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TOXICOLOGICAL ASSESSMENT

ATSUGI NAVAL AIR FACILITY - ATSUGI, JAPAN
AMBIENT AIR STUDY - INCINERATOR EMISSIONS
06 SEPTEMBER - 04 OCTOBER 1988

PREPARED BY

U.S. NAVY
AIRCRAFT ENVIRONMENTAL SUPPORT
NAVAL AVIATION DEPOT
NORTH ISLAND
SAN DIEGO, CALIFORNIA

Polynuclear Aromatic Hydrocarbons

In the preliminary incinerator emissions study, we found mean values of polynuclear aromatic hydrocarbons (PAH's) to be in the range of 0.8 - 30 nanogram per cubic meter. No United States Environmental Protection Agency (EPA) background exposure limits have been established for any of the PAH's found in the filter samples. However, these compounds are all listed as *"Priority One"* for toxicological profiles by the EPA, i.e., the EPA deems it necessary that each of these "suspect" compounds is studied in further detail to assess harmful effects associated with exposure.

The OSHA standards are based on 8 hour worker exposure data and are therefore inappropriate for comparison. Therefore, we compared sample values to baseline ambient levels measured in studies in the seventies.

We compared the mean concentration of each PAH found in the filter samples with that of background sample data conducted in Europe in 1977. Mean concentrations for each PAH compound were obtained by averaging all samples taken whether the incinerator was known to be in operation or not. The background levels were subtracted from the mean concentrations, divided by the background levels, and multiplied by 100 to give the *Percentage Difference of Background.* - as represented in Table 1.

Heavy Metals

Heavy metal content in the filter samples (cadmium, chromium, lead, mercury, and arsenic) fall in a concentration range of 0.01 and 0.79 micrograms per cubic meter.

Comparing burn mean concentrations to that of concentrations of metals during non-burn occurrences (background) display percent differences of up to 508%. These values can be found in Table 2.

Additional monitoring must be conducted (at the direct emission point by EPA methodology standards) in order to determine if the incinerator emissions are above or below acceptable health levels. Current federal regulations require that a facility report any emissions of the above listed metals and conduct source testing. Emission standards for heavy metals are currently under Federal Clean Air Act scrutiny.

Particulates

The high volume sampler collects (with greatest efficiency) particulate matter with an aerodynamic diameter of equal to or less than 10 micron, commonly referred to as PM_{10} particles. The mean filter concentration reflecting this particulate size range was found to be 44 micrograms per cubic meter, the maximum value 85 micrograms per cubic meter.

Epidemiological studies conducted by EPA staff concluded that cases of bronchitis aggravation as well as mortality could be attributed to levels as low as 150 micrograms per cubic meter. Naturally, this level may change with considerations to population sensitivity.

There are severe health risks associated with the deposition and penetration of ambient fine and coarse particles in the thorax (tracheobronchial and alveolar regions of the respiratory tract). Maximum penetration to this region occurs during oronasal or mouth inhalation. Of particular interest to the U.S. EPA are PM_{10} particles, due to their overwhelming ability to penetrate and deposit in various sensitive regions of the respiratory tract.

Standards set by the EPA for incinerators limit the particulate emissions based on test methods conducted directly at the stack outlet. Therefore, these limits are not applicable to preliminary study concentrations. We do suggest conducting additional monitoring in order to quantify these emissions by EPA established methods at the stack outlet. Furthermore, testing must be conducted to characterize plastic and rubber incinerator operations that we were told were routinely performed. The emissions associated with the incineration of these materials contain numerous carcinogenic materials.

Conclusions

Although not fully substantiated, the study of synergistic and antagonistic effects of certain chemicals upon simultaneous exposure occurs. Therefore, a toxicological study of the target organs and simultaneous exposures may prove to validate the existence of potential dangers involved with the inhalation of these compounds.

Consequently, due to the lack of available data, we recommend that an extensive emissions testing protocol and literature search be conducted to better assess the potential exposures due to the close proximity of the incinerator to the naval facility.

Incinerator plume modeling, background fingerprinting and additional ambient air monitoring (continuous short term concentration samples) would better demonstrate the high exposure receptor areas and when these events are most likely to occur.

TABLE 1: POLYNUCLEAR AROMATIC HYDROCARBONS - COMPARISON TABLE
MEAN EMISSION CONCENTRATIONS vs BACKGROUND LEVELS

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08 SEPTEMBER - 04 OCTOBER 1988

COMPOUND	MEAN MEAN (x̄) CONC. (ng/m3)	BACKGOUND CONC.* (ng/m3)	PERCENT DIFFERENCE (%) **
Benzo[k]fluoranthene	3.83	0.48	700%
Benzo[a]pyrene	29.50	0.32	9100%
Indeno[1,2,3-cd]pyrene	3.26	0.36	800%
Benzo[ghi]perylene	4.15	0.29	1400%
2-Fluorobiphenol	4.40	dna	---
Benz[a]anthracene	0.927	0.34	100%
Benzo[b]fluoranthene	10.20	0.62	1500%
Chrysene	4.74	0.81	500%

dna = data not available

mean concentrations represent all samples taken whether incinerator in operation or not.

*numbers obtained from background studies conducted in June 1977, Norway. ref. "Long-range Transport of PAH's. A. Bjorseth and G. Lunde, Atmospheric Environment. 13, 45-53, 1978.

**percent difference of background =
((mean conc. - background) / background) x 100.

TABLE 2: HEAVY METALS - COMPARISON TABLE
MEAN EMISSION CONCENTRATIONS vs BACKGROUND LEVELS

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	BACKGROUND MEAN ($\bar{x}$) CONC. (ug/m3)	Burn MEAN ($\bar{x}$) CONC. (ug/m3)	PERCENT DIFFERENCE (%) **
Cadmium	0.00351	0.01548	341
Chromium	0.00815	0.03819	368
Lead	0.08480	0.25101	196
Mercury	0.00359	0.00957	167
Arsenic	0.06430	0.39167	509

**percent difference calculation =
[(burn mean conc. - background mean conc.) / background mean conc.] x 100