

HEALTH RISK ASSESSMENT
Activities at the Jinkanpo Incineration Complex
and the Impacts on NAF Atsugi, Japan

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HEALTH RISK ASSESSMENT

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EXECUTIVE SUMMARY

The U.S. Navy operates a Naval Air Facility (NAF) in Atsugi, Japan in support of U.S. Naval forces in the Western Pacific. NAF Atsugi personnel have been experiencing air pollution problems that may be directly related to the operation of the Jinkanpo Incineration Complex. The Jinkanpo Facility is located directly south of NAF Atsugi and is operated as a private waste combustion and disposal complex.

The primary concern is whether the air pollutant emissions from the Jinkanpo Incineration Complex are adversely impacting the air quality at NAF Atsugi. In order to determine the air quality impact of the Jinkanpo Incineration Complex on NAF Atsugi, the Naval Facilities Engineering Service Center (NFESC) conducted a series of aerometric studies. The studies included an initial review of the Jinkanpo incinerator source test data, the monitoring of ambient air quality levels both upwind and downwind of the incineration complex, the developing of air pollutant emission rates for the Jinkanpo Complex based on observed ambient monitoring data, predicting the air quality impacts associated with the operation of the incineration complex for all expected air pollutant emissions and the preparing of a health risk assessment of the Jinkanpo Incineration Complex emissions for the area surrounding the complex.

The following report provides a brief summary of source test findings and the ambient monitoring data as a prelude to the health risk assessment. The report also provides a detailed discussion of the emission rate analyses and a health risk assessment. NFESC provided the ambient air monitoring data and the Jinkanpo stack test data. RTP Environmental Associates, Inc.[®] (RTP) was contracted by NFESC to provide the emission rate analyses and the health risk assessment.

Based on the data presented in this report, there is sufficient compelling evidence to believe that the activities at the Jinkanpo Incineration Complex are having a significant adverse health impact on the personnel and property located at NAF Atsugi. The impacts are very significant for several air toxic compounds including: benzene, carbon tetrachloride, dioxins, arsenic, chromium, PM-10, sulfur dioxide, nitrogen oxides, hydrochloric acid, cadmium and mercury. The term significant adverse health impact means that either the measured or predicted impact levels exceed ambient air quality standards and/or guidelines applied to protect human health by various agencies in the United States. The analyses indicate that incineration and waste chemical and residue storage, handling and disposal are the primary sources causing the adverse health impacts. The adverse health impacts also extend beyond the area of NAF Atsugi, based on United States and other standards and guidelines for a healthful environment.

Activities at the Jinkanpo Incineration Complex, therefore, should be reviewed and actions should be taken to reduce the air pollutant emissions from both the incinerators as well as the other onsite activities. The level of emission control required will be a function of the individual sources and the pollutants being released.

1.0 INTRODUCTION

The Naval Facilities Engineering Service Center (NFESC) has conducted an ambient air quality health risk assessment study for the Naval Air Facility (NAF) in Atsugi, Japan. The purpose of the air quality health risk assessment was to determine if air toxic emissions resulting from activities at Jinkanpo Incineration Complex were posing a significant risk to NAF Atsugi personnel. This report has been prepared by RTP Environmental Associates, Inc.[®] (RTP) in conjunction with NFESC staff and presents the findings of the studies that have been performed as part of the health risk assessment of the Jinkanpo Incineration Complex.

The Jinkanpo Incineration Complex is located in Atsugi, Japan and is positioned just to the south and east of NAF Atsugi. The primary activities at the complex include the disposal of municipal solid waste, the storage of various waste materials onsite prior to incineration and the handling and disposal of ash and other residues. These activities release airborne toxics which may significantly impact NAF Atsugi.

The health risk assessment required technical information on incinerator operations, area diffusion climatology and source/receptor relationships. Only limited data was available on the incinerator operations and source characteristics. The data that was available has been used to develop an approximation of how the incinerator complex operates. The area diffusion climatology has been defined by meteorological records collected at NAF Atsugi. The source/receptor relationships were developed from a series of topographic maps and photographs of the area surrounding the incinerator and maps of NAF Atsugi.

The health risk assessment also utilized ambient air quality monitoring data and concurrent meteorological data that was collected by NFESC. NFESC performed an extensive aerometric monitoring study to define the impacts associated with the operation of the Jinkanpo Complex. Ambient aerometric data was collected over an eight (8) week period beginning on July 26, 1994 and ending on September 11, 1994. The ambient aerometric data when used in conjunction with a refined atmospheric dispersion model provided emissions data on the various air toxic pollutants being released from the Jinkanpo Complex. The emissions data were compared to data provided in the Jinkanpo stack test results and to emissions data for other incineration facilities. Based on a high correlation between the three different data sets, a complete emission inventory was developed for the Jinkanpo Complex.

The impact analysis included the use of the United States Environmental Protection Agency (USEPA) Industrial Source Complex Model, ISCST2. The ISCST2 code is the most up-to-date refined atmospheric dispersion model currently approved for simulating complex industrial sources such as the Jinkanpo Incineration Complex. The model was used to predict where the maximum impacts were likely to occur and the approximate concentrations expected so that the NFESC monitoring activities would be conducted

at expected impact locations. The model was also used to predict the expected ambient air impact levels at selected receptors for both short-term (one hour) and long-term (annual) averaging periods for the complete emission inventory for the Jinkanpo Complex.

The atmospheric dispersion model results were used to provide a complete impact analysis of the air toxic releases from incinerator complex. Impacts were calculated for both short-term or acute exposure impacts and for long-term or chronic exposure impacts. The area dispersion climatology was based on meteorological observations at NAF Atsugi. The predicted impacts were compared to air pollutant standards and guidelines issued by various federal and state regulatory agencies in the United States. This comparison with standards and guidelines constitutes the health risk analysis.

The health risk assessment primarily focuses on the inhalation pathway. Other exposure pathways are not addressed. Therefore, the health risks that are identified could be further amplified if other routes of exposure and synergistic effects are taken into consideration.

2.0 ANALYTICAL APPROACH

The analytical approach for this phase of the overall study involved the development of emission factors for the Jinkanpo Incineration Complex and the health risk assessment associated with the Jinkanpo emissions. The other portions of the study had been defined in previous reports associated with the overall study. Certain features of this preceding work are important to this study and they will be addressed briefly below. Figure 2.1 provides a general schematic diagram of NAF Atsugi and the Jinkanpo Incineration Complex.

The air pollution emission inventory for the Jinkanpo Incineration Complex was in part defined by an ambient air monitoring study. The study was designed to simultaneously collect ambient air samples in areas downwind and upwind of the Jinkanpo Incineration Complex was performed by NFESC personnel. Samples were collected on a variety of media using a variety of sampling techniques. Daily weather forecasts were issued to define local meteorological conditions so that sample locations could be positioned to record impacts associated with the Jinkanpo Incineration Complex activities. Data was collected for volatile organic compounds, particulate matter, heavy metals, selenium, polychlorinated dibenzo-p-dioxins, polychlorinated dibenzo furans, polychlorinated biphenyls, pesticides, and polycyclic aromatic hydrocarbons. The samples were forwarded to various analytical laboratories for analysis. Quality assurance and control procedures were followed by both NFESC personnel collecting the samples and the analytical laboratories responsible for the sample analyses. These data sets were forwarded along with onsite and standard NAF Atsugi surface weather data during the sampling events to RTP Environmental Associates, Inc.[®] for further analysis.

RTP received the data base from NFESC and developed the emission inventory for the Jinkanpo Incineration Complex. The emission inventory was based on a series of conservative assumptions. The inventory was developed by knowing the general source characteristics from the Jinkanpo stack test data and by using the refined ISCST2 dispersion model to back calculate what emission rates were necessary to cause the downwind impacts observed during the NFESC ambient air study. It is possible to calculate the emission rates that would result in a specific air quality impact at a specific downwind location if several additional facts are known. One must be able to define the period specific dispersion climatology during the sampling event that is representative of the area between the source of the monitored air contaminant and the point of sampling. In this case, an onsite meteorological station was installed at the sampling points and collected data over the periods that were used to define Jinkanpo Incineration Complex emissions. This data in combination with background pollutant concentrations upwind of the Jinkanpo Incineration Complex were used to compute, via an air dispersion model, the air toxic release rates for the compounds observed during the sampling program. The ISCST2 atmospheric dispersion model was used with the NFESC data to quantify a portion of the pollutant emission rates for both point and area sources at the facility.

A second set of data was also used to compute other air pollutant releases from the Jinkanpo Incineration Complex. This data included average air pollutant emission rates measured from actual source tests data at the Jinkanpo site as well as emission rate data taken from other similar operating incineration facilities.

These data were used to complete the emission inventory for the incinerator complex and thereby allow a more complete definition of the overall impacts that are associated with the activities at the Jinkanpo site.

The model was then used to calculate both on base and off base impacts for various averaging periods. In this case, two primary averaging periods were used. Short-term impacts were based on maximum emission rates and impact averages are related to acute health impacts and short-term guidelines or standards. Long-term impacts were based on average emission rates and impact averages are related to chronic health impacts and long-term guidelines or standards. Short-term release rates were based on the maximum observed short-term concentrations while average observed values were used to calculate long-term release rates.

Receptor points are locations at which concentration impacts are predicted by a diffusion model. Several receptor point arrays were used to quantify the overall impact of the Jinkanpo Incineration Complex. Receptors were primarily divided into two sets, those that were on NAF Atsugi property and those that were on Japanese property other than the incinerator site.

The dispersion model also requires meteorological data to calculate the area dispersion climatology. In this

case three data sets were used. The NFESC sampling team collected onsite meteorological data during a portion of the sampling program. Data was also available from the NAF Atsugi weather station and was used to forecast expected wind flow patterns for sampling events and to define meteorological conditions when the onsite weather station was not operational. Finally, data for the NAF Atsugi weather station over the 1991 calendar year was used to define the long-term diffusion climatology for the surrounding area including the NAF Atsugi property, the Jinkanpo Incineration Complex and the other adjoining properties.

The ISCST2 atmospheric dispersion model results for both long-term and short-term predictions were tabulated and combined with the source emissions data from the activities at the Jinkanpo Incineration Complex. The pollutant specific impact concentrations at the maximum impacted receptor locations at both on-base (NAF Atsugi) and off-base properties were tabulated for direct comparison to acceptable standards and guidelines.

The standards and guidelines used in this case were based on several different sources and regulatory agencies. The United States Environmental Protection Agency (USEPA) has developed a set of criteria documents and has used those documents to establish acceptable ambient air quality standards for a set of criteria pollutants. The various states in the U.S. use these standards to define acceptable air quality levels. In addition, other agencies have established standards and guidelines of other pollutants not necessarily covered by the USEPA standards. The other guidelines used in this report include the Integrated Risk Information System (IRIS) and the Health Effects Assessment Summary Tables (HEAST) publications and the New York State air toxic guidelines. In combination, these guidelines and standards provide the basis for comparing predicted impacts to acceptable health risk guidelines.

By utilizing the above approach, NFESC, in conjunction with RTP, was able to provide a health risk assessment of the activities at the Jinkanpo Incineration Complex. The details of the analysis are provided in the following sections.

3.0 FACILITY DESCRIPTION

3.1 Incinerator Design and Operation

There was little data supplied directly by NFESC on the design and operation of the Jinkanpo Incineration Complex. In fact, the incinerator is not directly referenced in various USEPA studies on Japanese incinerators. Therefore, data had to be developed and several assumptions have been used in composing a complete design and operations data base for the Jinkanpo Incineration Complex. Although this data may not precisely define all activities at the complex, we believe it is more than adequate to estimate potential impacts and health risk. Should more precise data become available, the model input used in this analysis can be easily modified to reflect that data or to assess how well control systems that may be installed on

Figure 3.1

NAF Atsugi Health Risk Assessment

Jinkanpo Incinerator Complex

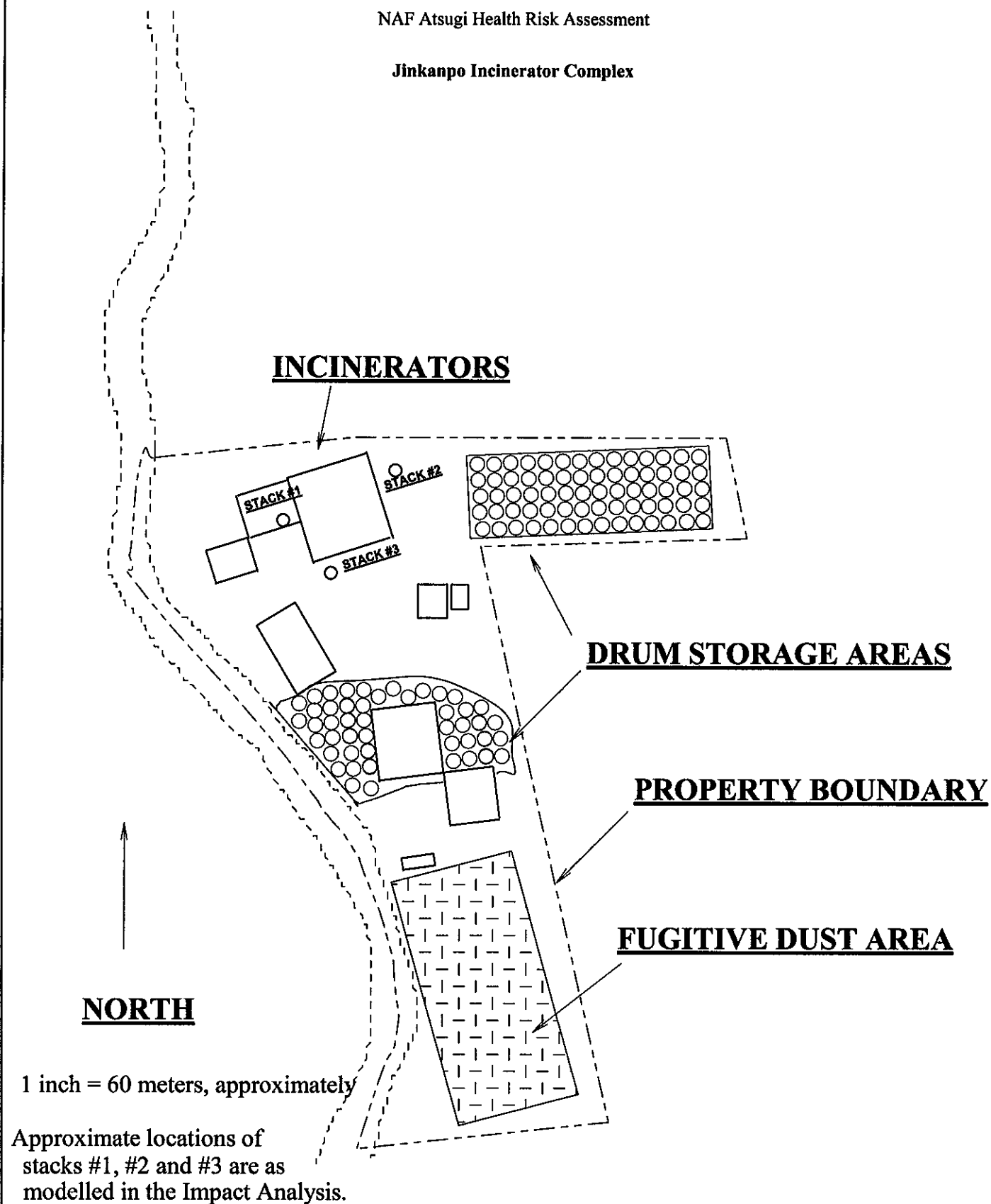


TABLE 3.1

NAF Atsugi Health Risk Assessment

**ESTIMATED JINKANPO INCINERATOR DESIGN
AND OPERATING CHARACTERISTICS**

Parameter	Specification
Number of Point Sources	3
Number of Area Sources	3
UTM Coordinates of Facility Grid Centroid	N: 3,922,7 E: 358,980
Point Source Incineration Grid Locations	No. 1 x = 1,269 y = 695 z = 36.6 No. 2 x = 1,303 y = 710 z = 36.6 No. 3 x = 1,288 y = 692 z = 36.6
Area Source Grid Locations	NDRUMS x = 1,354 y = 715 z = 39.6 SDRUMS x = 1,316 y = 625 z = 36.6 FUGDST x = 1,349 y = 530 z = 35.1

Building characteristics for downwash calculations:

Point Source No. 1 : Building Height = 13.7m Building Width = 15.0 m

Point Source No. 2: Building Height = 9.1 m Building Width = 23.0 m

Point Source No. 3: Building Height = 9.1 m Building Width = 23.0 m

Source Modeling Parameters

Point Source No.	Base Elevation (m)	Stack Height (m)	Stack Diameter (m)	Stack Exit Temperature (K)	Stack Exit Velocity (m/sec)	Stack Exit Volume (m3/sec)
1	36.6	18.3	1.2	477	2.74	3.1
2	36.6	18.3	1.0	477	3.96	3.1
3	36.6	13.7	0.75	477	5.28	2.3
Area Sources						
NDRUMS	39.6	--	--	--	--	--
SDRUMS	36.6	--	--	--	--	--
FUGDST	35.1	--	--	--	--	--

Note: Values in this table are taken from various data sources including: Jinkanpo stack test data, aerial photographs and topographic maps.

TABLE 3.2

NAF Atsugi Health Risk Assessment

**INCINERATOR AND FUGITIVE DUST AREA EMISSION FACTORS
BASED ON NFESC MONITORING DATA**

Component Group : Particulate / Heavy Metals

CONTAMINANT	Short-Term MER	Long-Term AMER
PM-10	6.08E-01	4.99E-01
Chromium	1.83E-04	1.26E-04
Arsenic	2.22E-04	1.21E-04
Selenium	2.74E-05	1.33E-05
Lead	1.00E-02	6.98E-03

Component Group : Polychlorinated Pesticides and PCB's

CONTAMINANT	Short-Term MER	Long-Term AMER
Aldrin	6.14E-06	6.14E-06
α -BHX	2.15E-05	2.15E-05
β -BHX	3.52E-05	2.36E-05
Δ -BHX	1.07E-05	1.07E-05
γ -BHX	9.52E-06	4.86E-06
Chlordane	4.12E-06	2.92E-06

Component Group : PCDD and PCDF

CONTAMINANT	Short-Term MER	Long-Term AMER
2,3,7,8-TCDD	4.01E-09	3.74E-09
TOTAL TCDD	3.43E-07	3.15E-07
1,2,3,7,8-PeCDD	1.65E-08	1.02E-08
TOTAL PeCDD	4.52E-07	3.78E-07
1,2,3,4,7,8-HxCDD	1.65E-08	1.31E-08
1,2,3,6,7,8-HxCDD	3.31E-08	2.43E-08
1,2,3,7,8,9-HxCDD	1.89E-08	1.43E-08
TOTAL HxCDD	4.49E-07	3.59E-07
1,2,3,4,6,7,8-HpCDD	2.29E-07	1.52E-07
TOTAL HpCDD	4.68E-07	3.14E-07
OCDD	5.96E-07	5.96E-07
2,3,7,8-TCDF	3.31E-08	2.62E-08
TOTAL TCDF	1.45E-06	1.23E-06
1,2,3,7,8-PeCDF	6.15E-08	4.62E-08
2,3,4,7,8-PeCDF	1.16E-07	9.07E-08
TOTAL PeCDF	1.57E-06	1.23E-06
1,2,3,4,7,8-HxCDF	9.22E-08	6.73E-08
1,2,3,6,7,8-HxCDF	8.27E-08	6.26E-08
2,3,4,6,7,8-HxCDF	1.23E-07	8.95E-08
1,2,3,7,8,9-HxCDF	4.02E-08	3.07E-08
TOTAL HxCDF	8.53E-07	6.28E-07
1,2,3,4,6,7,8-HpCDF	3.38E-07	2.56E-07
1,2,3,4,7,8,9,-HpCDF	5.44E-08	4.36E-08
TOTAL HpCDF	5.98E-07	4.51E-07
OCDF	2.01E-07	1.19E-07

TABLE 3.2
Continued

NAF Atsugi Health Risk Assessment

**INCINERATOR AND FUGITIVE DUST AREA EMISSION FACTOR
BASED ON NFESC MONITORING DATA**

Component Group : PAH's

CONTAMINANT	Short-Term	Long-Term
	MBR	AMER
Phenanthrene	4.38E-04	4.38E-04
Fluoranthene	2.70E-04	2.70E-04
Pyrene	2.05E-04	2.05E-04

Note:

- MER : Peak Mass Emission Rate in grams per second for the entire Jinkanp Incineration Complex and used for short-term concentration impact calculations.
- AMER : Average Mass Emission rate in grams per second used in long-term concentration impact calculations.

TABLE 3.3**NAF Atsugi Health Risk Assessment****DRUM STORAGE AND DISPOSAL AREA EMISSION FACTORS
BASED ON NFESC MONITORING DATA**

Component Group : Volatile Organic Compounds

CONTAMINANT	Short-Term MER	Long-Term AMER
Chloroform		
1,1,1-trichloroethane	4.12E-02	2.43E-02
Carbon tetrachloride	2.05E-03	2.05E-03
Benzene	1.68E-02	1.22E-02
1,2-Dichloroethane		
1-Heptene		
n-Heptane	3.29E-03	1.83E-03
Trichloroethene	1.25E-03	1.25E-03
1,2-Dichloropropane		
Toluene	1.81E-01	1.18E-01
Tetrachloroethene	1.84E-03	1.84E-03
1,3-Dichloropropene		
Ethylene Dibromide		
Chlorobenzene		
Ethylbenzene	5.23E-02	3.43E-02
Xylene	1.00E-01	6.19E-02
Bromoform		
Isopropylbenzene		
Bromobenzene		

Note:

- MER: Peak Mass Emission Rate in grams per second for the entire Jinkanpo Incineration Complex.
- AMER: Average Mass Emission Rate in grams per second for the Jinkanpo Incineration Complex and is used in long-term concentration impact calculations.

the various sources at the Jinkanpo Incineration Complex will work prior to their installation.

Based on photographic evidence, a brief statement on facility operation and source test data, the following data base was developed. Figure 3.1 provides a schematic layout of the Jinkanpo Incineration Complex.

The assumed source characteristics are provided in Table 3.1. These data were used in the modeling of emission rates and dispersion rates for predicting maximum impact concentrations under various meteorological conditions.

Table 3.2 provides the calculated release rates of the incinerators and fugitive dust area at the Jinkanpo Complex based on using a wet scrubber/cyclone as the primary emission control technology for the three onsite incinerators. No additional engineering data was available on the types of combustion systems or the types of control systems that are utilized at the Jinkanpo facility. Therefore, the values presented herein are based on the available data from the Jinkanpo source tests, data from other incinerators and the NFESC ambient monitoring data during the July-September 1994 sampling program. The incinerators in the simulation were all fixed at design operating conditions with wet scrubber technology in place and operating normally. As observed during the ambient tests, three incinerators were operating during the monitoring program. If the incinerators were operating at less than design capability during the sampling period, the impacts projected in this analysis would increase or decrease depending on actual operation.

The fugitive emissions are released during the storage, handling and disposal of liquid and solid waste materials onsite. The fugitive sources have been divided into two volume sources associated with the storage, handling and disposal of liquid waste and one volume source associated with the storage, handling and disposal of incinerator residues.

Table 3.3 provides the calculated release rates for the volatile organic compounds from the drum storage areas. In the emission rate calculation, it was assumed that the volatile organic compounds observed in the ambient samples were released from the drum storage, handling and disposal areas. These compounds, when placed into the incinerators, would be consumed during a normal combustion cycle since volatile organic compounds are flammable with ignition temperatures well below those observed in incinerators. Other compound groups such as particulate matter, metals, dioxins/furans, polycyclic aromatic hydrocarbons and polychlorinated biphenyls and pesticides would have been primarily released from both the incinerator stack and from the incinerator residue storage, handling and disposal area.

Finally, a third data set that included compounds typically released from municipal solid waste (MSW) combustion facilities. Data from tests at the Jinkanpo Incineration Complex and other incineration facilities were used to define the release rates for the remaining compounds that are released from the Jinkanpo

TABLE 3.4**NAF Atsugi Health Risk Assessment****GENERAL INCINERATOR EMISSION FACTORS BASED ON
JINKANPO STACK TEST DATA AND MWC DATA**

COMPOUND	MER	AMER
	(g/s)	(g/s)
Sulfur Dioxide	4.02E+00	4.02E+00
Nitrogen Oxides	5.64E+00	5.64E+00
Carbon Monoxide	3.91E+00	3.91E+00
Hydrochloric Acid	1.10E+00	1.10E+00
Sulfuric Acid	7.01E-04	7.01E-04
Ammonia	5.89E-04	5.89E-04
Cadmium	6.83E-04	6.83E-04
Mercury	4.36E-03	4.36E-03
Nickel	1.04E-03	1.04E-03
Fluorides	1.62E-02	1.62E-02

NOTE:

- MER: Peak Mass Emission Rate in grams per second.
- AMER: Average Mass Emission Rate in grams per second.
- The MER and AMER are equivalent for the General Incineration Factors in this case.
- MWC: Municipal Waste Combustor Data as in Appendix A.

TABLE 3.5**NAF Atsugi Health Risk Assessment****GENERAL INCINERATOR EMISSION FACTORS COMPARED WITH
JINKANPO STACK TEST DATA AND MODELLED NFESC VALUES**

Compound	General MWC Emission Factors (mg/m3)	Jinkanpo Test Data (mg/m3)	RTP Calculated Values (mg/m3)
PCDD/PCDF	0.0004		0.000695
Arsenic	0.0219		0.0142
Chromium	0.152		0.0147
Cadmium	0.189	0.08	
Fluorides	0.777	1.9	
Lead	3.28	3.78	0.817
Hydrochloric Acid	96.9	129	
Total Suspended Particulate	460	300	58.4

Note:

Values in this table are utilized in Figure 3.2 to compare the correlation between generally accepted Municipal Waste Combustor (MWC) emission factors as provided in Appendix A with stack test data from the Jinkanpo Incinerator and from the emission factors calculated from the NFESC ambient air monitoring data.

Figure 3.2

Correlation of Modelled NFESC Data and Jinkanpo Test Data
vs. General MWC Emission Factors

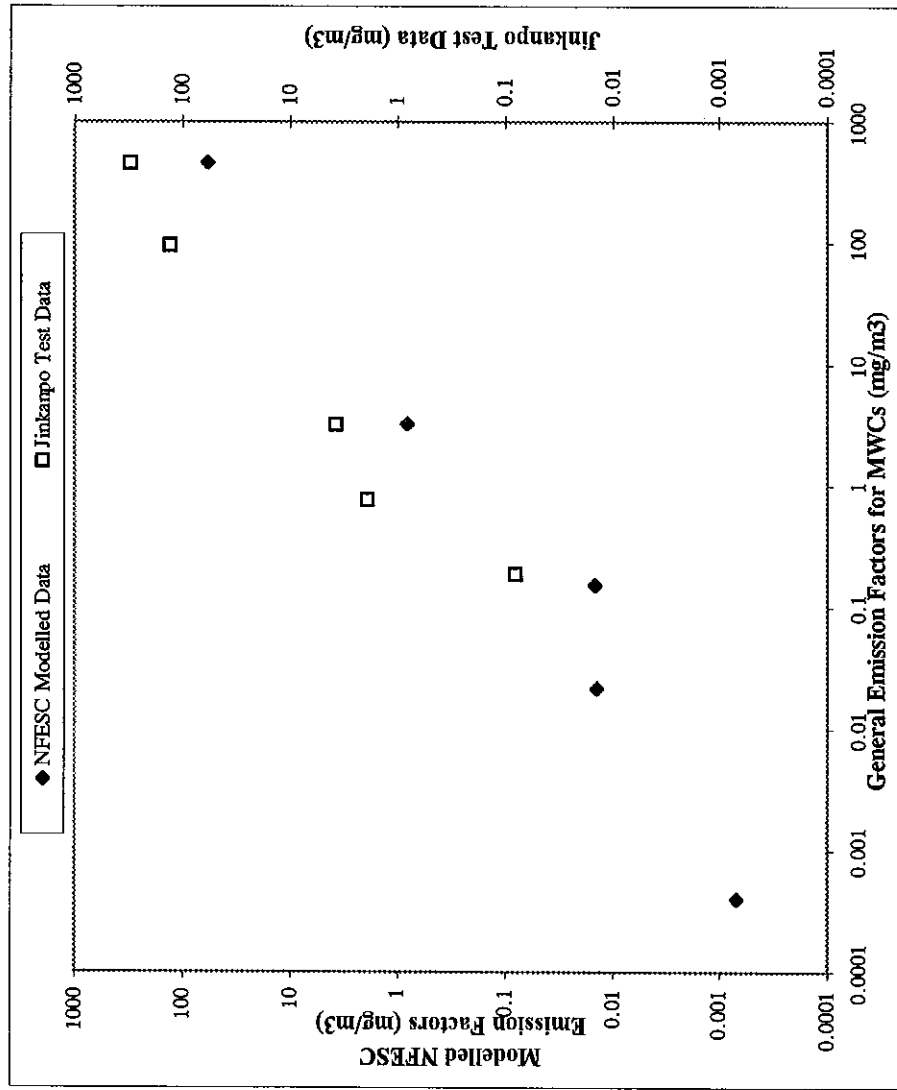


TABLE 4.1

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

NFESC MONITORING DATA SUMMARY

Test Parameter (s)	Volatiles Organic Compounds (Modified) EPA Method TO-14 SUMMA Canister	Volatiles Organic Compounds EPA Method TO-1 Tenax Trap	PM10/Metals PM10/High Volume Sampler 8x10 QMA Filter	Polychlorinated Pesticides & PCBs Modified EPA Method TO-4 PUF Cartridge / PS-1	PCDD & PCDF Modified EPA Method TO-9 PUF Cartridge / PS-1	PAHs Modified EPA Method TO-13 PUF Cartridge / PS-1
Collection Matrix	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID
7/26/1994	S1-1, S2-1	T1-1, T2-1	PM1-1, PM2-1	PUF1-1, PUF2-1	PUF1-1, PUF2-1	PUF1-1, PUF2-1
7/31/1994	S1-2, S2-2					
8/3/1994	S1-3, S2-3	T1-2, T2-2	PM1-2, PM2-2	PUF1-2, PUF2-2	PUF1-2, PUF2-2	PUF1-2, PUF2-2
8/4/1994			PM1-3, PM2-3			
8/7/1994	S1-4, S2-4	T1-4, T2-4				
8/12/1994			PM1-8, PM2-8			
8/18/1994			PM1-10, PM2-10	PUF1-10, PUF2-10	PUF1-10, PUF2-10	PUF1-10, PUF2-10
8/19/1994			PM1-11, PM2-11	PUF1-11, PUF2-11	PUF1-11, PUF2-11	PUF1-11, PUF2-11
8/26/1994	S1-5, S2-5, S1-6, S2-6	T1-5, T2-5				
8/27/1994				PUF1-13, PUF2-13	PUF1-13, PUF2-13	PUF1-13, PUF2-13
8/28/1994				PUF1-14, PUF2-14	PUF1-14, PUF2-14	PUF1-14, PUF2-14
8/31/1994	S1-7, S2-7					
9/1/1994		T1-01, T2-01				
9/2/1994	S1-8, S2-8					
9/3/1994	S1-9, S2-9					
9/4/1994		T1-02, T2-02				
9/6/1994	S1-10, S2-10	T1-03, T2-03				
9/7/1994	S1-11, S2-11	T1-04, T2-04				
9/8/1994	S1-12, S2-12	T1-06, T2-06, T1-07, T2-07				
9/10/1994		T1-08, T2-08, T1-09, T2-09				
9/11/1994		T1-010, T2-010				

Incineration Complex. These additional compound release rates are presented in Table 3.4. The emission rate values that were obtained from other sources are provided in the table.

Table 3.5 presents a direct comparison of general MSW emission factors and the Jinkanpo test data and the emissions data developed from the NFESC monitoring program. Figure 3.2 provides a graphic of this data comparing the Jinkanpo emission rate data used in this analysis with other standard incinerator emission rate data. The data shows a strong correlation between the standard emission factors and the predicted values based on NFESC monitoring data and the Jinkanpo stack test data. In fact, the calculated values in some case significantly underpredicted the generally accepted emission factors for MSW incineration. This fact would tend to underestimate the actual impacts being predicted for the complex.

The strong correlation between the Jinkanpo stack test data, the standard emission factors and emission factors calculated from the observed ambient air concentrations during the NFESC intensive ambient monitoring program provides the rationale to allow the use of the predicted emission factors for the incinerator complex in the calculation of overall health risks for the facility.

4.0 AEROMETRIC MONITORING DATA

The NFESC ambient air monitoring program provided data on observed air toxic pollutant concentrations in the lee of the Jinkanpo Incineration Complex over the period from July 26, 1994 through September 11, 1994. These data have been applied to quantify a portion of the emission factors used in this health risk assessment of the Jinkanpo Incineration Complex.

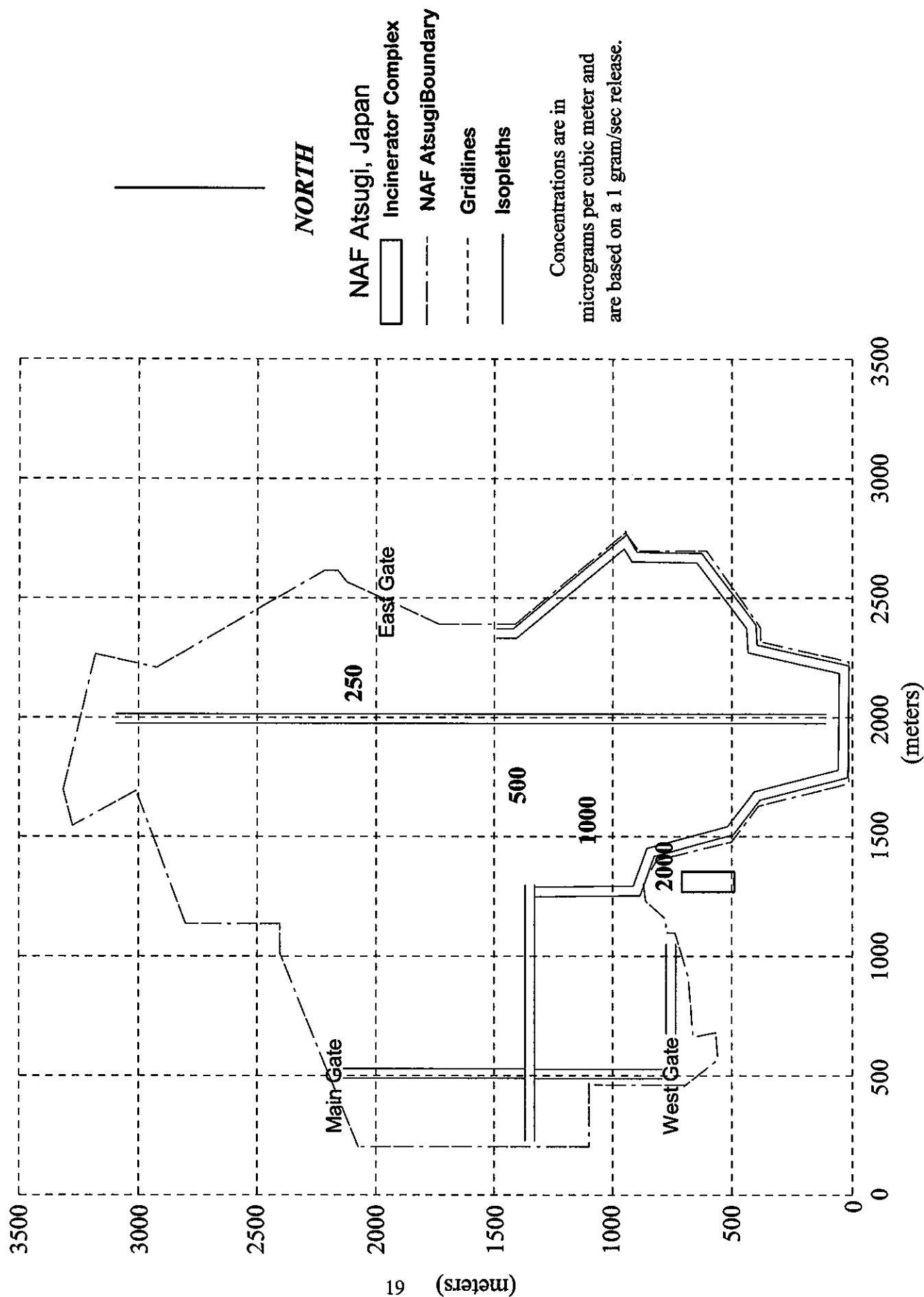
A summary of the NFESC data has been provided in Appendix A. Table 4.1 provides a summary of the samples taken for the individual compound groups that were monitored. The sample identifiers are provided in Appendix A along with the specific air toxic compound concentrations for each sample identified. The references for other MSW emission factors are also provided in Appendix A.

The meteorological data collected during the NFESC sampling program is presented in Appendix B. The data represents continuous observations of onsite wind speed, wind direction, temperature, relative humidity, barometric pressure and precipitation. Additionally, a full year of hourly observations during the 1991 calendar year that was used in the impact modeling analysis of Jinkanpo Incineration Complex. is also contained in Appendix B.

5.0 AIR QUALITY IMPACT ANALYSIS

An air quality impact analysis was performed to evaluate the impacts associated with the operation of the Jinkanpo Incineration Complex. The impact analysis utilized the USEPA approved ISCST2 dispersion

Figure 5.2 : Short-term Concentration Isopleths for the Jinkanpo Incineration Facility
Drum Area Sources



model in conjunction with the source data developed for the Jinkanpo Incineration Complex. The analysis provides the normalized concentration impact at selected receptor locations that can be expected for a non-reactive neutrally buoyant air pollutant released from a specific source. These normalized values are then combined with actual gram per second release rates for each pollutant of interest to provide pollutant specific concentration maxima at locations on NAF Atsugi and at other locations on surrounding properties.

5.1 Normalized Air Quality Impacts

Normalized air quality impacts were calculated for a series of receptor grids utilizing the ISCST2 dispersion model and Jinkanpo Incineration Complex source information. Normalized concentration impacts are calculated at emission rates of 1.0 grams per second for each source in question. This allows the computation of the dilution rate associated with a particular site without involving each specific air contaminant release rate. The linking of specific pollution emission rates to the normalized concentration impacts presented below will be performed in the following Section 6.0, the Health Risk Assessment.

Figure 5.1 provides the normalized long-term concentration isopleths for two drum storage, handling and disposal areas at the incineration facility. The computer model results for all receptor points that were used in calculating the isopleths are provided in Appendix C. The model results indicate that the maximum long-term or chronic health impact values occur for on-base receptors along the NAF Atsugi property boundary closest to the Jinkanpo Incineration Complex.

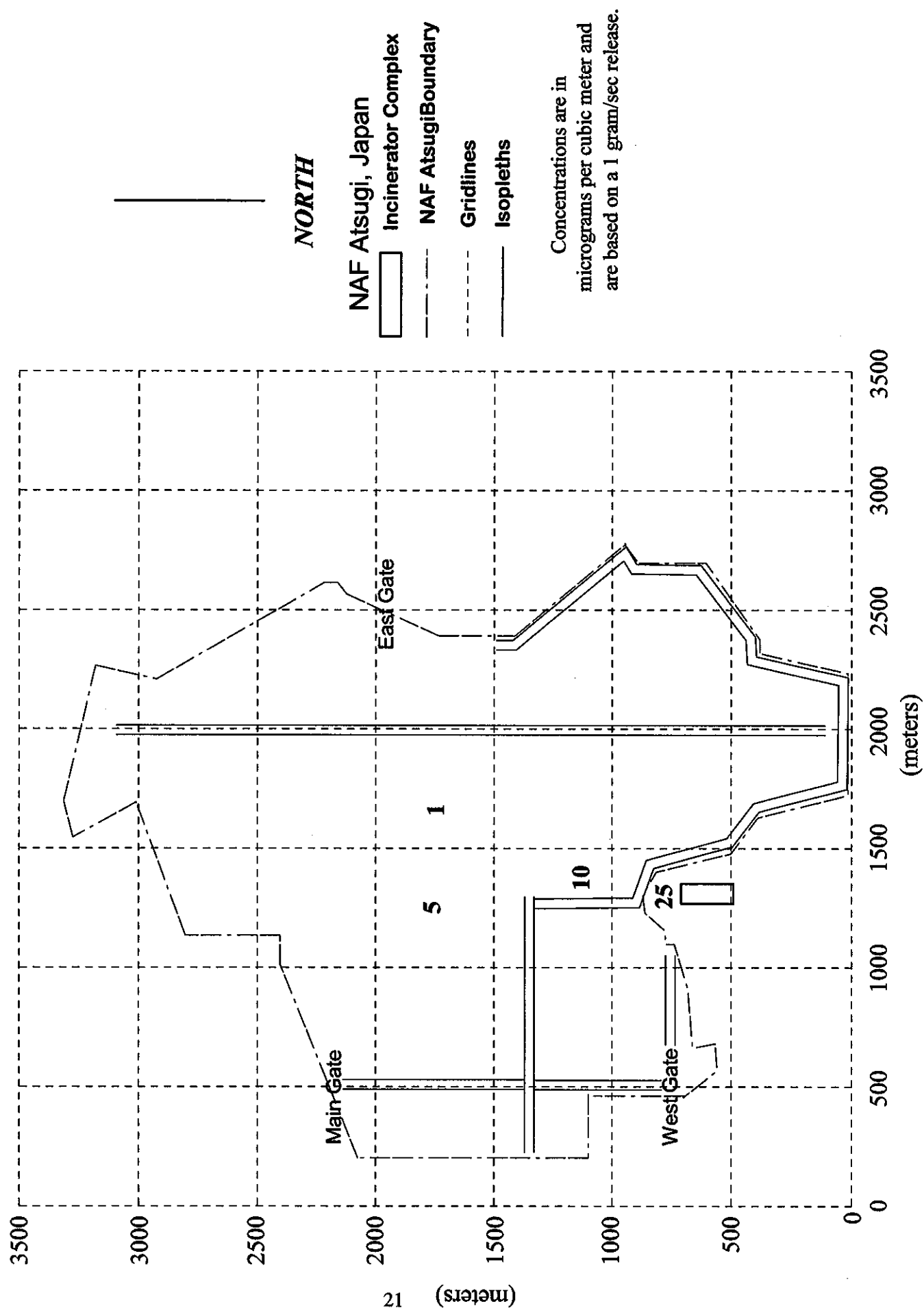
The maximum normalized short-term concentration isopleths for the two drum storage, handling and disposal areas have been plotted in Figure 5.2. The computer results for all receptor points that were used in calculating the isopleths are provided in Appendix C. The model results indicate that the maximum short-term or acute health impact value occurs along the base property boundary.

Figures 5.3 and 5.4 provide normalized long-term and maximum short-term concentration isopleths for the incinerator stacks and the fugitive dust areas at the Jinkanpo Complex, respectively. The actual computer model results are presented in Appendix C.

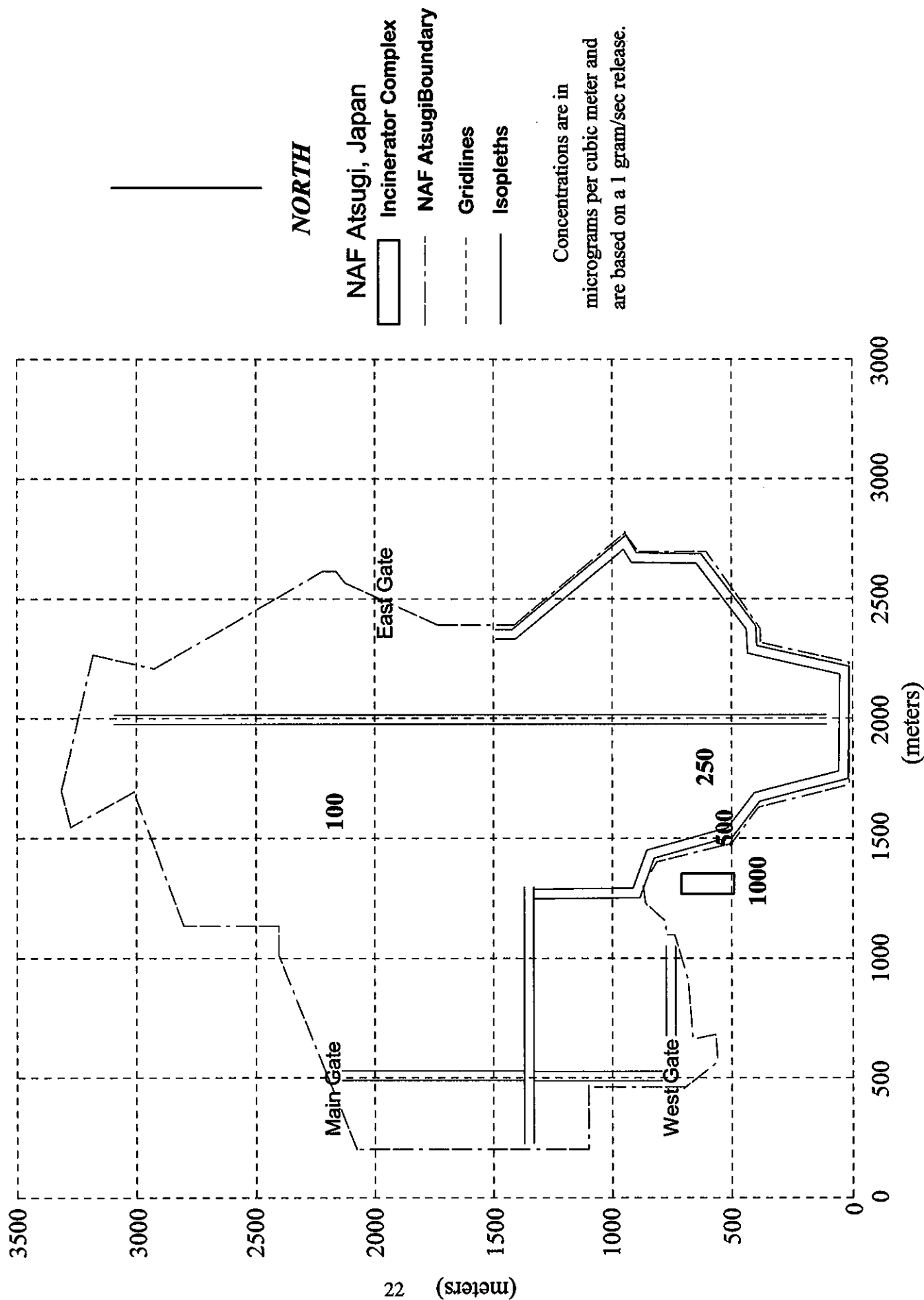
6.0 **HEALTH RISK ASSESSMENT**

A health risk assessment has been prepared to determine if the air pollutant emissions from the Jinkanpo Incineration Complex have a significant impact on NAF Atsugi. The assessment provides a preliminary qualitative and quantitative analysis of the types of pollutants being released by activities at the incineration complex and compares the air quality impact of these activities directly to established U.S. health standards and guidelines for general population exposure.

**Figure 5.3 : Long-term Concentration Isopleths for the Jinkanpo Incineration Facility
Point and Fugitive Dust Sources**



**Figure 5.4 : Short-term Concentration Isopleths for the Jinkanpo Incineration Facility
Point and Fugitive Dust Sources**



This health risk assessment is limited to examining the inhalation pathway exposure route. The inhalation pathway is generally the most direct route of exposure for airborne contaminants and provides an initial estimate of the overall level of health risk. If the exposure is significant via the inhalation pathway, other exposure routes will need to be explored in that inhalation only partially quantifies the health risk to individuals. The other routes of exposure that should be analyzed including dermal and ingestion pathways. These pathways are generally more complex to evaluate although they could substantially increase the health risk. If the inhalation pathway is insignificant, other exposure pathways may still pose significant risk, and therefore, they should be examined to fully quantify the level of exposure.

The health risk assessment is also limited in the manner chemical mixtures of two or more chemical substances are addressed. The effect of simultaneous absorption of two or more chemicals may produce a variety of responses. Responses to chemical mixtures can be additive, synergistic or antagonistic. Generally, U.S. and other health and environmental agency groups recommend an approach that uses some type of additive dose model. In this analysis, a less conservative approach is applied in that no additive or increased toxicologic mechanisms are active. Therefore, the risks quantified in this analysis may well be underestimates of actual health risk.

6.1 Pollutant Specific Impacts at NAF Atsugi

Table 6.1 provides a health impact summary of the individual air pollutants and air toxics that are being released from the Jinkanpo Incineration Complex. The individual airborne pollutant emission rates were quantified in Section 4.0 and the normalized concentration impacts from various sources at the Jinkanpo Incineration Complex were quantified in Section 5.0. The pollutant specific maximum short-term and long-term concentration impacts for receptors located on NAF Atsugi property are calculated by combining the maximum normalized concentration impacts as calculated in Section 5.0 with the emission factors provided in Section 3.0. Adjoining the predicted individual concentration impacts are the respective short-term and long-term health guidelines. The health guideline values were derived from several different sources including: USEPA Ambient Air Quality Standards, New York State Ambient Air Quality Standards, New York Air Toxic Guidelines, IRIS tables and the HEAST compilation. A group of standard or guideline reference sources were required since no one source or agency provides a complete listing of all the compounds known to be emitted from the Jinkanpo Incineration Complex. Where more than one standard and guideline value was available, the standard was chosen to represent health risk. Where more than one or more guideline values were available, the most stringent guideline value was selected to represent health risk.

The highlighted values in Table 6.1 indicate that the level of impact exceeds the health risk guideline. The values are presented in scientific notation because of the extensive range of the impact values. For example: the predicted short-term maximum concentration impact for carbon tetrachloride on NAF Atsugi

TABLE 6.1

NAF Atsugi Health Risk Assessment

COMPARISON OF JINKANPO INCINERATOR COMPLEX IMPACTS WITH
HEALTH RISK GUIDELINES ON NAF ATSUGI PROPERTY

Component Group: Volatile Organic Compounds

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
Chloroform		9.80E+02		2.30E+01
1,1,1-Trichloroethane	1.46E+02	4.50E+05	5.36E+00	1.00E+03
Carbon tetrachloride	7.24E+00	1.30E+03	4.52E-01	7.00E-02
Benzene	5.93E+01	3.00E+01	2.70E+00	1.20E-01
1,2-Dichloroethane		9.50E+02		3.90E-02
1-Heptene				
n-Heptane	1.17E+01		4.05E-01	
Trichloroethene	4.41E+00	3.30E+04	2.75E-01	4.50E-01
1,2-Dichloropropane		8.30E+04		1.50E-01
Toluene	6.39E+02	8.90E+04	2.60E+01	2.00E+03
Tetrachloroethene	6.51E+00	8.10E+04	4.07E-01	1.20E+00
1,3-Dichloropropene				
Ethylene Dibromide				
Chlorobenzene				2.00E+01
Ethylbenzene	1.85E+02	1.00E+05	7.58E+00	1.00E+03
Xylene	3.55E+02	1.00E+05	1.37E+01	3.00E+02
Bromoform		1.20E+03		2.00E-02
Isopropylbenzene				
Bromobenzene				

Component Group : Polychlorinated Pesticides and PCBs

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
Aldrin	5.01E-03		1.78E-04	
α -BHX	1.75E-02		6.24E-04	
β -BHX	2.87E-02		6.83E-04	
Δ -BHX	8.76E-03		3.11E-04	
γ -BHX	7.77E-03		1.41E-04	
Chlordane	3.36E-03		8.48E-05	
4,4'-DDD				
4,4'-DDE				
4,4'-DDT				
Dieldrin				
Endosulfan I				
Endosulfan II				
Endosulfan Sulfate				
Endrin				
Endrin Ketone				
Heptachlor				
Heptachlor Epoxide				
Toxaphene				

TABLE 6.1
Continued

NAF Atsugi Health Risk Assessment

**COMPARISON OF JINKANPO INCINERATOR COMPLEX IMPACTS WITH
HEALTH RISK GUIDELINES ON NAF ATSUGI PROPERTY**

Component Group : Polychlorinated Pesticides and PCBs

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
Aroclor 1016				
Aroclor 1221				
Aroclor 1232				
Aroclor 1242				
Aroclor 1248				
Aroclor 1254				
Aroclor 1260				

Component Group: PCDDs and PCDFs

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
2,3,7,8-TCDD	3.27E-06		1.09E-07	
TOTAL TCDD	2.80E-04		9.14E-06	3.00E-08
1,2,3,7,8-PeCDD	1.35E-05		2.96E-07	
TOTAL PeCDD	3.68E-04		1.10E-05	
1,2,3,4,7,8-HxCDD	1.35E-05		3.80E-07	
1,2,3,6,7,8-HxCDD	2.70E-05		7.04E-07	
1,2,3,7,8,9-HxCDD	1.54E-05		4.14E-07	
TOTAL HxCDD	3.67E-04		1.04E-05	
1,2,3,4,6,7,8-HpCDD	1.87E-04		4.42E-06	
TOTAL HpCDD	3.82E-04		9.11E-06	
OCDD	4.86E-04		1.73E-05	
2,3,7,8-TCDF	2.70E-05		7.60E-07	
TOTAL TCDF	1.18E-03		3.58E-05	
1,2,3,7,8-PeCDF	5.02E-05		1.34E-06	
2,3,4,7,8-PeCDF	9.45E-05		2.63E-06	
TOTAL PeCDF	1.28E-03		3.57E-05	
1,2,3,4,7,8-HxCDF	7.52E-05		1.95E-06	
1,2,3,6,7,8-HxCDF	6.75E-05		1.82E-06	
2,3,4,6,7,8-HxCDF	1.00E-04		2.59E-06	
1,2,3,7,8,9-HxCDF	3.28E-05		8.91E-07	
TOTAL HxCDF	6.96E-04		1.82E-05	
1,2,3,4,6,7,8-HpCDF	2.76E-04		7.42E-06	
1,2,3,4,7,8,9,-HpCDF	4.44E-05		1.26E-06	
TOTAL HpCDF	4.88E-04		1.31E-05	
OCDF	1.64E-04		3.45E-06	

TABLE 6.1
Continued

NAF Atsugi Health Risk Assessment

**COMPARISON OF JINKANPO INCINERATOR COMPLEX IMPACTS WITH
HEALTH RISK GUIDELINES ON NAF ATSUGI PROPERTY**

Component Group : PAHs (Semi-Volatiles)

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
Naphthalene				
2-Methylnaphthalene				
2-Chloronaphthalene				
Acenaphthylene				
Acenaphthene				
Fluorene				
Phenanthrene	3.57E-01		1.27E-02	
Anthracene				
Fluoranthene	2.20E-01		7.83E-03	
Pyrene	1.67E-01		5.94E-03	
Chrysene				
Benzo(a)anthracene				
Benzo(b)fluoranthene				
Benzo(k)fluoranthene				
Benzo(a)pyrene				
Indeno(1,2,3-c,d)pyrene				
Dibenz(a,h)anthracene				
Benzo(g,h,i)perylene				

Component Group : Particulate / Heavy Metals

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
PM-10	4.96E+02	1.50E+02*	1.45E+01	5.00E+01*
Chromium	1.50E-01	1.00E-01	3.64E-03	1.00E-01
Arsenic	1.81E-01	2.00E-01	3.52E-03	2.30E-04
Selenium	2.24E-02	4.80E+01	3.85E-04	4.80E-01
Lead	8.18E+00	NA	2.02E-01	1.50E+00*
Chromium VI				

TABLE 6.1**Concluded**

NAF Atsugi Health Risk Assessment

**COMPARISON OF JINKANPO INCINERATOR COMPLEX IMPACTS WITH
HEALTH RISK GUIDELINES ON NAF ATSUGI PROPERTY**

Component Group : Other Compounds

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
Sulfur Dioxide	3.28E+03	1.31E+03*	1.17E+02	8.00E+01*
Nitrogen Oxides	4.60E+03		1.64E+02	1.00E+02*
Carbon Monoxide	3.19E+03	4.00E+04*	1.13E+02	
Hydrochloric Acid	8.99E+02	1.50E+02	3.20E+01	7.00E+00
Sulfuric Acid	5.72E-01	2.40E+02	2.03E-02	2.40E+00
Ammonia	4.81E-01	3.60E+02	1.71E-02	4.00E+03
Cadmium	5.58E-01	2.00E-01	1.98E-02	5.00E-04
Mercury	3.56E+00	1.00E+00	1.26E-01	2.40E-02
Nickel	8.51E-01	1.50E+00	3.02E-02	2.00E-02
Fluorides	1.32E+01	2.85E+00**	4.71E-01	2.85E+00**

NOTE:

- o All concentrations are in micrograms per cubic meter.
- o Short-term maximum impacts were based on a peak on base impact of 816 micrograms per cubic meter (ug/m3) for all compounds except VOCs. The normalized VOC value is 3537 ug/m3 and is associated with the drum storage/disposal areas.
- o Long-term maximum impacts were based on a peak on base impact of 29.0 ug/m3 for all compounds except VOC's. The normalized VOC value is 221 ug/m3 and is associated with the drum storage/disposal areas.
- o The short-term and long-term guidelines are based on New York State Air Toxic Guidelines unless otherwise specified.
- * USEPA Primary and Secondary Ambient Air Quality Standards
- ** New York State Ambient Air Standard (24-Hour).

as shown in Table 6.1 under Compound Group: Volatile Organic Compounds, Maximum Long-Term Impact is 4.52E-01 or 0.452 micrograms per cubic meter. This value is above the long-term health guideline for carbon tetrachloride which, as shown in Table 6.1 under Compound Group: Volatile Organic Compounds, Long-Term Health Guideline is 7.00E-02 or 0.07 micrograms per cubic meter.

Therefore, there is an unacceptable health risk exposure to individuals at the maximum impact receptor point when the Jinkanpo Incineration Complex is operating according to design and worst-case meteorological conditions transport the incinerator complex air pollutants over the maximum impact point on NAF Atsugi.

There are several compounds released by the Jinkanpo Incineration Complex that exceed Health Guidelines at NAF Atsugi as shown in Table 6.1. These include carbon tetrachloride, benzene, total tetrachlorinated dibenzo-p-dioxins (total TCDD), sulfur dioxide, nitrogen dioxide, hydrochloric acid, cadmium, mercury, nickel, particulate matter less than 10 microns, chromium and arsenic. The above compounds were either monitored directly downwind of the Jinkanpo Incineration Complex by the NFESC monitoring team or emission rates were based on Jinkanpo stack test data or MWC stack test data.

The magnitude of some of these exceedances is particularly troublesome. For example, total TCDD predicted annual impact is more than 300 times the total TCDD health guideline. In fact, all modeled points on the NAF Atsugi facility exceeded the guideline value for total TCDD. The highest exceedance of a health standard or guideline is also for total TCDD.

Impact concentrations for some of the other compounds released during incineration are also provided in Table 6.1. Several compounds do not have estimated impacts because the ambient air data or other stack test data was not available to define precise emission rates. The lack of an impact or a standard, however, does not imply that the impact is not significant for that specific compound.

6.2 Other Pollutant Specific Impacts Off-Base

The Jinkanpo Incineration Complex air pollutant impact analysis also included the calculation of impacts that were not directly on NAF Atsugi property. Other properties surrounding the Jinkanpo Incineration Facility are actually experiencing impacts that exceed those on NAF Atsugi property. Table 6.2 provides the maximum impact concentrations for both short-term and long-term averaging periods for off NAF Atsugi property. The specific location of the maximum impact points are provided in Section 5.0. It should be noted that off-base impacts are all higher than on-base impacts and therefore off-base values would also exceed the above health risk guidelines.

TABLE 6.2

NAF Atsugi Health Risk Assessment

COMPARISON OF JINKANPO INCINERATOR COMPLEX IMPACTS WITH
HEALTH RISK GUIDELINES AT MAXIMUM OFF-BASE IMPACT POINT

Component Group: Volatile Organic Compounds

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
Chloroform		9.80E+02		2.30E+01
1,1,1-Trichloroethane	1.57E+02	4.50E+05	7.06E+00	1.00E+03
Carbon tetrachloride	7.82E+00	1.30E+03	5.96E-01	7.00E-02
Benzene	6.40E+01	3.00E+01	3.55E+00	1.20E-01
1,2-Dichloroethane		9.50E+02		3.90E-02
1-Heptene				
n-Heptane	1.26E+01		5.33E-01	
Trichloroethene	4.76E+00	3.30E+04	3.63E-01	4.50E-01
1,2-Dichloropropane		8.30E+04		1.50E-01
Toluene	6.89E+02	8.90E+04	3.42E+01	2.00E+03
Tetrachloroethene	7.02E+00	8.10E+04	5.35E-01	1.20E+00
1,3-Dichloropropene				
Ethylene Dibromide				
Chlorobenzene				2.00E+01
Ethylbenzene	1.99E+02	1.00E+05	9.99E+00	1.00E+03
Xylene	3.83E+02	1.00E+05	1.80E+01	3.00E+02
Bromoform		1.20E+03		2.00E-02
Isopropylbenzene				
Bromobenzene				

Component Group : Polychlorinated Pesticides and PCBs

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
Aldrin	5.70E-03		3.47E-04	
α -BHX	2.00E-02		1.21E-03	
β -BHX	3.27E-02		1.33E-03	
Δ -BHX	9.97E-03		6.07E-04	
γ -BHX	8.84E-03		2.74E-04	
Chlordane	3.82E-03		1.65E-04	
4,4'-DDD				
4,4'-DDE				
4,4'-DDT				
Dieldrin				
Endosulfan I				
Endosulfan II				
Endosulfan Sulfate				
Endrin				
Endrin Ketone				
Heptachlor				
Heptachlor Epoxide				
Toxaphene				

TABLE 6.2

Continued

NAF Atsugi Health Risk Assessment

COMPARISON OF JINKANPO INCINERATOR COMPLEX IMPACTS WITH
HEALTH RISK GUIDELINES AT MAXIMUM OFF-BASE IMPACT POINT

Component Group : Polychlorinated Pesticides and PCBs

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
Aroclor 1016				
Aroclor 1221				
Aroclor 1232				
Aroclor 1242				
Aroclor 1248				
Aroclor 1254				
Aroclor 1260				

Component Group: PCDDs and PCDFs

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
2,3,7,8-TCDD	3.72E-06		2.11E-07	
TOTAL TCDD	3.18E-04		1.78E-05	3.00E-08
1,2,3,7,8-PeCDD	1.54E-05		5.77E-07	
TOTAL PeCDD	4.19E-04		2.14E-05	
1,2,3,4,7,8-HxCDD	1.54E-05		7.40E-07	
1,2,3,6,7,8-HxCDD	3.07E-05		1.37E-06	
1,2,3,7,8,9-HxCDD	1.76E-05		8.07E-07	
TOTAL HxCDD	4.17E-04		2.03E-05	
1,2,3,4,6,7,8-HpCDD	2.13E-04		8.61E-06	
TOTAL HpCDD	4.35E-04		1.77E-05	
OCDD	5.53E-04		3.37E-05	
2,3,7,8-TCDF	3.07E-05		1.48E-06	
TOTAL TCDF	1.35E-03		6.97E-05	
1,2,3,7,8-PeCDF	5.71E-05		2.61E-06	
2,3,4,7,8-PeCDF	1.08E-04		5.13E-06	
TOTAL PeCDF	1.45E-03		6.96E-05	
1,2,3,4,7,8-HxCDF	8.57E-05		3.80E-06	
1,2,3,6,7,8-HxCDF	7.69E-05		3.54E-06	
2,3,4,6,7,8-HxCDF	1.14E-04		5.05E-06	
1,2,3,7,8,9-HxCDF	3.73E-05		1.74E-06	
TOTAL HxCDF	7.93E-04		3.55E-05	
1,2,3,4,6,7,8-HpCDF	3.14E-04		1.45E-05	
1,2,3,4,7,8,9-HpCDF	5.05E-05		2.46E-06	
TOTAL HpCDF	5.56E-04		2.55E-05	
OCDF	1.87E-04		6.71E-06	

TABLE 6.2

Continued

NAF Atsugi Health Risk Assessment

COMPARISON OF JINKANPO INCINERATOR COMPLEX IMPACTS WITH
HEALTH RISK GUIDELINES AT MAXIMUM OFF-BASE IMPACT POINT

Component Group : PAHs (Semi-Volatiles)

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
Naphthalene				
2-Methylnaphthalene				
2-Chloronaphthalene				
Acenaphthylene				
Acenaphthene				
Fluorene				
Phenanthrene	4.07E-01		2.47E-02	
Anthracene				
Fluoranthene	2.51E-01		1.53E-02	
Pyrene	1.90E-01		1.16E-02	
Chrysene				
Benzo(a)anthracene				
Benzo(b)fluoranthene				
Benzo(k)fluoranthene				
Benzo(a)pyrene				
Indeno(1,2,3-c,d)pyrene				
Dibenz(a,h)anthracene				
Benzo(g,h,i)perylene				

Component Group : Particulate / Heavy Metals

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
PM-10	5.65E+02	1.50E+02*	2.82E+01	5.00E+01*
Chromium	1.70E-01	1.00E-01	7.09E-03	1.00E-01
Arsenic	2.06E-01	2.00E-01	6.85E-03	2.30E-04
Selenium	2.55E-02	4.80E+01	7.50E-04	4.80E-01
Lead	9.32E+00	NA	3.94E-01	1.50E+00*
Chromium VI				

TABLE 6.2
Concluded

NAF Atsugi Health Risk Assessment

**COMPARISON OF JINKANPO INCINERATOR COMPLEX IMPACTS WITH
HEALTH RISK GUIDELINES AT MAXIMUM OFF-BASE IMPACT POINT**

Component Group : Other Compounds

CONTAMINANT	Maximum Short - Term Impact	Short-term Health Guideline	Maximum Long-Term Impact	Long-Term Health Guideline
Sulfur Dioxide	3.74E+03	1.31E+03*	2.27E+02	8.00E+01*
Nitrogen Oxides	5.24E+03		3.19E+02	1.00E+02*
Carbon Monoxide	3.64E+03	4.00E+04*	2.21E+02	
Hydrochloric Acid	1.02E+03	1.50E+02	6.23E+01	7.00E+00
Sulfuric Acid	6.51E-01	2.40E+02	3.96E-02	2.40E+00
Ammonia	5.48E-01	3.60E+02	3.33E-02	4.00E+03
Cadmium	6.35E-01	2.00E-01	3.86E-02	5.00E-04
Mercury	4.05E+00	1.00E+00	2.46E-01	2.40E-02
Nickel	9.68E-01	1.50E+00	5.89E-02	2.00E-02
Fluorides	1.51E+01	2.85E+00**	9.17E-01	2.85E+00**

NOTE:

- o All concentrations are in micrograms per cubic meter.
- o Short-term maximum impacts were based on a peak off base impact of 929 micrograms per cubic meter (ug/m3) for all compounds except VOCs. The normalized VOC value is 3,817 ug/m3 and is associated with the drum storage/disposal areas.
- o Long-term maximum impacts were based on a peak off base impact of 56.5 ug/m3 meter for all compounds except VOC's. The normalized VOC value is 291 ug/m3 and is associated with the drum storage/disposal areas.
- o The short-term and long-term guidelines are based on New York State Air Toxic Guidelines unless otherwise specified.
- * USEPA Primary and Secondary Ambient Air Quality Standards
- ** New York State Ambient Air Standard (24-Hour).

6.3 Other Health Risk Issues

As was stated briefly in the introduction to this section, the health risk assessment presented above does not include other health related risks associated with the activities at the Jinkanpo Incineration Complex. It is important to address these other issues since several of them could significantly increase the severity of the problems that are being caused by current operations.

It is notable that the impacts for several stack related pollutants could have been significantly worse prior to the installation of wet scrubbers at the incinerators. These impacts can be approximated since ground-level concentration impacts are directly related to emission rates on a linear basis. Thus, if the emission rate is increased by a factor of 10 times the current rates, the impact would be 10 times current impacts. Since the wet scrubbers reduced some emissions by a factor of 10, concentration impacts prior to the installation were likely to be 10 times the current values. For sulfur dioxide for example, the current value is 2.5 times the short-term standard. Without wet scrubbing, this value would have been 25 times the short-term standard.

The study of ambient downwind air pollutant concentrations by NFESC did not continuously monitor all the releases from the Jinkanpo Incineration Complex. The study only monitored the release rates when the wind flow vectors were transporting pollutants over the downwind monitor station. Since the activities at the incinerator complex are not completely consistent, there is a further possibility that pollutant release rates estimated during the NFESC study could be higher. In which case, the impacts would also be correspondingly higher.

The ambient monitoring program provided a data base for a variety of compounds, however, as noted several compounds were not detected. These compounds may have been present, however, the analytical sensitivity was not sufficient to detect them. Therefore, for all non-detect compounds with standards or guidelines below the detection limit, a health risk may be present.

At the beginning of this section, it was also stated that this health risk assessment only included inhalation health risk. An inhalation health risk assessment is normally considered a first step. If the analysis shows that exposure from inhalation of airborne pollutants is significant, it is likely that the health risk may be understated and that further review is necessary. The exposure of NAF Atsugi personnel to other health risks from dermal and ingestion exposure pathways could considerably add to the risks presented in this analysis. In fact, these other exposure pathways could be the predominate exposure pathways

depending on personal lifestyles, target organ(s), food sources, residence and work place demographics, etc. Preparing a more complete health risk assessment would require considerable data on each of these

items.

Finally, the health risk assessment values presented in this analysis were developed based on a somewhat optimistic approach to the data base that was available. Therefore, the results do not overstate the level of the impacts that are predicted. If a more conservative approach was applied, one could expect that the stated risks would increase substantially.

7.0 CONCLUSIONS AND RECOMMENDATIONS

A health risk assessment was performed to provide an optimistic estimate of the health risk exposure of NAF Atsugi personnel to the air pollutant impacts resulting from the operation of the Jinkanpo Incineration Complex. The assessment was performed using data collected by NFESC personnel, test data from the Jinkanpo Incinerator units, onsite meteorological data, a USEPA approved atmospheric dispersion model and health related standards and guidelines.

The results of the analyses indicate that the activities at the Jinkanpo Incineration Complex are having a significant adverse impact on NAF Atsugi. Concentrations for several pollutants exceed established guidelines by a wide margin suggesting that the health of NAF Atsugi personnel is not being adequately protected.

Based on the above findings, it appears that activities on NAF Atsugi should be monitored and outdoor activities should be curtailed when the Jinkanpo Incineration Complex activities are causing significant impacts on NAF Atsugi. Since several of the compounds analyzed exhibited exceedances of short-term values, depending on meteorological conditions, these levels could be immediately hazardous to human health as shown by the short-term impacts for several compounds.

Long-term exposure on NAF Atsugi to emissions from the Jinkanpo Incineration Complex exceed established standards and guideline. This finding suggests that long-term or chronic exposure to various air contaminants released from the Jinkanpo Incineration Complex should also be monitored and reduced to comply with long-term U.S. Federal and State standards and guidelines.

The health risk assessment was based on inhalation risk and does not include the assessment of other exposure pathways. These other exposure pathways should be researched and analyzed to assure that fully adequate measures are taken to avoid NAF Atsugi personnel exposure to levels in excess of the reference standards and guidelines.

The Jinkanpo Incineration Complex pollutant emissions need to be carefully inventoried for all air toxic and other releases. Steps should be taken to reduce the emissions of all pollutants exceeding the above

referenced guidelines and standards immediately. Additional investigations should be undertaken to assess the total health risk associated with the facility to reduce NAF Atsugi personnel exposure to levels of air toxics that are below the referenced guidelines and standards.

Until the air toxic releases from the Jinkanpo Incineration Complex do not cause exceedances of the referenced guidelines and standards, procedures should be instituted to protect the health and safety of NAF Atsugi personnel.

APPENDIX A

NFESC AMBIENT AIR QUALITY MONITORING DATA AND MWC SUPPORTING DATA FOR EMISSION FACTORS

SITE: Naval Air Facility (NAF), Atsugi, Japan
DATES: July 26, 1994 thru September 11, 1994

Appendix A-1

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Summa Canister Upwind Samples S1-1 thru S1-12

Sample ID	S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S1-8	S1-9	S1-10	S1-11	S1-12
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
Freon 12								4.2				
Freon 114												
Chloromethane												
Vinyl Chloride												
Bromomethane												
Chloroethane												
Freon 11									4.6			
1,1-Dichloroethene												
Freon 113								7.6				
Methylene Chloride	6.4		5.0	4.0	10.9			25.4				10.9
1,1-Dichloroethane												
cis-1,2-Dichloroethene												
Chloroform												
1,1,1-Trichloroethane	8.9				105.5	4.9	5.6	26.1	4.0			
Carbon Tetrachloride												
Benzene		2.8						4.2	6.8			3.2
1,2-Dichloroethane												
Trichloroethene							12.6	18.6	23.5			19.7
1,2-Dichloropropane												
cis-1,3-Dichloropropene												
Toluene	14.2	4.2	8.8		103.4	13.0	29.9	68.9	31.8	15.3	13.4	35.6
trans-1,3-Dichloropropene												
1,1,2-Trichloroethane	7.8											
Tetrachloroethene	15.8				5.4			54.4	5.6			6.6

Appendix A-1
Continued

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Summa Canister Upwind Samples
S1-1 thru S1-12

Sample ID	S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S1-8	S1-9	S1-10	S1-11	S1-12
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
Ethylene Dibromide												
Chlorobenzene	6.6											
Ethyl Benzene					7.5			19.4	6.2	4.0	3.5	5.3
Xylene	44.1		4.4	12.3	18.1	13.2	16.3	39.2	11.5	5.7	4.9	33.1
Styrene								4.3			3.4	
1,1,2,2-Tetrachloroethane												
Trimethylbenzene	4.1				4.6		5.5	10.5				10.5
1,3-Dichlorobenzene												
1,4-Dichlorobenzene									4.5			
Chlorotoluene												
1,2-Dichlorobenzene												
1,2,4-Trichlorobenzene	5.7											
Hexachlorobutadiene												

Appendix A-2

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Summa Canister Downwind Samples S2-1 thru S2-12

Sample ID	S2-1	S2-2	S2-3	S2-4	S2-5	S2-6	S2-7	S2-8	S2-9	S2-10	S2-11	S2-12
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
Freon 12			7.5					7.0				
Freon 114												
Chloromethane				2.5				5.5				
Vinyl Chloride												
Bromomethane												
Chloroethane												
Freon 11	10.3		33.1	4.7	4.7			6.9		6.3	14.8	
1,1-Dichloroethene												
Freon 113												
Methylene Chloride	113.0	9.9	228.5	33.9	13.4		158.9	105.9	5.6	25.1	1659.1	98.8
1,1-Dichloroethane												
cis-1,2-Dichloroethene												
Chloroform											168.6	17.9
1,1,1-Trichloroethane	24.4		17.2	7.8	18.9	11.1		17.8	5.5	11.7		4.4
Carbon Tetrachloride	5.0											
Benzene	15.0	14.3	13.3	28.9	5.2	13.0		12.0	9.4	13.3	84.5	42.3
1,2-Dichloroethane												
Trichloroethene			12.0				13.1	5.5			256.6	41.0
1,2-Dichloropropane												
cis-1,3-Dichloropropene												
Toluene	80.4	53.6	141.7	49.8	264.3	68.9	68.9	421.3	61.3	183.8	317.9	114.9
trans-1,3-Dichloropropene												
1,1,2-Trichloroethane												
Tetrachloroethene			8.3									

Appendix A-2
Continued
 NAF Atsugi Health Risk Assessment
 NFESC July 26 - September 11, 1994 Sampling Program

Summa Canister Downwind Samples
S2-1 thru S2-12

Sample ID	S2-1	S2-2	S2-3	S2-4	S2-5	S2-6	S2-7	S2-8	S2-9	S2-10	S2-11	S2-12
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
Ethylene Dibromide												
Chlorobenzene												
Ethyl Benzene	26.5	8.8	26.9	15.4	83.8	25.1	10.1	105.8	13.7	48.5	101.4	21.2
Xylene	51.2	19.0	54.2	29.5	126.1	59.1	27.3	168.9	22.1	70.6	170.2	38.8
Styrene	15.6	8.2	23.8	41.1		20.4		26.0		5.6		6.1
1,1,2,2-Tetrachloroethane												
Trimethylbenzene	6.0		15.2	5.0	12.0	7.5		40.5	5.5	21.4	27.0	7.0
1,3-Dichlorobenzene												
1,4-Dichlorobenzene								4.9				
Chlorotoluene												
1,2-Dichlorobenzene												
1,2,4-Trichlorobenzene												
Hexachlorobutadiene												

Appendix A-3

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Tenax Trap Upwind Samples T1-1 thru T1-12

Sample ID	T1-1	T1-2	T1-4	T1-5	T1-01	T1-02	T1-03	T1-04	T1-06	T1-07	T1-08	T1-09	T1-10
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
Chloroform													
1,1,1-Trichloroethane	1.31	0.90		20.31	6.10	1.96	1.53	2.04	3.25	3.57	1.48	2.02	1.48
Carbon Tetrachloride				3.57									
Benzene	1.51	1.32		0.91	1.49	1.96	2.65	1.39	1.30	0.91	1.91	1.88	2.18
1,2-Dichloroethane													
1-Heptene													
n-Heptane	0.76			1.40					1.01				
Trichloroethene													
1,2-Dichloropropane													
Toluene	8.26	15.99	1.00	9.10	18.97	5.87	8.37	6.35	18.06	16.09	6.85	7.67	8.43
Tetrachloroethene					3.52	4.47	1.26	0.88	1.30	1.82	0.85	0.98	
1,3-Dichloropropene													
Ethylene Dibromide													
Chlorobenzene													
Ethyl Benzene	1.79	15.30			5.56	1.61	1.33	3.94	2.53	2.59	1.20	1.53	1.55
Xylene	3.51	70.22	0.71	0.77	10.03	3.01	2.79	7.88	4.62	4.69	1.62	2.93	4.15
Bromoform													
Isopropylbenzene													
Bromobenzene													

Appendix A-4

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Tenax Trap Downwind Samples T2-1 thru T2-12

Sample ID	T2-1	T2-2	T2-4	T2-5	T2-01	T2-02	T2-03	T2-04	T2-06	T2-07	T2-08	T2-09	T2-10
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
Chloroform								12.81	7.78	6.82	0.84	0.93	
1,1,1-Trichloroethane	15.20	3.98	3.31	28.37	4.93	2.88	3.01	5.13	4.95	4.98	2.94	3.28	1.74
Carbon Tetrachloride	1.38	0.68		5.18				0.93	0.78	0.85			
Benzene	4.08	5.17	6.69	5.60	10.14	2.88	25.84	39.86	50.91	53.30	40.54	47.82	4.53
1,2-Dichloroethane													
1-Heptene													
n-Heptane	1.87		0.84	3.40			5.17	6.62	2.40	2.42		1.07	0.70
Trichloroethene	1.11			1.06		0.86	1.87	24.91	13.43	17.06	1.96	2.07	1.11
1,2-Dichloropropane									5.87	6.11			
Toluene	69.10	8.38	20.41	62.41	57.76	20.87	53.11	53.39	70.70	92.39	58.72	48.53	14.62
Tetrachloroethene	1.31					0.86							
1,3-Dichloropropene													
Ethylene Dibromide													
Chlorobenzene													
Ethyl Benzene	19.35		6.55	22.70	11.83	6.41	12.92	14.24	13.43	14.93	9.09	1.43	2.51
Xylene	37.32	2.44	9.08	39.72	25.07	11.73	25.69	24.20	26.02	29.07	18.11	1.93	5.64
Bromoform													
Isopropylbenzene													
Bromobenzene													

Appendix A-5

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

PM-10/Metals Upwind Samples PM1-1 thru PM1-11

Sample ID	PM1-1	PM1-2	PM1-3	PM1-8	PM1-10	PM1-11
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
PM-10	34.5637	54.4165	48.2329	26.2236	32.1215	29.9572
Chromium	0.0034	0.0025	0.0032	0.0022	0.0071	0.0039
Arsenic	0.0010	0.0018	0.0017	0.0017	0.0021	0.0031
Selenium	0.0008	0.0016	0.0020		0.0015	0.0008
Lead	0.0433	0.0439	0.0585	0.0148	0.0478	0.0704
Chromium VI						

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NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

PM-10/Metals Downwind Samples PM2-1 thru PM2-11

Sample ID	PM2-1	PM2-2	PM2-3	PM2-8	PM2-10	PM2-11
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
PM-10	65.2093	85.9405	64.9560	48.5992	57.8071	68.7708
Chromium	0.0084	0.0120	0.0081	0.0056	0.0138	0.0134
Arsenic	0.0043	0.0133	0.0055	0.0030	0.0084	0.0082
Selenium	0.0024	0.0020	0.0024	0.0205	0.0020	0.0014
Lead	0.6277	0.3151	0.3015	0.2679	0.4272	0.7032
Chromium VI						

Appendix A-7

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Polychlorinated Biphenyls and Pesticides Upwind Samples PUF1-1 thru PUF1-14

Sample ID	PUF1-1 (ug/m3)	PUF1-2 (ug/m3)	PUF1-10 (ug/m3)	PUF1-11 (ug/m3)	PUF1-13 (ug/m3)	PUF1-14 (ug/m3)
Compound						
Aldrin	0.0014	0.0016	0.0018	0.0017	0.0014	0.0015
a-BHC	0.0057	0.0055	0.0023	0.0036	0.0041	0.0033
b-BHC	0.0028	0.0019	0.0035	0.0024	0.0022	0.0014
d-BHC	0.0014	0.0020	0.0018	0.0018	0.0023	0.0014
g-BHC	0.0022	0.0021	0.0025	0.0020	0.0023	0.0021
Chlordane	0.0018	0.0026	0.0013	0.0019	0.0022	0.0030
4,4'-DDD						
4,4'-DDE						
4,4'-DDT						
Dieldrin						
Endosulfan I						
Endosulfan II						
Endosulfan Sulfate						
Endrin						
Endrin Ketone						
Heptachlor						
Heptachlor Epoxide						
Toxaphene						
Aroclor 1016						
Aroclor 1221						
Aroclor 1232						
Aroclor 1242						
Aroclor 1248						
Aroclor 1254						
Aroclor 1260						

Appendix A-8

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Polychlorinated Biphenyls and Pesticides Downwind Samples PUF2-1 thru PUF2-14

Sample ID	PUF2-1	PUF2-2	PUF2-10	PUF2-11	PUF2-13	PUF2-14
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
Aldrin	0.0014	0.0019	0.0014	0.0018	0.0014	0.0013
a-BHC	0.0036	0.0035	0.0032	0.0030	0.0034	0.0033
b-BHC	0.0022	0.0025	0.0049	0.0027	0.0019	0.0017
d-BHC	0.0022	0.0026	0.0017	0.0019	0.0030	0.0017
g-BHC	0.0022	0.0026	0.0025	0.0020	0.0017	0.0022
Chlordane	0.0016	0.0027	0.0015	0.0018	0.0019	0.0026
4,4'-DDD						
4,4'-DDE						
4,4'-DDT						
Dieldrin						
Endosulfan I						
Endosulfan II						
Endosulfan Sulfate						
Endrin						
Endrin Ketone						
Heptachlor						
Heptachlor Epoxide						
Toxaphene						
Aroclor 1016						
Aroclor 1221						
Aroclor 1232						
Aroclor 1242						
Aroclor 1248						
Aroclor 1254						
Aroclor 1260						

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NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzo-p-Furans Upwind Samples PUF1-1 thru PUF1-14

Sample ID	PUF1-1 (ng/m3)	PUF1-2 (ng/m3)	PUF1-10 (ng/m3)	PUF1-11 (ng/m3)	PUF1-13 (ng/m3)	PUF1-14 (ng/m3)
Compound						
2,3,7,8-TCDD						
Total TCDD	0.0023	0.0039	0.0038	0.0036	0.0041	0.0049
1,2,3,7,8-PeCDD	0.0002	0.0003	0.0002	0.0002	0.0002	0.0003
Total PeCDD	0.0030	0.0054	0.0041	0.0046	0.0048	0.0068
1,2,3,4,7,8-HxCDD	0.0002	0.0003	0.0002	0.0003	0.0002	0.0004
1,2,3,6,7,8-HxCDD	0.0004	0.0006	0.0004	0.0007	0.0004	0.0008
1,2,3,7,8,9-HxCDD	0.0003	0.0004	0.0003	0.0004	0.0002	0.0006
Total HxCDD	0.0046	0.0083	0.0052	0.0083	0.0055	0.0100
1,2,3,4,6,7,8-HpCDD	0.0057	0.0072	0.0041	0.0067	0.0029	0.0058
Total HpCDD	0.0109	0.0144	0.0084	0.0134	0.0061	0.0126
OCDD	0.0223	0.0439	0.0094	0.0119	0.0061	0.0115
2,3,7,8-TCDF	0.0002	0.0003	0.0003	0.0002	0.0003	0.0004
Total TCDF	0.0119	0.0245	0.0178	0.0165	0.0188	0.0267
1,2,3,7,8-PeCDF	0.0004	0.0007	0.0005	0.0006	0.0006	0.0009
2,3,4,7,8-PeCDF	0.0011	0.0024	0.0015	0.0023	0.0014	0.0027
Total PeCDF	0.0145	0.0306	0.0178	0.0274	0.0188	0.0278
1,2,3,4,7,8-HxCDF	0.0009	0.0017	0.0010	0.0017	0.0011	0.0021
1,2,3,6,7,8-HxCDF	0.0011	0.0022	0.0013	0.0022	0.0012	0.0023
2,3,4,6,7,8-HxCDF	0.0037	0.0067	0.0037	0.0078	0.0027	0.0052
1,2,3,7,8,9-HxCDF	0.0011	0.0020	0.0012	0.0024	0.0009	0.0019
Total HxCDF	0.0171	0.0322	0.0183	0.0346	0.0155	0.0293
1,2,3,4,6,7,8-HpCDF	0.0093	0.0156	0.0094	0.0186	0.0072	0.0136
1,2,3,4,7,8,9-HpCDF	0.0034	0.0051	0.0031	0.0062	0.0023	0.0042
Total HpCDF	0.0249	0.0422	0.0241	0.0496	0.0183	0.0319
OCDF	0.0161	0.0261	0.0147	0.0243	0.0100	0.0157

Appendix A-10

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzo-p-Furans Downwind Samples PUF2-1 thru PUF2-14

Sample ID	PUF2-1 (ng/m3)	PUF2-2 (ng/m3)	PUF2-10 (ng/m3)	PUF2-11 (ng/m3)	PUF2-13 (ng/m3)	PUF2-14 (ng/m3)
Compound						
2,3,7,8-TCDD	0.0003	0.0002	0.0002	0.0003	0.0003	0.0001
Total TCDD	0.0307	0.0188	0.0183	0.0288	0.0397	0.0152
1,2,3,7,8-PeCDD	0.0017	0.0005	0.0009	0.0016	0.0015	0.0009
Total PeCDD	0.0388	0.0212	0.0232	0.0409	0.0495	0.0213
1,2,3,4,7,8-HxCDD	0.0014	0.0008	0.0009	0.0016	0.0017	0.0009
1,2,3,6,7,8-HxCDD	0.0026	0.0014	0.0018	0.0034	0.0038	0.0022
1,2,3,7,8,9-HxCDD	0.0017	0.0009	0.0011	0.0021	0.0023	0.0013
Total HxCDD	0.0378	0.0222	0.0242	0.0457	0.0544	0.0254
1,2,3,4,6,7,8-HpCDD	0.0236	0.0111	0.0138	0.0216	0.0261	0.0188
Total HpCDD	0.0473	0.0227	0.0282	0.0442	0.0528	0.0355
OCDD	0.0756	0.0217	0.0346	0.0298	0.0430	0.0441
2,3,7,8-TCDF	0.0020	0.0013	0.0017	0.0026	0.0022	0.0013
Total TCDF	0.1134	0.0772	0.0791	0.1298	0.1305	0.0761
1,2,3,7,8-PeCDF	0.0040	0.0023	0.0031	0.0053	0.0049	0.0027
2,3,4,7,8-PeCDF	0.0076	0.0058	0.0064	0.0111	0.0103	0.0061
Total PeCDF	0.0993	0.0772	0.0840	0.1346	0.1305	0.0761
1,2,3,4,7,8-HxCDF	0.0057	0.0039	0.0049	0.0087	0.0087	0.0051
1,2,3,6,7,8-HxCDF	0.0057	0.0044	0.0048	0.0087	0.0082	0.0050
2,3,4,6,7,8-HxCDF	0.0099	0.0096	0.0089	0.0163	0.0125	0.0091
1,2,3,7,8,9-HxCDF	0.0030	0.0031	0.0029	0.0053	0.0040	0.0031
Total HxCDF	0.0662	0.0531	0.0544	0.1009	0.0870	0.0609
1,2,3,4,6,7,8-HpCDF	0.0260	0.0246	0.0237	0.0423	0.0408	0.0289
1,2,3,4,7,8,9-HpCDF	0.0061	0.0068	0.0054	0.0106	0.0087	0.0071
Total HpCDF	0.0567	0.0579	0.0494	0.0913	0.0816	0.0609
OCDF	0.0246	0.0280	0.0232	0.0370	0.0332	0.0279

Appendix A-11

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Polychlorinated Aromatic Hydrocarbons Upwind Samples PUF1-1 thru PUF1-14

Sample ID	PUF1-1	PUF1-2	PUF1-10	PUF1-11	PUF1-13	PUF1-14
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
Naphthalene						
2-Methylnaphthalene						
2-Chloronaphthalene						
Acenaphthylene						
Acenaphthene						
Fluorene						
Phenanthrene	0.0130	0.0228	0.0136	0.0243	0.0221	0.0230
Anthracene						
Fluoranthene						
Pyrene						
Chrysene						
Benzo(a)anthracene						
Benzo(b)fluoranthene						
Benzo(k)fluoranthene						
Benzo(a)pyrene						
Indeno(1,2,3-c,d)pyrene						
Dibenz(a,h)anthracene						
Benzo(g,h,i)perylene						

Appendix A-12

NAF Atsugi Health Risk Assessment
NFESC July 26 - September 11, 1994 Sampling Program

Polychlorinated Aromatic Hydrocarbons Downwind Samples PUF2-1 thru PUF2-14

Sample ID	PUF2-1	PUF2-2	PUF2-10	PUF2-11	PUF2-13	PUF2-14
Compound	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)
Naphthalene						
2-Methylnaphthalene						
2-Chloronaphthalene						
Acenaphthylene						
Acenaphthene						
Fluorene						
Phenanthrene	0.0345	0.0164	0.0321	0.0250	0.0228	0.0193
Anthracene						
Fluoranthene	0.0184	0.0140				
Pyrene	0.0232	0.0106				
Chrysene	0.0104					
Benzo(a)anthracene						
Benzo(b)fluoranthene						
Benzo(k)fluoranthene						
Benzo(a)pyrene						
Indeno(1,2,3-c,d)pyrene						
Dibenz(a,h)anthracene						
Benzo(g,h,i)perylene						