 DEGREES F.
0934: INJECTIONS: 0.5 PPM (2.572 TORR-LITER) METHYLNITRITE.
1005: T=0. 70% LIGHTS.
1225: DUMP AND FILL.

TEMPERATURE DATA UNAVAILABLE FOR THIS RUN.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 1005 PST

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO2-UNC | T 14B-1 | 0.489 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3370 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | ACETONE PPM 10'C-600 |
|---|---|---|---|---|---|---|---|---|
| 1 900 | -65 | 0.000 | 0.016 | 0.054 | 0.067 | ------ | ------ | ------ |
| 1 915 | -50 | 0.002 | 0.023 | 0.048 | 0.074 | ------ | 0.0007 | 0.0010 |
| 1 930 | -35 | 0.023 | 0.004 | 0.010 | 0.011 | ------ | ------ | ------ |
| 1 940 | -25 | ------ | ------ | ------ | ------ | ------ | 0.0000 | 0.0007 |
| 1 945 | -20 | 0.019 | 0.003 | 0.489 A | 0.489 A | ------ | ------ | ------ |
| 1 955 | -10 | ------ | ------ | ------ | ------ | 0.025 | ------ | ------ |
| 1 1000 | -5 | 0.018 | 0.002 | 0.493 | 0.493 | ------ | ------ | ------ |
| 1 1015 | 10 | 0.234 | 0.011 | 0.302 | 0.308 | ------ | ------ | ------ |
| 1 1030 | 25 | 0.284 | 0.009 | 0.209 | 0.213 | ------ | ------ | ------ |
| 1 1045 | 40 | 0.320 | 0.008 | 0.231 | 0.235 | ------ | ------ | ------ |
| 1 1100 | 55 | 0.325 | 0.009 | 0.295 | 0.299 | ------ | ------ | ------ |
| 1 1115 | 70 | 0.325 | 0.011 | 0.341 | 0.346 | ------ | ------ | ------ |
| 1 1130 | 85 | 0.333 | 0.007 | 0.361 | 0.366 | ------ | ------ | ------ |
| 1 1145 | 100 | 0.331 | 0.008 | 0.376 | 0.381 | ------ | ------ | ------ |
| 1 1200 | 115 | 0.331 | 0.008 | 0.386 | 0.392 | 0.052 | ------ | ------ |
| 1 1215 | 130 | 0.333 | 0.005 | 0.388 | 0.393 | ------ | ------ | ------ |

------ NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.

ITC-547
N-OCTANE/METHYLNITRITE
1982 DEC. 1

0900: THIRD AND FINAL FILL.
0920: INJECTIONS: 486 MICROLITERS N-OCTANE,
~0.5 PPM (2.484 LITER-TORR) METHYLNITRITE
1000: T=0. 70% LIGHTS.
1600: DUMP AND FILL.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 1000 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 28.2 | 2.3 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO2-UNC | T 14B-1 | 0.400 | PPM |
| N-C8 | C-20M | 8.2115 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHRONOTROPIC ACID HCHO ANALYSIS |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1413 | D-1413 | DASIBI 1413 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |

ITC-547
N-OCTANE/METHYLNITRITE
1982 DEC. 1



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-1413 | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C8 PPM C-20M | C8-N-4 PPM 5' C-600 | C8-N-2 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 905 | -55 | ------ | ------ | ------ | ------ | ------ | 0.0000 | 0.0013 | 0.0000 | 0.000 | ------ | 0.0014 |
| 1 915 | -45 | ------ | ------ | 0.001 | 0.002 | 0.002 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 930 | -30 | ------ | 0.000 | 0.002 | 0.006 | 0.007 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 940 | -20 | ------ | ------ | ------ | ------ | ------ | 8.211 | 0.0000 | 0.0000 | ------ | ------ | ------ |
| 1 945 | -15 | ------ | 0.007 | 0.004 | 0.482 A | 0.483 A | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 950 | -10 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.008 | ------ |
| 1 1000 | 0 | ------ | 0.009 | 0.007 | 0.480 | 0.484 | 8.211 | 0.0032 | 0.0000 | 0.000 | ------ | 0.0010 |
| 1 1015 | 15 | ------ | 0.011 | 0.009 | 0.424 | 0.426 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1030 | 30 | ------ | 0.619 | 0.009 | 0.409 | 0.412 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1045 | 45 | ------ | 0.729 | 0.005 | 0.417 | 0.419 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1100 | 60 | ------ | 0.790 | 0.004 | 0.412 | 0.414 | 7.740 | 0.0971 | 0.0768 | 0.002 | 0.218 | 0.0153 |
| 1 1115 | 75 | ------ | 0.846 | 0.015 | 0.416 | 0.418 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1130 | 90 | ------ | 0.897 | 0.004 | 0.395 | 0.398 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1145 | 105 | ------ | 0.939 | 0.007 | 0.388 | 0.392 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1200 | 120 | ------ | 0.970 | 0.003 | 0.371 | 0.375 | 7.603 | 0.1164 | 0.0991 | 0.004 | 0.172 | 0.0182 |
| 1 1215 | 135 | ------ | 0.997 | 0.009 | 0.370 | 0.375 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1230 | 150 | ------ | 1.011 | 0.006 | 0.360 | 0.365 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1245 | 165 | ------ | 1.030 | 0.004 | 0.358 | 0.363 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1300 | 180 | ------ | 1.041 | 0.006 | 0.361 | 0.367 | 7.542 | 0.1545 | 0.1191 | 0.007 | 0.155 | 0.0224 |
| 1 1315 | 195 | 1.104 | 1.043 | 0.010 | 0.342 | 0.348 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1330 | 210 | 1.082 | 1.045 | 0.008 | 0.359 | 0.364 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1345 | 225 | 1.061 | ------ | 0.010 | 0.356 | 0.363 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1400 | 240 | 1.046 | ------ | 0.007 | 0.372 | 0.378 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1415 | 255 | 1.030 | ------ | 0.013 | 0.388 | 0.396 | 7.451 | 0.1377 | 0.1172 | 0.009 | ------ | 0.0264 |
| 1 1430 | 270 | 1.014 | ------ | 0.014 | 0.394 | 0.400 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1440 | 280 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.146 | ------ |
| 1 1445 | 285 | 1.008 | ------ | 0.012 | 0.397 | 0.404 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1500 | 300 | 0.986 | ------ | 0.012 | 0.401 | 0.408 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1515 | 315 | 0.980 | ------ | 0.003 | 0.393 | 0.401 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1530 | 330 | 0.969 | ------ | 0.015 | 0.408 | 0.416 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1545 | 345 | 0.957 | ------ | 0.010 | 0.405 | 0.412 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1600 | 360 | 0.145 | ------ | 0.018 | 0.338 | 0.350 | ------ | ------ | ------ | ------ | ------ | ------ |

------ NO DATA TAKEN

ITC-547
N-OCTANE/METHYLNITRITE
1982 DEC. 1



| CLOCK TIME DAY | HR. | ELAPSED TIME (MIN) | ACETONE PPM 10'C-600 | ME-N PPM ECD-1 | T DEG C DORIC-1 |
|---|---|---|---|---|---|
| 1 | 905 | -55 | 0.0016 | 0.0000 | ------ |
| 1 | 915 | -45 | ------ | ------ | 24.1 |
| 1 | 930 | -30 | ------ | ------ | 24.9 |
| 1 | 940 | -20 | ------ | ------ | ------ |
| 1 | 945 | -15 | ------ | ------ | 24.8 |
| 1 | 1000 | 0 | 0.0006 | 0.0000 | 24.6 |
| 1 | 1015 | 15 | ------ | ------ | 27.3 |
| 1 | 1030 | 30 | ------ | ------ | 28.3 |
| 1 | 1045 | 45 | ------ | ------ | 28.3 |
| 1 | 1100 | 60 | 0.0086 | 0.0036 | 29.1 |
| 1 | 1115 | 75 | ------ | ------ | 29.2 |
| 1 | 1130 | 90 | ------ | ------ | 29.4 |
| 1 | 1145 | 105 | ------ | ------ | 29.8 |
| 1 | 1200 | 120 | 0.0085 | 0.0037 | 29.7 |
| 1 | 1215 | 135 | ------ | ------ | 30.2 |
| 1 | 1230 | 150 | ------ | ------ | 30.1 |
| 1 | 1245 | 165 | ------ | ------ | 30.5 |
| 1 | 1300 | 180 | 0.0063 | 0.0039 | 30.6 |
| 1 | 1415 | 255 | 0.0072 | 0.0036 | ------ |

------ NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.

0909: THIRD AND FINAL FILL.
0934-0941: INJECTIONS: 243 MICROLITERS N-OCTANE,
0.5 PPM (2.43 LITER-TORR) METHYLNITRITE.
1000: T=0. 70% LIGHTS.
1446: DUMP AND REFILL.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 1000 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 29.8 | 1.6 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.007 | PPM |
| NO2-UNC | T 14B-1 | 0.455 | PPM |
| N-C8 | C-20M | 4.7520 | PPM |
| C8-N-4 | 5' C-600 | 0.0000 | PPM |
| C8-N-2 | 5' C-600 | 0.0000 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 1212 | D-1212 | DASIBI 1212 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |

ITC-548
N-OCTANE/METHYLNITRITE
1982 DEC. 6



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-1212 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C8 PPM C-20M | C8-N-4 PPM 5' C-600 | C8-N-2 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | ME-N PPM ECD-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 905 | -55 | ------ | ------ | ------ | ------ | 0.0000 | 0.0000 | 0.0000 | 0.000 | ------ | 0.0000 | ------ |
| 1 945 | -15 | 0.698 | 0.006 | 0.451 A | 0.452 A | 4.782 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 955 | -5 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.025 | ------ | ------ |
| 1 1000 | 0 | 0.027 | 0.007 | 0.455 | 0.456 | 4.752 | 0.0000 | 0.0000 | 0.000 | ------ | 0.0000 | ------ |
| 1 1015 | 15 | 0.365 | 0.010 | 0.401 | 0.405 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1030 | 30 | 0.593 | 0.007 | 0.382 | 0.386 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1045 | 45 | 0.685 | 0.010 | 0.396 | 0.399 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1100 | 60 | 0.737 | 0.006 | 0.390 | 0.394 | 3.779 | ------ | ------ | 0.003 | 0.211 | 0.0169 | ------ |
| 1 1115 | 75 | 0.782 | 0.013 | 0.388 | 0.392 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1130 | 90 | 0.824 | 0.011 | 0.379 | 0.384 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1145 | 105 | 0.863 | 0.010 | 0.371 | 0.376 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1200 | 120 | 0.892 | 0.008 | 0.363 | 0.369 | 3.916 | 0.1028 | 0.0710 | 0.006 | 0.213 | 0.0211 | ------ |
| 1 1215 | 135 | 0.918 | 0.006 | 0.357 | 0.362 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1230 | 150 | 0.938 | 0.010 | 0.359 | 0.365 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1245 | 165 | 0.960 | 0.010 | 0.360 | 0.366 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1300 | 180 | 0.975 | 0.014 | 0.367 | 0.373 | 3.631 | 0.1228 | 0.0956 | 0.010 | 0.172 | 0.0272 | ------ |
| 1 1315 | 195 | 0.981 | 0.012 | 0.366 | 0.372 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1330 | 210 | 0.985 | 0.012 | 0.367 | 0.373 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1345 | 225 | 0.991 | 0.009 | 0.367 | 0.373 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1400 | 240 | 0.990 | 0.013 | 0.370 | 0.377 | 3.574 | 0.1189 | 0.0929 | 0.013 | 0.165 | 0.0335 | 0.0031 |
| 1 1415 | 255 | 0.989 | 0.011 | 0.369 | 0.376 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1430 | 270 | 0.983 | 0.016 | 0.378 | 0.385 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

------ NO DATA TAKEN

ITC-548
N-OCTANE/METHYLNITRITE
1982 DEC. 6



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | T DEG C DORIC-1 |
|---|---|---|
| 1 945 | -15 | ------- |
| 1 1000 | 0 | 24.0 |
| 1 1015 | 15 | 27.9 |
| 1 1030 | 30 | 28.7 |
| 1 1045 | 45 | 29.4 |
| 1 1100 | 60 | 30.0 |
| 1 1115 | 75 | 30.0 |
| 1 1130 | 90 | 30.0 |
| 1 1145 | 105 | 30.3 |
| 1 1200 | 120 | 30.5 |
| 1 1215 | 135 | 30.3 |
| 1 1230 | 150 | 30.3 |
| 1 1245 | 165 | 30.3 |
| 1 1300 | 180 | 30.4 |
| 1 1315 | 195 | 30.5 |
| 1 1330 | 210 | 30.6 |
| 1 1345 | 225 | 30.5 |
| 1 1400 | 240 | 30.6 |
| 1 1415 | 255 | 30.6 |
| 1 1430 | 270 | 30.7 |

------- NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.

0852: THIRD AND FINAL FILL.
0923: INJECTIONS: 49 MICROLITERS N-OCTANE,
0.5 PPM (2.32 LITER-TORR) METHYLNITRITE.
0945: T=0. 70% LIGHTS.
1647: DUMP AND REFILL.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 945 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 28.5 | 2.2 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO2-UNC | T 14B-1 | 0.446 | PPM |
| N-C8 | C-20M | 0.9599 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 1413 | D-1413 | DASIBI 1413 OZONE MONITOR |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2100 | FN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-549
N-OCTANE/METHYLNITRITE
1982 DEC. 7



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-1413 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C8 PPM C-20M | C8-N-4 PPM 5' C-600 | C8-N-2 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | ME-N PPM ECD-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 900 | -45 | -0.013 | 0.006 | 0.016 | 0.019 | 0.0143 | 0.0000 | 0.0000 | 0.000 B | ------ | 0.0000 | 0.0000 |
| 1 915 | -30 | -0.014 | 0.007 | 0.015 | 0.017 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 930 | -15 | 0.019 | 0.007 | 0.446 | 0.448 | 0.9542 | 0.0000 | 0.0000 | ------ | ------ | ------ | ------ |
| 1 940 | -5 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.023 | ------ | ------ |
| 1 945 | 0 | 0.018 | 0.008 | 0.446 | 0.448 | 0.9599 | 0.0000 | 0.0000 | 0.000 | ------ | 0.0000 | 0.0000 |
| 1 1000 | 15 | 0.323 | 0.010 | 0.366 | 0.371 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1015 | 30 | 0.507 | 0.010 | 0.342 | 0.347 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1030 | 45 | 0.574 | 0.011 | 0.345 | 0.350 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1045 | 60 | 0.613 | 0.008 | 0.348 | 0.353 | 0.6643 | 0.0567 | 0.0307 | 0.009 | 0.186 | 0.0203 | 0.0027 |
| 1 1100 | 75 | 0.642 | 0.013 | 0.357 | 0.363 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1115 | 90 | 0.675 | 0.009 | 0.359 | 0.364 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1130 | 105 | 0.702 | 0.013 | 0.367 | 0.372 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1145 | 120 | 0.727 | 0.001 | 0.361 | 0.365 | 0.6330 | 0.0624 | 0.0342 | 0.015 | 0.167 | 0.0239 | 0.0029 |
| 1 1200 | 135 | 0.752 | 0.009 | 0.372 | 0.376 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1215 | 150 | 0.771 | 0.011 | 0.375 | 0.380 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1230 | 165 | 0.790 | 0.010 | 0.375 | 0.379 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1245 | 180 | 0.808 | 0.009 | 0.374 | 0.379 | 0.6045 | 0.0570 | 0.0395 | 0.021 | 0.146 | 0.0264 | 0.0027 |
| 1 1300 | 195 | 0.824 | 0.002 | 0.368 | 0.372 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1315 | 210 | 0.844 | 0.009 | 0.379 | 0.383 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1330 | 225 | 0.857 | 0.012 | 0.380 | 0.385 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1345 | 240 | 0.871 | 0.009 | 0.380 | 0.384 | 0.5816 | 0.0662 | 0.0535 | 0.026 | 0.121 | 0.0342 | 0.0026 |
| 1 1400 | 255 | 0.878 | 0.003 | 0.373 | 0.377 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1415 | 270 | 0.892 | 0.002 | 0.370 | 0.375 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1430 | 285 | 0.899 | 0.010 | 0.378 | 0.383 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1445 | 300 | 0.909 | 0.010 | 0.380 | 0.384 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1500 | 315 | 0.914 | 0.009 | 0.376 | 0.380 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1515 | 330 | 0.917 | 0.006 | 0.374 | 0.378 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1530 | 345 | 0.920 | 0.008 | 0.376 | 0.381 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1545 | 360 | 0.924 | 0.012 | 0.383 | 0.387 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1600 | 375 | 0.921 | 0.008 | 0.300 | 0.305 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1615 | 390 | 0.919 | 0.010 | 0.347 | 0.352 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1630 | 405 | 0.919 | 0.010 | 0.363 | 0.367 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1645 | 420 | 0.921 | 0.007 | 0.367 | 0.372 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

------ NO DATA TAKEN

ITC-549
N-OCTANE/METHYLNITRITE
1982 DEC. 7

| CLOCK TIME DAY | HR. | ELAPSED TIME (MIN) | T DEG C DORIC-1 |
|---|---|---|---|
| 1 | 900 | -45 | 23.3 |
| 1 | 915 | -30 | 23.0 |
| 1 | 930 | -15 | 22.6 |
| 1 | 945 | 0 | 22.5 |
| 1 | 1000 | 15 | 26.7 |
| 1 | 1015 | 30 | 27.8 |
| 1 | 1030 | 45 | 28.7 |
| 1 | 1045 | 60 | 29.1 |
| 1 | 1100 | 75 | 29.3 |
| 1 | 1115 | 90 | 29.5 |
| 1 | 1130 | 105 | 29.7 |
| 1 | 1145 | 120 | 29.7 |
| 1 | 1200 | 135 | 29.9 |
| 1 | 1215 | 150 | 29.9 |
| 1 | 1230 | 165 | 29.6 |
| 1 | 1245 | 180 | 29.3 |
| 1 | 1300 | 195 | 29.7 |
| 1 | 1315 | 210 | 30.0 |
| 1 | 1330 | 225 | 29.7 |
| 1 | 1345 | 240 | 29.7 |
| 1 | 1400 | 255 | 29.5 |
| 1 | 1415 | 270 | 29.4 |
| 1 | 1430 | 285 | 29.2 |
| 1 | 1445 | 300 | 29.3 |
| 1 | 1500 | 315 | 29.1 |
| 1 | 1515 | 330 | 29.2 |
| 1 | 1530 | 345 | 29.1 |
| 1 | 1545 | 360 | 29.2 |
| 1 | 1600 | 375 | 29.4 |
| 1 | 1615 | 390 | 29.4 |
| 1 | 1630 | 405 | 29.4 |
| 1 | 1645 | 420 | 29.3 |

-------- NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.
B SEVERAL OTHER ORGANIC NITRATES DETECTED ON THE PANALYZER INCLUDING METHYLNITRITE

0848: THIRD AND FINAL FILL AT 50% R.H.
0936: INJECTIONS: 0.72 ML. NO, 0.18 ML. NO2, 0.061 ML. PROPENE,
AND 0.061 ML. N-BUTANE.
1015: T=0. 70% LIGHTS.
1216: RUN ENDED. BAG DUMPED.

T=0 AT 1015 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 26.0 | 3.4 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.080 | PPM |
| NO2-UNC | T 14B-1 | 0.059 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 2290 | DMS-2 | RM-103; DIMETHYLSULFOLANE GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-550
NOX-AIR IRRADIATION
1982 DEC. 8



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | LNC4/C3= RAW DATA | HYDROXYL PPT | PROPENE PPM DMS-2 | N-C4 PPM DMS-2 | HCHO PPM CA | ACETALD PPM 10'C-600 | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 900 | -75 | 0.000 | 0.010 | 0.060 | 0.068 | ------ | ------ | 0.00066 | 0.00018 | ------ | 0.0033 | 22.8 |
| 1 915 | -60 | 0.000 | 0.009 | 0.035 | 0.044 | ------ | ------ | ------ | ------ | ------ | ------ | 22.0 |
| 1 930 | -45 | 0.000 | 0.083 | 0.065 | 0.148 | ------ | ------ | ------ | ------ | ------ | ------ | 22.5 |
| 1 938 | -37 | ------ | ------ | ------ | ------ | -0.0580 | ------ | 0.00930 | 0.00915 | 0.017 | ------ | ------ |
| 1 945 | -30 | 0.000 | 0.085 | 0.060 | 0.145 | ------ | ------ | ------ | ------ | ------ | ------ | 22.4 |
| 1 951 | -24 | ------ | ------ | ------ | ------ | -0.0630 | ------ | 0.00917 | 0.00898 | ------ | ------ | ------ |
| 1 1000 | -15 | 0.000 | 0.080 | 0.060 | 0.140 | ------ | ------ | ------ | ------ | ------ | ------ | 22.4 |
| 1 1015 | 0 | 0.000 | 0.080 | 0.059 | 0.138 | -0.0620 | 0.193 | 0.00936 | 0.00917 | ------ | ------ | 21.9 |
| 1 1030 | 15 | 0.001 | 0.083 | 0.054 | 0.137 | 0.0320 | 0.238 | 0.00841 | 0.00905 | ------ | ------ | 26.9 |
| 1 1045 | 30 | 0.000 | 0.083 | 0.058 | 0.139 | 0.1480 | 0.191 | 0.00741 | 0.00896 | ------ | ------ | 27.5 |
| 1 1100 | 45 | 0.005 | 0.078 | 0.057 | 0.135 | 0.2410 | 0.263 | 0.00653 | 0.00867 | ------ | ------ | 28.3 |
| 1 1115 | 60 | 0.002 | 0.076 | 0.060 | 0.135 | 0.3690 | 0.218 | 0.00575 | 0.00867 | ------ | ------ | 28.9 |
| 1 1130 | 75 | 0.009 | 0.074 | 0.062 | 0.135 | 0.4750 | 0.185 | 0.00513 | 0.00860 | ------ | ------ | 29.5 |
| 1 1145 | 90 | 0.003 | 0.071 | 0.063 | 0.133 | 0.5650 | 0.148 | 0.00468 | 0.00859 | ------ | ------ | 29.5 |
| 1 1200 | 105 | 0.008 | 0.067 | 0.064 | 0.131 | 0.6370 | 0.183 | 0.00431 | 0.00849 | ------ | ------ | 29.8 |
| 1 1210 | 115 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.004 | ------ | ------ |
| 1 1215 | 120 | 0.008 | 0.066 | 0.066 | 0.132 | 0.7260 | ------ | 0.00389 | 0.00839 | ------ | ------ | 29.5 |

------ NO DATA TAKEN

ITC-552
N-OCTANE/NOX
1982 DEC. 9



0841: THIRD AND FINAL FILL.
0908: INJECTIONS: 2432 MICROLITERS N-OCTANE, 0.72 ML. NO, AND 0.18 ML. NO2.
0945: T=0. 70% LIGHTS.
1612: DUMP AND FILL.

T=0 AT 945 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 27.9 | 2.0 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.088 | PPM |
| NO2-UNC | T 14B-1 | 0.043 | PPM |
| N-C8 | C-20M | 53.6026 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | B-3378 | BASIRI 3378 OZONE MONITOR |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-552
N-OCTANE/NOX
1982 DEC. 9



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C8 PPM C-20M | C8-N-4 PPM 5' C-600 | C8-N-3 PPM 5' C-600 | C8-N-2 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 830 | -75 | 0.010 | 0.000 | 0.000 | 0.000 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 845 | -60 | 0.000 | 0.006 | 0.041 | 0.046 | 0.0000 | 0.0064 | ------ | 0.0000 | 0.000 | ------ | 0.0048 |
| 1 900 | -45 | 0.000 | 0.008 | 0.018 | 0.025 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 915 | -30 | 0.000 | 0.088 | 0.043 | 0.131 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 920 | -25 | ------ | ------ | ------ | ------ | 53.98 | 0.0000 | ------ | 0.0000 | ------ | ------ | ------ |
| 1 929 | -16 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.013 | ------ |
| 1 930 | -15 | 0.000 | 0.088 | 0.043 | 0.130 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 945 | 0 | 0.000 | 0.088 | 0.043 | 0.131 | 53.60 | 0.0045 | ------ | 0.0000 | 0.000 | ------ | ------ |
| 1 1000 | 15 | 0.001 | 0.080 | 0.051 | 0.131 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1015 | 30 | 0.002 | 0.070 | 0.061 | 0.130 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1030 | 45 | 0.009 | 0.059 | 0.073 | 0.132 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1045 | 60 | 0.012 | 0.049 | 0.084 | 0.132 | 53.53 | 0.0096 | ------ | 0.0000 | 0.000 | 0.013 | ------ |
| 1 1100 | 75 | 0.021 | 0.039 | 0.095 | 0.133 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1115 | 90 | 0.033 | 0.030 | 0.103 | 0.132 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1130 | 105 | 0.052 | 0.024 | 0.109 | 0.132 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1145 | 120 | 0.069 | 0.019 | 0.113 | 0.132 | 53.22 | 0.0038 | 0.0000 | 0.0000 | 0.000 | 0.015 | 0.0108 |
| 1 1200 | 135 | 0.082 | 0.018 | 0.116 | 0.133 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1215 | 150 | 0.102 | 0.016 | 0.116 | 0.131 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1230 | 165 | 0.123 | 0.015 | 0.117 | 0.131 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1245 | 180 | 0.141 | 0.012 | 0.116 | 0.129 | 52.46 | 0.0384 | 0.0554 A | 0.0191 | 0.000 | 0.017 | 0.0132 |
| 1 1300 | 195 | 0.158 | 0.013 | 0.118 | 0.130 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1315 | 210 | 0.167 | 0.012 | 0.117 | 0.129 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1330 | 225 | 0.187 | 0.010 | 0.115 | 0.126 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1345 | 240 | 0.212 | 0.011 | 0.115 | 0.125 | 52.54 | 0.0256 | ------ | 0.0261 | 0.000 | 0.013 | 0.0129 |
| 1 1400 | 255 | 0.217 | 0.011 | 0.114 | 0.125 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1415 | 270 | 0.243 | 0.010 | 0.113 | 0.123 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1430 | 285 | 0.255 | 0.010 | 0.113 | 0.123 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1445 | 300 | 0.272 | 0.011 | 0.110 | 0.120 | 52.39 | 0.0512 | ------ | 0.0261 | 0.001 | 0.010 | 0.0145 |
| 1 1500 | 315 | 0.283 | 0.010 | 0.111 | 0.120 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1515 | 330 | 0.296 | 0.010 | 0.108 | 0.117 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1530 | 345 | 0.311 | 0.009 | 0.107 | 0.116 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1545 | 360 | 0.315 | 0.009 | 0.105 | 0.113 | 52.38 | 0.0576 | ------ | 0.0191 | 0.001 | ------ | 0.0140 |
| 1 1600 | 375 | 0.021 | 0.008 | 0.031 | 0.038 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1601 | 376 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.010 | ------ |

------ NO DATA TAKEN

ITC-552
N-OCTANE/NOX
1982 DEC. 9



| CLOCK TIME DAY | HR. | ELAPSED TIME (MIN) | T DEG C DORIC-1 |
|---|---|---|---|
| 1 | 830 | -75 | 26.1 |
| 1 | 845 | -60 | 24.8 |
| 1 | 900 | -45 | 24.2 |
| 1 | 915 | -30 | 23.9 |
| 1 | 930 | -15 | 23.7 |
| 1 | 945 | 0 | 23.4 |
| 1 | 1000 | 15 | 27.4 |
| 1 | 1015 | 30 | 28.3 |
| 1 | 1030 | 45 | 29.2 |
| 1 | 1045 | 60 | 29.4 |
| 1 | 1100 | 75 | 29.9 |
| 1 | 1115 | 90 | 29.2 |
| 1 | 1130 | 105 | 29.5 |
| 1 | 1145 | 120 | 29.2 |
| 1 | 1200 | 135 | 29.4 |
| 1 | 1215 | 150 | 29.0 |
| 1 | 1230 | 165 | 26.7 |
| 1 | 1245 | 180 | ------- |
| 1 | 1300 | 195 | ------- |
| 1 | 1315 | 210 | ------- |
| 1 | 1330 | 225 | 29.1 |
| 1 | 1345 | 240 | 28.5 |
| 1 | 1400 | 255 | 28.8 |
| 1 | 1415 | 270 | 28.6 |
| 1 | 1430 | 285 | 28.9 |
| 1 | 1445 | 300 | 28.8 |
| 1 | 1500 | 315 | 29.0 |
| 1 | 1515 | 330 | 28.8 |
| 1 | 1530 | 345 | 29.0 |
| 1 | 1545 | 360 | 28.7 |
| 1 | 1600 | 375 | 29.0 |

------- NO DATA TAKEN

NOTES

A NO FURTHER DATA DUE TO INTERFERENCE.

0842: THIRD AND FINAL FILL.
0854: INJECTIONS: 0.5 PPM (2.27 LITER-TORR) METHYLNITRITE.
0900: T=0. 70% LIGHTS.
1400: DUMP AND FILL.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 900 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 28.7 | 1.8 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.004 | PPM |
| NO2-UNC | T 14B-1 | 0.422 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-553
METHYLNITRITE
1982 DEC. 10

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | HCHO PPM CA | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|
| 1 830 | -30 | 0.000 | 0.007 | 0.002 | 0.006 | ------- | 25.6 |
| 1 845 | -15 | 0.002 | 0.120 | 0.053 | 0.172 | ------- | 24.0 |
| 1 900 | 0 | 0.012 | 0.004 | 0.422 A | 0.424 A | ------- | 24.1 |
| 1 909 | 9 | ------- | ------- | ------- | ------- | 0.065 | ------- |
| 1 915 | 15 | 0.232 | 0.006 | 0.244 | 0.248 | ------- | 27.7 |
| 1 930 | 30 | 0.306 | 0.005 | 0.170 | 0.175 | ------- | 28.4 |
| 1 945 | 45 | 0.329 | 0.009 | 0.178 | 0.183 | ------- | 29.0 |
| 1 1000 | 60 | 0.344 | 0.002 | 0.217 | 0.221 | ------- | 29.3 |
| 1 1015 | 75 | 0.351 | 0.008 | 0.262 | 0.267 | ------- | 29.4 |
| 1 1030 | 90 | 0.354 | 0.008 | 0.290 | 0.295 | 0.082 | 29.7 |
| 1 1045 | 105 | 0.354 | 0.005 | 0.304 | 0.308 | ------- | 29.5 |
| 1 1100 | 120 | 0.356 | 0.035 | 0.159 | 0.192 | ------- | 29.8 |
| 1 1115 | 135 | 0.362 | 0.000 | 0.236 | 0.240 | ------- | 29.5 |
| 1 1130 | 150 | 0.357 | 0.007 | 0.298 | 0.302 | ------- | 29.5 |
| 1 1143 | 163 | ------- | ------- | ------- | ------- | 0.100 | ------- |
| 1 1145 | 165 | 0.364 | 0.007 | 0.317 | 0.321 | ------- | 29.2 |
| 1 1200 | 180 | 0.371 | 0.007 | 0.334 | 0.338 | ------- | 29.4 |
| 1 1215 | 195 | 0.367 | 0.002 | 0.332 | 0.337 | ------- | 29.3 |
| 1 1230 | 210 | 0.369 | 0.004 | 0.347 | 0.350 | ------- | 29.5 |
| 1 1245 | 225 | 0.374 | 0.007 | 0.348 | 0.352 | ------- | 29.4 |
| 1 1300 | 240 | 0.373 | 0.005 | 0.348 | 0.353 | ------- | 29.6 |
| 1 1315 | 255 | 0.381 | 0.012 | 0.354 | 0.359 | ------- | 29.4 |
| 1 1330 | 270 | 0.386 | 0.007 | 0.355 | 0.359 | ------- | 29.8 |
| 1 1345 | 285 | 0.379 | 0.005 | 0.353 | 0.356 | ------- | 29.7 |
| 1 1400 | 300 | ------- | 0.005 | 0.009 | 0.012 | ------- | ------- |

------- NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.

0847: THIRD AND FINAL FILL.
0910: 0.5 PPM (2.30 LITER-TORR) METHYLNITRITE INTO CHAMBER.
0919: 390 MICROLITERS N-HEXANE INTO CHAMBER.
1000: T=0. 70% LIGHTS.
1440: DUMP AND FILL.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 1000 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 27.5 | 2.0 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO2-UNC | T 14B-1 | 0.417 | PPM |
| N-C6 | C-20M | 9.2525 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-554
N-HEXANE/METHYLNITRITE
1982 DEC. 13



| CLOCK TIME DAY | CLOCK TIME HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C6 PPM C-20M | C6-N-2 PPM 5' C-600 | C6-N-3 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | N-C8 PPM C-20M | ACETALD PPM 10'C-600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 845 | -75 | 0.011 | 0.020 | 0.054 | 0.073 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 855 | -65 | ------ | ------ | ------ | ------ | 0.0000 | 0.0010 | 0.0015 | 0.000 B | ------ | 0.0048 | 0.0000 |
| 1 | 900 | -60 | 0.008 | 0.013 | 0.049 | 0.066 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 915 | -45 | 0.009 | 0.008 | 0.039 | 0.052 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 930 | -30 | 0.011 | 0.002 | 0.411 A | 0.412 A | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 935 | -25 | ------ | ------ | ------ | ------ | 9.042 | 0.0004 | 0.0003 | ------ | ------ | ------ | ------ |
| 1 | 945 | -15 | 0.022 | 0.004 | 0.415 | 0.415 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 946 | -14 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.008 | ------ | ------ |
| 1 | 1000 | 0 | 0.019 | 0.004 | 0.417 | 0.418 | 9.252 | 0.0001 | 0.0003 | 0.000 | ------ | ------ | 0.0000 |
| 1 | 1015 | 15 | 0.402 | 0.008 | 0.362 | 0.365 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1030 | 30 | 0.665 | 0.007 | 0.361 | 0.364 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1045 | 45 | 0.768 | 0.007 | 0.365 | 0.369 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1100 | 60 | 0.839 | 0.005 | 0.366 | 0.370 | 8.643 | 0.0432 | 0.0652 | 0.005 | 0.207 | ------ | 0.0216 |
| 1 | 1115 | 75 | 0.900 | 0.007 | 0.363 | 0.367 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1130 | 90 | 0.956 | 0.004 | 0.359 | 0.362 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1145 | 105 | 0.999 | 0.009 | 0.360 | 0.363 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1200 | 120 | 1.031 | 0.012 | 0.363 | 0.366 | 8.538 | 0.0484 | 0.0710 | 0.010 | 0.213 | ------ | 0.0247 |
| 1 | 1215 | 135 | 1.062 | 0.000 | 0.346 | 0.349 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1230 | 150 | 1.092 | 0.014 | 0.363 | 0.366 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1245 | 165 | 0.104 | 0.004 | 0.346 | 0.350 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1300 | 180 | 1.128 | 0.007 | 0.353 | 0.357 | 8.362 | 0.0599 | 0.0863 | 0.015 | 0.169 | ------ | ------ |
| 1 | 1315 | 195 | 1.131 | 0.009 | 0.344 | 0.348 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1330 | 210 | 1.142 | 0.006 | 0.351 | 0.355 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1345 | 225 | 1.145 | 0.006 | 0.348 | 0.352 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1400 | 240 | 1.152 | 0.006 | 0.351 | 0.355 | 8.444 | 0.0484 | 0.0694 | 0.020 | 0.165 | ------ | 0.0367 |
| 1 | 1415 | 255 | 1.143 | 0.007 | 0.351 | 0.355 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 | 1430 | 270 | 1.142 | 0.006 | 0.353 | 0.357 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

------ NO DATA TAKEN

ITC-554
N-HEXANE/METHYLNITRITE
1982 DEC. 13



| CLOCK TIME DAY | HR. | ELAPSED TIME (MIN) | ME-N PPM ECD-1 | T DEG C DORIC-1 |
|---|---|---|---|---|
| 1 | 945 | -15 | ------- | 23.0 |
| 1 | 1000 | 0 | ------- | 22.8 |
| 1 | 1015 | 15 | ------- | 25.6 |
| 1 | 1030 | 30 | ------- | 26.8 |
| 1 | 1045 | 45 | ------- | 27.2 |
| 1 | 1100 | 60 | ------- | 27.9 |
| 1 | 1115 | 75 | ------- | 27.8 |
| 1 | 1130 | 90 | ------- | 28.2 |
| 1 | 1145 | 105 | ------- | 28.2 |
| 1 | 1200 | 120 | ------- | 28.5 |
| 1 | 1215 | 135 | ------- | 28.3 |
| 1 | 1230 | 150 | ------- | 28.9 |
| 1 | 1245 | 165 | ------- | ------- |
| 1 | 1300 | 180 | ------- | ------- |
| 1 | 1315 | 195 | ------- | ------- |
| 1 | 1330 | 210 | ------- | 28.8 |
| 1 | 1345 | 225 | ------- | 28.7 |
| 1 | 1400 | 240 | 0.0025 | 28.9 |
| 1 | 1415 | 255 | ------- | 29.0 |
| 1 | 1430 | 270 | ------- | 29.0 |

------- NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.
B MANY OTHER ORGANIC NITRATES DETECTED ON PANALYZER IN ADDITION TO PAN.

ITC-555
N-HEXANE/METHYLNITRITE
1982 DEC. 14



0846: THIRD AND FINAL FILL.
0901: 0.5 PPM (2.52 LITER-TORR) METHYLNITRITE INTO CHAMBER.
0908: 195 MICROLITERS N-HEXANE INTO CHAMBER.
0930: T=0. 70% LIGHTS.
1435: DUMP AND FILL.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 930 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 27.4 | 2.2 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO2-UNC | T 14B-1 | 0.470 | PPM |
| N-C6 | C-20M | 4.6848 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12" 5% CARBOWAX-400 GC; ECD |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-555
N-HEXANE/METHYLNITRITE
1982 DEC. 14



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C6 PPM C-20M | C6-N-2 PPM 5' C-600 | C6-N-3 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | ME-N PPM ECD-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 850 | -40 | ------ | ------ | ------ | ------ | 0.0000 | 0.0020 | 0.0045 | 0.000 | ------ | 0.0040 | ------ |
| 1 900 | -30 | 0.001 | 0.001 | 0.008 | 0.009 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 915 | -15 | 0.011 | 0.004 | 0.473 A | 0.473 A | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 920 | -10 | ------ | ------ | ------ | ------ | 4.579 | 0.0006 | 0.0010 | ------ | ------ | ------ | ------ |
| 1 928 | -2 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.031 | ------ | ------ |
| 1 930 | 0 | 0.011 | 0.003 | 0.470 | 0.472 | 4.685 | 0.0001 | 0.0009 | 0.000 | ------ | 0.0000 | ------ |
| 1 945 | 15 | 0.432 | 0.005 | 0.412 | 0.415 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1000 | 30 | 0.695 | 0.002 | 0.389 | 0.392 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1015 | 45 | 0.816 | 0.005 | 0.395 | 0.398 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1030 | 60 | 0.880 | 0.007 | 0.398 | 0.401 | ------ | 0.0330 | 0.0476 | 0.009 | 0.236 | 0.0293 | ------ |
| 1 1036 | 66 | ------ | ------ | ------ | ------ | 4.134 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1045 | 75 | 0.938 | 0.005 | 0.397 | 0.400 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1100 | 90 | 0.989 | 0.009 | 0.400 | 0.404 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1115 | 105 | 1.022 | 0.006 | 0.398 | 0.401 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1130 | 120 | 1.065 | 0.001 | 0.394 | 0.398 | 4.096 | 0.0515 | 0.0833 | 0.017 | 0.245 | 0.0335 | ------ |
| 1 1145 | 135 | 1.100 | 0.013 | 0.405 | 0.410 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1200 | 150 | 1.130 | 0.005 | 0.405 | 0.408 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1215 | 165 | 1.151 | 0.005 | 0.400 | 0.404 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1230 | 180 | 1.173 | 0.010 | 0.409 | 0.413 | 4.041 | 0.0565 | 0.0839 | 0.025 | 0.203 | 0.0374 | ------ |
| 1 1245 | 195 | 1.181 | 0.005 | 0.400 | 0.404 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1300 | 210 | 1.192 | 0.008 | 0.407 | 0.412 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1315 | 225 | 1.202 | 0.006 | 0.400 | 0.403 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1330 | 240 | 1.205 | 0.007 | 0.405 | 0.409 | 3.994 | 0.0526 | 0.0811 | 0.032 | 0.182 | 0.0408 | 0.0032 |

------ NO DATA TAKEN

ITC-555
N-HEXANE/METHYLNITRITE
1982 DEC. 14



| CLOCK TIME DAY | HR. | ELAPSED TIME (MIN) | T DEG C DORIC-1 |
|---|---|---|---|
| 1 | 900 | -30 | 22.3 |
| 1 | 915 | -15 | 23.5 |
| 1 | 930 | 0 | 22.8 |
| 1 | 945 | 15 | 26.9 |
| 1 | 1000 | 30 | 27.9 |
| 1 | 1015 | 45 | 28.1 |
| 1 | 1030 | 60 | 28.7 |
| 1 | 1045 | 75 | 28.6 |
| 1 | 1100 | 90 | 29.1 |
| 1 | 1115 | 105 | 29.0 |
| 1 | 1130 | 120 | 28.7 |
| 1 | 1145 | 135 | 28.4 |
| 1 | 1200 | 150 | 28.6 |
| 1 | 1215 | 165 | 28.5 |
| 1 | 1230 | 180 | 28.8 |
| 1 | 1245 | 195 | ------- |
| 1 | 1300 | 210 | ------- |
| 1 | 1315 | 225 | 28.0 |
| 1 | 1330 | 240 | 28.7 |

------- NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.

0844: THIRD AND FINAL FILL.
0904: ~0.5 PPM (2.48 LITER-TORR) METHYLNITRITE INTO CHAMBER.
0910: 39 MICROLITERS N-HEXANE INTO CHAMBER.
0930: T=0. 70% LIGHTS.
1545: DUMP AND FILL.

NOTE: INITIAL 'NO2-UNC' READING ACTUALLY REFLECTS INITIAL METHYLNITRITE.
NO 'NO' OR 'NO2' INJECTED.

T=0 AT 930 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 27.6 | 3.0 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO2-UNC | T 14B-1 | 0.475 | PPM |
| N-C6 | C-20M | 0.9170 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-556
N-HEXANE/METHYLNITRITE
1982 DEC. 15



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C6 PPM C-20M | C6-N-2 PPM 5' C-600 | C6-N-3 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ACETALD PPM 10'C-600 | ME-N PPM ECD-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 830 | -60 | 0.000 | 0.000 | 0.000 | 0.000 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 845 | -45 | 0.000 | 0.002 | 0.001 | 0.001 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 850 | -40 | ------ | ------ | ------ | ------ | 0.0000 | 0.0011 | 0.0029 | 0.000 | ------ | 0.0000 | ------ |
| 1 900 | -30 | 0.000 | 0.003 | 0.015 | 0.016 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 915 | -15 | 0.000 | 0.004 | 0.471 A | 0.472 A | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 918 | -12 | ------ | ------ | ------ | ------ | 0.9147 | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 924 | -6 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.023 | ------ | ------ |
| 1 930 | 0 | 0.000 | 0.006 | 0.475 | 0.476 | 0.9170 | 0.0005 | 0.0009 | 0.000 | ------ | 0.0000 | ------ |
| 1 945 | 15 | 0.000 | 0.004 | 0.375 | 0.379 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1000 | 30 | 0.585 | 0.008 | 0.356 | 0.360 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1015 | 45 | 0.668 | 0.002 | 0.367 | 0.371 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1030 | 60 | 0.703 | 0.000 | 0.379 | 0.383 | 0.6559 | 0.0243 | 0.0391 | 0.021 | 0.178 | 0.0212 | ------ |
| 1 1045 | 75 | 0.740 | 0.003 | 0.391 | 0.394 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1100 | 90 | 0.765 | 0.003 | 0.400 | 0.404 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1115 | 105 | 0.792 | 0.001 | 0.401 | 0.405 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1130 | 120 | 0.821 | 0.002 | 0.405 | 0.408 | 0.6266 | 0.0227 | 0.0397 | 0.028 | 0.130 | 0.0224 | ------ |
| 1 1145 | 135 | 0.837 | 0.006 | 0.409 | 0.413 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1200 | 150 | ------ | 0.003 | 0.409 | 0.412 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1215 | 165 | 0.891 | 0.000 | 0.403 | 0.407 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1230 | 180 | 0.923 | 0.005 | 0.411 | 0.414 | 0.6096 | 0.0273 | 0.0496 | 0.037 | 0.136 | 0.0253 | ------ |
| 1 1245 | 195 | 0.923 | 0.000 | 0.404 | 0.407 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1300 | 210 | 0.937 | 0.005 | 0.413 | 0.416 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1315 | 225 | 0.963 | 0.001 | 0.407 | 0.410 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1330 | 240 | 0.966 | 0.005 | 0.413 | 0.416 | 0.5891 | 0.0270 | 0.0476 | 0.045 | ------ | 0.0278 | 0.0032 |
| 1 1345 | 255 | 0.985 | 0.003 | 0.407 | 0.410 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1400 | 270 | 1.000 | 0.001 | 0.407 | 0.410 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1415 | 285 | 1.000 | 0.002 | 0.407 | 0.410 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1430 | 300 | 1.014 | 0.003 | 0.408 | 0.411 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1445 | 315 | 1.017 | 0.001 | 0.405 | 0.408 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1500 | 330 | 1.020 | 0.000 | 0.401 | 0.404 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1515 | 345 | 1.029 | 0.004 | 0.409 | 0.412 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1530 | 360 | 1.035 | 0.000 | 0.402 | 0.405 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1 1545 | 375 | 1.024 | 0.081 | 0.331 | 0.411 | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

------ NO DATA TAKEN

ITC-556
N-HEXANE/METHYLNITRITE
1982 DEC. 15



| CLOCK TIME DAY | HR. | ELAPSED TIME (MIN) | T DEG C DORIC-1 |
|---|---|---|---|
| 1 | 830 | -60 | 18.4 |
| 1 | 845 | -45 | 19.1 |
| 1 | 900 | -30 | 22.7 |
| 1 | 915 | -15 | 23.7 |
| 1 | 930 | 0 | 23.4 |
| 1 | 945 | 15 | 27.1 |
| 1 | 1000 | 30 | 28.3 |
| 1 | 1015 | 45 | 28.5 |
| 1 | 1030 | 60 | 29.0 |
| 1 | 1045 | 75 | 29.0 |
| 1 | 1100 | 90 | 29.3 |
| 1 | 1115 | 105 | 29.4 |
| 1 | 1130 | 120 | 28.7 |
| 1 | 1145 | 135 | 28.8 |
| 1 | 1200 | 150 | 28.9 |
| 1 | 1215 | 165 | 28.7 |
| 1 | 1230 | 180 | 28.8 |
| 1 | 1245 | 195 | 28.6 |
| 1 | 1300 | 210 | 28.7 |
| 1 | 1315 | 225 | 28.6 |
| 1 | 1330 | 240 | 28.9 |
| 1 | 1345 | 255 | 28.8 |
| 1 | 1400 | 270 | 28.9 |
| 1 | 1415 | 285 | 28.7 |
| 1 | 1430 | 300 | 29.0 |
| 1 | 1445 | 315 | 28.9 |
| 1 | 1500 | 330 | 29.1 |
| 1 | 1515 | 345 | 29.1 |
| 1 | 1530 | 360 | 29.3 |
| 1 | 1545 | 375 | 28.9 |

------ NO DATA TAKEN

NOTES

A NO2 NOT INJECTED. THIS VALUE REFLECTS RESPONSE TO METHYLNITRITE.

0838: THIRD AND FINAL FILL AT 50% R.H.
0855: INJECTIONS: 0.061 ML. PROPENE, 0.061 ML. N-BUTANE,
0.72 ML. NO, 0.18 ML. NO2.
0930: T=0. 70% LIGHTS.
1140: DUMP AND FILL AFTER K1.

T=0 AT 930 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 26.3 | 3.1 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.096 | PPM |
| NO2-UNC | T 14B-1 | 0.039 | PPM |
| PROPENE | DMS-2 | 0.00958 | PPM |
| N-C4 | DMS-2 | 0.00888 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 2290 | DMS-2 | RM-103; DIMETHYLSULFOLANE GC; FID |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-557
NOX-AIR IRRADIATION
1982 DEC. 16



| CLOCK TIME DAY | HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | LNC4/C3= RAW DATA | HYDROXYL PPT | PROPENE PPM DMS-2 | N-C4 PPM DMS-2 | HCHO PPM CA | ACETALD PPM 10'C-600 | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 831 | -59 | 0.000 | 0.128 | 0.095 | 0.222 | ------ | ------ | ------ | ------ | ------ | ------ | 24.3 |
| 1 | 840 | -50 | ------ | ------ | ------ | ------ | ------ | ------ | 0.00069 | 0.00029 | ------ | 0.0036 | ------ |
| 1 | 846 | -44 | 0.001 | 0.013 | 0.019 | 0.029 | ------ | ------ | ------ | ------ | ------ | ------ | 23.0 |
| 1 | 901 | -29 | 0.000 | 0.096 | 0.039 | 0.131 | ------ | ------ | ------ | ------ | ------ | ------ | 22.4 |
| 1 | 903 | -27 | ------ | ------ | ------ | ------ | -0.1180 | ------ | 0.00958 | 0.00888 | ------ | ------ | ------ |
| 1 | 907 | -23 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.017 | ------ | ------ |
| 1 | 916 | -14 | 0.000 | 0.098 | 0.038 | 0.131 | ------ | ------ | ------ | ------ | ------ | ------ | 22.0 |
| 1 | 930 | 0 | ------ | ------ | ------ | ------ | -0.1180 | 0.142 | 0.00958 | 0.00888 | ------ | ------ | ------ |
| 1 | 931 | 1 | 0.000 | 0.086 | 0.044 | 0.129 | ------ | ------ | ------ | ------ | ------ | ------ | 22.1 |
| 1 | 945 | 15 | 0.000 | 0.095 | 0.037 | 0.132 | -0.0490 | 0.220 | 0.00865 | 0.00859 | ------ | ------ | 26.6 |
| 1 | 1000 | 30 | 0.000 | 0.094 | 0.041 | 0.134 | 0.0580 | 0.201 | 0.00777 | 0.00859 | ------ | ------ | 27.6 |
| 1 | 1015 | 45 | 0.000 | 0.090 | 0.043 | 0.133 | 0.1560 | 0.136 | 0.00696 | 0.00849 | ------ | ------ | 28.2 |
| 1 | 1030 | 60 | 0.000 | 0.086 | 0.044 | 0.131 | 0.2220 | 0.238 | 0.00655 | 0.00853 | ------ | ------ | 28.7 |
| 1 | 1045 | 75 | 0.011 | 0.084 | 0.048 | 0.132 | 0.3380 | 0.160 | 0.00573 | 0.00837 | ------ | ------ | 29.1 |
| 1 | 1100 | 90 | 0.001 | 0.082 | 0.052 | 0.132 | 0.4160 | 0.088 | 0.00526 | 0.00832 | ------ | ------ | 29.6 |
| 1 | 1115 | 105 | 0.002 | 0.077 | 0.054 | 0.131 | 0.4590 | 0.197 | 0.00498 | 0.00822 | ------ | ------ | 29.7 |
| 1 | 1120 | 110 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.023 | ------ | ------ |
| 1 | 1130 | 120 | 0.000 | 0.075 | 0.056 | 0.131 | 0.5550 | ------ | 0.00451 | 0.00820 | ------ | ------ | 29.2 |

------ NO DATA TAKEN

ITC-559
N-HEXANE/NOX
1982 DEC. 17



0847: THIRD AND FINAL FILL.
0908: INJECTIONS: 1.95 ML. N-HEXANE, 0.72 ML. NO, 0.18 ML. NO2.
0945: T=0. 70% LIGHTS.

T=0 AT 945 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 26.3 | 7.1 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.097 | PPM |
| NO2-UNC | T 14B-1 | 0.016 | PPM |
| N-C6 | C-20M | 46.5669 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1400 | C-20M | RM-121; C-20M/DC-703 GC; FID |
| 2930 | 5' C-600 | RM-103; 5' 5% CARBOWAX-600 GC; FID |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-559
N-HEXANE/NOX
1982 DEC. 17



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | N-C6 PPM C-20M | C6-N-2 PPM 5' C-600 | C6-N-3 PPM 5' C-600 | PAN PPM ECD-1 | HCHO PPM CA | ME-N PPM ECD-1 | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 830 | -75 | 0.000 | 0.005 | 0.004 | 0.009 | ------ | ------ | ------ | ------ | ------ | ------ | 22.7 |
| 1 845 | -60 | 0.002 | 0.057 | 0.050 | 0.100 | ------ | ------ | ------ | ------ | ------ | ------ | 25.6 |
| 1 850 | -55 | ------ | ------ | ------ | ------ | 0.0000 | 0.0000 | 0.0034 | ------ | ------ | ------ | ------ |
| 1 900 | -45 | 0.001 | 0.013 | 0.011 | 0.022 | ------ | ------ | ------ | ------ | ------ | ------ | 23.1 |
| 1 915 | -30 | 0.000 | 0.013 | 0.010 | 0.022 | ------ | ------ | ------ | ------ | ------ | ------ | 22.5 |
| 1 925 | -20 | ------ | ------ | ------ | ------ | 46.85 | 0.0009 | 0.0010 | ------ | ------ | ------ | ------ |
| 1 930 | -15 | 0.000 | 0.096 | 0.016 | 0.100 | ------ | ------ | ------ | ------ | 0.017 | ------ | 22.5 |
| 1 945 | 0 | 0.000 | 0.097 | 0.016 | 0.134 | 46.57 | 0.0011 | 0.0017 | ------ | ------ | ------ | 22.1 |
| 1 1000 | 15 | 0.000 | 0.089 | 0.041 | 0.130 | ------ | ------ | ------ | ------ | ------ | ------ | 26.7 |
| 1 1015 | 30 | 0.000 | 0.078 | 0.053 | 0.131 | ------ | ------ | ------ | ------ | ------ | ------ | 27.9 |
| 1 1030 | 45 | 0.002 | 0.067 | 0.067 | 0.133 | ------ | ------ | ------ | ------ | ------ | ------ | 28.6 |
| 1 1045 | 60 | 0.011 | 0.055 | 0.076 | 0.132 | 46.61 | ------ | 0.0029 | ------ | 0.008 | ------ | 29.0 |
| 1 1100 | 75 | 0.014 | 0.046 | 0.089 | 0.134 | ------ | ------ | ------ | ------ | ------ | ------ | 29.3 |
| 1 1115 | 90 | 0.028 | 0.037 | 0.098 | 0.134 | ------ | ------ | ------ | ------ | ------ | ------ | 29.6 |
| 1 1130 | 105 | 0.035 | 0.029 | 0.104 | 0.134 | ------ | ------ | ------ | ------ | ------ | ------ | 29.0 |
| 1 1145 | 120 | 0.060 | 0.026 | 0.109 | 0.135 | 46.57 | 0.0083 | 0.0106 | ------ | 0.017 | ------ | 28.8 |
| 1 1200 | 135 | 0.079 | 0.023 | 0.113 | 0.136 | ------ | ------ | ------ | ------ | ------ | ------ | 28.4 |
| 1 1245 | 180 | ------ | ------ | ------ | ------ | 46.19 | 0.0065 | 0.0119 | 0.000 | 0.031 | ------ | ------ |
| 1 1300 | 195 | 0.031 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | -8.6 |
| 1 1315 | 210 | 0.172 | 0.016 | 0.122 | 0.137 | ------ | ------ | ------ | ------ | ------ | ------ | 28.6 |
| 1 1330 | 225 | 0.191 | 0.015 | 0.122 | 0.137 | ------ | ------ | ------ | ------ | ------ | ------ | 28.7 |
| 1 1345 | 240 | 0.205 | 0.015 | 0.122 | 0.136 | 45.91 | 0.0159 | 0.0210 | 0.000 | 0.006 | ------ | 28.8 |
| 1 1400 | 255 | 0.220 | 0.015 | 0.121 | 0.135 | ------ | ------ | ------ | ------ | ------ | ------ | 28.8 |
| 1 1415 | 270 | 0.242 | 0.014 | 0.120 | 0.134 | ------ | ------ | ------ | ------ | ------ | ------ | 28.8 |
| 1 1430 | 285 | 0.256 | 0.015 | 0.121 | 0.134 | ------ | ------ | ------ | ------ | ------ | ------ | 28.8 |
| 1 1445 | 300 | 0.283 | 0.013 | 0.119 | 0.132 | 45.35 | 0.0171 | 0.0267 | 0.001 | 0.013 | 0.0000 | 28.8 |
| 1 1500 | 315 | 0.297 | 0.014 | 0.117 | 0.131 | ------ | ------ | ------ | ------ | ------ | ------ | 28.9 |
| 1 1515 | 330 | 0.317 | 0.014 | 0.117 | 0.130 | ------ | ------ | ------ | ------ | ------ | ------ | 28.9 |
| 1 1530 | 345 | 0.337 | 0.013 | 0.115 | 0.128 | ------ | ------ | ------ | ------ | ------ | ------ | 28.9 |
| 1 1545 | 360 | 0.353 | 0.012 | 0.114 | 0.126 | ------ | ------ | ------ | ------ | ------ | ------ | 28.9 |
| 1 1600 | 375 | 0.371 | 0.013 | 0.113 | 0.125 | ------ | ------ | ------ | ------ | ------ | ------ | 28.9 |
| 1 1615 | 390 | 0.377 | 0.013 | 0.111 | 0.123 | ------ | ------ | ------ | ------ | ------ | ------ | 28.9 |

------ NO DATA TAKEN

NOTES

A THIS PEAK CUT SHORT BY THE WATER DIP....BUT GOT THE HIGHEST PART OF PEAK.

0837: THIRD AND FINAL FILL.
0848: INJECTIONS: ~1.95 ML. BENZENE, 0.08 ML. NO, 0.02 ML. NO2.
0930: T=0. 70% LIGHTS.
1230: DUMP AND FILL.

T=0 AT 930 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 26.8 | 2.9 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.079 | PPM |
| NO2-UNC | T 14B-1 | 0.037 | PPM |
| BENZENE | 10'C-600 | 55.3830 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-560
BENZENE/NOX
1982 DEC. 20



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | BENZENE PPM 10'C-600 | HCHO PPM CA | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|
| 1 815 | -75 | 0.000 | 0.000 | 0.000 | 0.000 | ------ | ------ | 23.1 |
| 1 830 | -60 | 0.005 | 0.001 | 0.001 | 0.001 | ------ | ------ | 24.5 |
| 1 845 | -45 | 0.000 | 0.005 | 0.021 | 0.026 | ------ | ------ | 23.1 |
| 1 900 | -30 | 0.000 | 0.008 | 0.010 | 0.018 | 54.94 | ------ | 22.5 |
| 1 915 | -15 | 0.000 | 0.078 | 0.037 | 0.100 | 55.46 | ------ | 22.4 |
| 1 918 | -12 | ------ | ------ | ------ | ------ | ------ | 0.013 | ------ |
| 1 930 | 0 | 0.000 | 0.079 | 0.037 | 0.115 | 55.38 | ------ | 22.2 |
| 1 945 | 15 | 0.014 | 0.043 | 0.071 | 0.113 | ------ | ------ | 26.7 |
| 1 1000 | 30 | 0.151 | 0.012 | 0.078 | 0.090 | ------ | ------ | 27.5 |
| 1 1015 | 45 | 0.261 | 0.008 | 0.058 | 0.065 | ------ | ------ | 28.0 |
| 1 1030 | 60 | 0.296 | 0.006 | 0.043 | 0.049 | 50.26 | ------ | 28.5 |
| 1 1045 | 75 | 0.322 | 0.005 | 0.034 | 0.039 | ------ | ------ | 28.7 |
| 1 1100 | 90 | 0.323 | 0.006 | 0.030 | 0.035 | ------ | ------ | 29.2 |
| 1 1115 | 105 | 0.313 | 0.005 | 0.026 | 0.031 | ------ | ------ | 29.3 |
| 1 1130 | 120 | 0.304 | 0.005 | 0.023 | 0.028 | 55.16 | 0.019 | 29.4 |
| 1 1145 | 135 | 0.293 | 0.005 | 0.023 | 0.028 | ------ | ------ | 29.5 |
| 1 1200 | 150 | 0.283 | 0.006 | 0.023 | 0.028 | ------ | ------ | 29.3 |
| 1 1215 | 165 | 0.272 | 0.004 | 0.020 | 0.025 | ------ | ------ | 29.1 |
| 1 1224 | 174 | ------ | ------ | ------ | ------ | ------ | 0.029 | ------ |
| 1 1230 | 180 | 0.263 | 0.004 | 0.021 | 0.026 | 54.97 | ------ | 29.1 |

------ NO DATA TAKEN

0048: THIRD AND FINAL FILL.
0902: INJECTIONS: ~0.4 ML. (10 PPM) BENZENE, 0.08 ML. NO, 0.02 ML. NO2.
0930: T=0, 70% LIGHTS.
1215: DUMP AND FILL.

T=0 AT 930 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 27.2 | 2.5 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.082 | PPM |
| NO2-UNC | T 14B-1 | 0.032 | PPM |
| BENZENE | 10'C-600 | 13.1850 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1000 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-561
BENZENE/NOX
1982 DEC. 21



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | BENZENE PPM 10'C-600 | HCHO PPM CA | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|
| 1 830 | -60 | 0.000 | 0.049 | 0.058 | 0.107 | ------ | ------ | 24.3 |
| 1 845 | -45 | 0.000 | 0.050 | 0.062 | 0.111 | 0.0063 | ------ | 26.0 |
| 1 900 | -30 | 0.002 | 0.032 | 0.061 | 0.091 | ------ | ------ | 23.8 |
| 1 910 | -20 | ------ | ------ | ------ | ------ | 13.29 | ------ | ------ |
| 1 915 | -15 | 0.000 | 0.082 | 0.033 | 0.114 | ------ | ------ | 23.0 |
| 1 920 | -10 | ------ | ------ | ------ | ------ | ------ | 0.017 | ------ |
| 1 925 | -5 | ------ | ------ | ------ | ------ | 13.35 | ------ | ------ |
| 1 930 | 0 | 0.000 | 0.082 | 0.032 | 0.113 | 13.19 | ------ | 22.6 |
| 1 945 | 15 | 0.000 | 0.054 | 0.059 | 0.112 | ------ | ------ | 26.9 |
| 1 1000 | 30 | 0.062 | 0.016 | 0.084 | 0.099 | ------ | ------ | 28.0 |
| 1 1015 | 45 | 0.160 | 0.008 | 0.069 | 0.077 | ------ | ------ | 28.4 |
| 1 1030 | 60 | 0.227 | 0.006 | 0.053 | 0.058 | 12.83 | ------ | 28.7 |
| 1 1045 | 75 | 0.261 | 0.006 | 0.041 | 0.047 | ------ | ------ | 28.8 |
| 1 1100 | 90 | 0.266 | 0.005 | 0.035 | 0.039 | ------ | ------ | 29.0 |
| 1 1115 | 105 | 0.273 | 0.007 | 0.031 | 0.036 | ------ | ------ | 29.1 |
| 1 1130 | 120 | 0.265 | 0.003 | 0.025 | 0.029 | 12.78 | 0.006 | 29.2 |
| 1 1145 | 135 | 0.263 | 0.005 | 0.026 | 0.030 | ------ | ------ | 29.2 |
| 1 1200 | 150 | 0.253 | 0.005 | 0.024 | 0.029 | ------ | ------ | 29.5 |
| 1 1215 | 165 | 0.245 | 0.005 | 0.024 | 0.029 | ------ | ------ | 29.5 |

------ NO DATA TAKEN

0848: THIRD AND FINAL FILL.
0858: INJECTIONS: ~0.4 ML. (10 PPM) BENZENE, 0.4 ML. NO, AND 0.1 ML. NO2.
0930: T=0. 70% LIGHTS.
1530: DUMP AND FILL.

T=0 AT 930 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 28.3 | 1.9 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.434 | PPM |
| NO2-UNC | T 14B-1 | 0.125 | PPM |
| BENZENE | 10'C-600 | 13.9571 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 1000 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 2000 | ECD-1 | RM-121; 12' 5% CARBOWAX-400 GC; ECD |
| 2920 | 10'C-600 | RM-121; 10' 10% CARBOWAX-600 GC; FID |
| 2100 | PN-1 | RM-121; POROPAK-N GC; FID |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |

ITC-562
BENZENE/NOX
1982 DEC. 22



| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | BENZENE PPM 10'C-600 | PAN PPM ECD-1 | HCHO PPM CA | T DEG C DORIC-1 |
|---|---|---|---|---|---|---|---|---|---|
| 1 845 | -45 | 0.001 | 0.007 | 0.001 | 0.006 | ------ | ------ | ------ | 26.2 |
| 1 855 | -35 | ------ | ------ | ------ | ------ | 0.0070 | ------ | ------ | ------ |
| 1 900 | -30 | 0.000 | 0.014 | 0.000 | 0.012 | ------ | ------ | ------ | 24.2 |
| 1 905 | -25 | ------ | ------ | ------ | ------ | 13.88 | ------ | ------ | ------ |
| 1 915 | -15 | 0.000 | 0.427 | 0.120 | 0.545 | ------ | ------ | ------ | 23.3 |
| 1 920 | -10 | ------ | ------ | ------ | ------ | 13.88 | ------ | 0.015 | ------ |
| 1 930 | 0 | 0.000 | 0.434 | 0.125 | 0.553 | 13.96 | ------ | ------ | 22.9 |
| 1 945 | 15 | 0.000 | 0.419 | 0.137 | 0.552 | ------ | ------ | ------ | 26.9 |
| 1 1000 | 30 | 0.009 | 0.394 | 0.159 | 0.550 | ------ | ------ | ------ | 28.0 |
| 1 1015 | 45 | 0.021 | 0.364 | 0.188 | 0.547 | ------ | ------ | ------ | 28.3 |
| 1 1030 | 60 | 0.031 | 0.323 | 0.215 | 0.538 | 13.87 | ------ | ------ | 28.9 |
| 1 1045 | 75 | 0.039 | 0.292 | 0.262 | 0.543 | ------ | ------ | ------ | 29.0 |
| 1 1100 | 90 | 0.043 | 0.249 | 0.290 | 0.530 | ------ | ------ | ------ | 29.3 |
| 1 1115 | 105 | 0.051 | 0.203 | 0.309 | 0.511 | ------ | ------ | ------ | 29.4 |
| 1 1130 | 120 | 0.061 | 0.162 | 0.332 | 0.496 | 13.73 | ------ | 0.015 | 29.5 |
| 1 1145 | 135 | 0.074 | 0.130 | 0.354 | 0.483 | ------ | ------ | ------ | 29.2 |
| 1 1200 | 150 | 0.091 | 0.095 | 0.364 | 0.460 | ------ | ------ | ------ | 29.5 |
| 1 1215 | 165 | 0.114 | 0.077 | 0.373 | 0.445 | ------ | ------ | ------ | 29.2 |
| 1 1230 | 180 | 0.136 | 0.056 | 0.357 | 0.411 | 12.92 | ------ | ------ | 29.2 |
| 1 1245 | 195 | 0.179 | 0.041 | 0.330 | 0.372 | ------ | ------ | ------ | 29.0 |
| 1 1300 | 210 | 0.215 | 0.032 | 0.298 | 0.328 | ------ | ------ | ------ | 29.1 |
| 1 1315 | 225 | 0.256 | 0.020 | 0.253 | 0.274 | ------ | ------ | ------ | 29.0 |
| 1 1330 | 240 | 0.311 | 0.021 | 0.210 | 0.224 | 12.59 | 0.000 | 0.004 | 29.2 |
| 1 1345 | 255 | 0.361 | 0.017 | 0.158 | 0.167 | ------ | ------ | ------ | 29.1 |
| 1 1400 | 270 | 0.401 | 0.011 | 0.104 | 0.111 | ------ | ------ | ------ | 29.1 |
| 1 1415 | 285 | 0.412 | 0.014 | 0.082 | 0.088 | ------ | ------ | ------ | 29.2 |
| 1 1430 | 300 | 0.403 | 0.008 | 0.062 | 0.068 | ------ | ------ | ------ | 29.3 |
| 1 1445 | 315 | 0.389 | 0.012 | 0.058 | 0.064 | ------ | ------ | ------ | 29.2 |
| 1 1500 | 330 | 0.366 | 0.007 | 0.049 | 0.055 | 12.12 | 0.001 | ------ | 29.3 |
| 1 1510 | 340 | ------ | ------ | ------ | ------ | ------ | 0.001 | ------ | ------ |
| 1 1515 | 345 | 0.347 | 0.006 | 0.045 | 0.050 | ------ | ------ | ------ | 29.3 |
| 1 1530 | 360 | 0.335 | 0.000 | 0.034 | 0.040 | ------ | ------ | ------ | 29.7 |

------ NO DATA TAKEN

ITC-563
NOX-AIR IRRADIATION
1982 DEC. 23



0829: THIRD AND FINAL FILL AT 50% R.H.
0843: INJECTIONS: 0.061 ML. PROPENE, 0.061 ML. N-BUTANE,
0.4 ML. NO, AND 0.1 ML. NO2.
0915: T=0. 70% LIGHTS.
1120: DUMP AND FILL.

T=0 AT 915 PST

| ID | INST. | AVERAGE VALUE | S.DEV | UNITS |
|---|---|---|---|---|
| T | DORIC-1 | 26.5 | 2.7 | DEG C |

| ID | INST. | INITIAL CONC. | UNITS |
|---|---|---|---|
| NO | T 14B-1 | 0.395 | PPM |
| NO2-UNC | T 14B-1 | 0.145 | PPM |
| PROPENE | DMS-1 | 0.0065 | PPM |
| N-C4 | DMS-1 | 0.0068 | PPM |

INSTRUMENTS USED

| ID | LABEL | DESCRIPTION |
|---|---|---|
| 3378 | D-3378 | DASIBI 3378 OZONE MONITOR |
| 1800 | DORIC-1 | DORIC TEMPERATURE INDICATOR, SN 61479 |
| 1510 | T 14B-1 | TECO 14B-1 NO-NOX ANALYZER |
| 3000 | CA | CHROMOTROPIC ACID HCHO ANALYSIS |
| 2200 | DMS-1 | CHAMP: DIMETHYLSULFOLANE GC: FID |

| CLOCK TIME DAY HR. | ELAPSED TIME (MIN) | OZONE PPM D-3378 | NO PPM T 14B-1 | NO2-UNC PPM T 14B-1 | NOX-UNC PPM T 14B-1 | LNC4/C3= RAW DATA | HYDROXYL PPT | PROPENE PPM DMS-1 | N-C4 PPM DMS-1 | HCHO PPM CA |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 815 | -60 | 0.000 | 0.020 | 0.032 | 0.052 | ------ | ------ | ------ | ------ | ------ |
| 1 830 | -45 | 0.000 | 0.008 | 0.032 | 0.043 | ------ | ------ | ------ | ------ | ------ |
| 1 845 | -30 | 0.000 | 0.370 | 0.159 | 0.525 | ------ | ------ | ------ | ------ | ------ |
| 1 850 | -25 | ------ | ------ | ------ | ------ | -0.0720 | ------ | 0.0065 | 0.0068 | ------ |
| 1 900 | -15 | 0.000 | 0.391 | 0.144 | 0.531 | ------ | ------ | ------ | ------ | ------ |
| 1 903 | -12 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.031 |
| 1 915 | 0 | 0.000 | 0.395 | 0.145 | 0.534 | -0.0770 | 0.088 | 0.0065 | 0.0068 | ------ |
| 1 930 | 15 | 0.000 | 0.397 | 0.139 | 0.532 | -0.0340 | 0.140 | 0.0061 | 0.0067 | ------ |
| 1 945 | 30 | 0.000 | 0.398 | 0.137 | 0.532 | 0.0340 | 0.119 | 0.0059 | 0.0068 | ------ |
| 1 1000 | 45 | 0.009 | 0.397 | 0.133 | 0.530 | 0.0920 | 0.086 | 0.0055 | 0.0067 | ------ |
| 1 1015 | 60 | 0.000 | 0.401 | 0.134 | 0.532 | 0.1340 | 0.066 | 0.0051 | 0.0066 | ------ |
| 1 1030 | 75 | 0.001 | 0.407 | 0.136 | 0.536 | 0.1660 | 0.107 | 0.0050 | 0.0067 | ------ |
| 1 1045 | 90 | 0.000 | 0.399 | 0.129 | 0.529 | 0.2180 | 0.090 | 0.0048 | 0.0067 | ------ |
| 1 1100 | 105 | 0.000 | 0.404 | 0.133 | 0.534 | ------ | ------ | ------ | ------ | ------ |
| 1 1105 | 110 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | 0.042 |
| 1 1115 | 120 | 0.194 | 0.405 | 0.128 | 0.531 | 0.3060 | ------ | 0.0041 | 0.0062 | ------ |

------ NO DATA TAKEN
$