TABLES

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Table 1 – Data Quality Objectives
Phoenix-Goodyear Airport North Superfund Site
Goodyear, Arizona

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
Problem Statement	Identify Decision(s)	Inputs to Decisions	Define Boundaries	Decision Rules	Limits on Decision Error	Sampling Approach Optimization
Operations on the UPI facility included activities that required the use of VOCs. While in operation, these facilities required the storage, handling, and use of a variety of chemicals. Particularly solvents. Some of the chemicals were released to the subsurface and VOCs have been detected in the subsurface near the UPI facility. At the June 19, 2003 technical meeting the U.S. EPA requested Crane redirect the perimeter soil gas investigation and collect air sampling data to evaluate risk to occupants of nearby buildings. In September, 2003 a summertime air sampling event was conducted. The results of the initial sampling event indicated that the concentration of PCE and TCE in indoor air were substantially below the acceptable risk based criteria. Additionally, the concentrations of PCE and TCE in indoor air were within the provisional health protective concentrations. Further, the concentrations in indoor air were similar to the concentrations in outdoor air and are likely related to outdoor ambient air quality. EPA requested a wintertime sampling event to evaluate seasonal variation in VOC concentrations and operation of the building HVAC systems.	Data Collection: If sufficient data are collected to evaluate the potential for migration of chemicals from the subsurface to indoor air, and if the data indicate concentrations below action levels or background, then the investigation may be necessary, in which case, a subsequent work plan will be submitted to EPA. Health Risks: The potential public health impact will be evaluated through comparison with three tiers of data and criteria: Tier 1) Local and regional ambient air background levels; Tier 2) acceptable air concentrations based on non-cancer short- and long-term exposure criteria; and Tier 3) risk-specific air concentrations based on theoretical cancer risks.	Identify facilities and outdoor locations targeted for air sampling. An informational questionnaire may be submitted to tenants and/ or building owners to collect information on the building foundation and base slab construction details, building use, and HVAC system construction and operation. Construction specifications for buildings will be obtained and evaluated. Soil vapor sampling data will be evaluated to determine the VOCs of concern. Except for additional regional ambient air samples, indoor and outdoor sample locations will be identical to the summer sampling event in 2003.	Areas targeted for representative site sampling are located on or near property formerly or currently owned by Unidynamics. Outdoor air samples will be collected from the air intakes of the HVAC systems in each building; three perimeter outdoor air samples will be collected to provide local background information; one air sample will be collected from the exhaust of the carbon polishing unit located at the main groundwater treatment facility; and regional background air samples will be collected north, east, and south of the site.	Data Collection: If the final vacuum gauge on the Silonite canister reads less than 2 inches of Hg, the results will be considered representative of a grab sample. Non-detected results will be considered invalid for risk evaluation. Positive results will be considered estimated values for risk evaluation purposes. Health Risks: Action levels are derived for health risks of $1x10^{-6}$ to $1x10^{-4}$. Tier 1: Statistical evaluations will be conducted with an appropriate statistical test to evaluate whether the mean site concentration is significantly different from the mean for the local or regional background concentrations. If the mean of the site concentrations for a chemical in indoor air is not found to be significantly greater than the mean of that chemical in background samples, then it will be concluded that these chemicals in indoor air are considered to be representative of background. If mean indoor air concentrations are greater than background concentrations, data will be further evaluated using Tiers 2 and 3. Tier 2: The Tier 2 values will be applied based first on OSHA values, then on MRLs, and then on RBCs derived from RfCs. If the mean concentration in a building exceeds the criteria, then confirmation samples will be collected and the building occupants will be informed. If chemical concentrations in indoor air are caused from volatilization from the subsurface, appropriate measures will be taken to prevent or reduce the levels of exposures. If the mean concentrations of the chemicals of interest do not exceed Tier 2 criteria, no interim measures are necessary. Tier 3: Two sets of exposure assumptions are applied: 1) central tendency exposure assumptions, which include an assumed inhalation rate of 8 m^3 air/day and 6.6 years workplace exposure duration; and 2) reasonable maximum exposure assumptions derived through application of an assumed inhalation rate of 10.4 m^3 air/day and a 21.9 year exposure duration. The Tier 3 RBCs for these two exposure assumptions are based on risk estimates of one in one million and one in ten thousand. If the mean concentration exceeds Tier 3 criteria, then potential alternative measures will be evaluated and discussed with EPA. If the mean concentrations do not exceed Tier 3 criteria, further mitigation is not necessary.	The procedures for the collection and assessment of data are to be within the acceptable ranges of precision, accuracy, representativeness, completeness, and comparability. The criteria for accuracy vary for each analyte, but are generally 30%. The relative percent difference (RPD) is about 30%. Results of samples in areas near floor cracks represent localized preferential pathways, and are not representative of exposure point concentrations to occupants.	Using building information, locations were selected for the collection of a minimum of four indoor air samples at each building selected for sampling. Outdoor air samples will be collected at the HVAC system air intakes. Geomatrix will collect 24-hour background samples near the perimeter of the property to serve as local background and also at locations further from the site to the east, north, and south to represent regional background. Geomatrix will collect the perimeter local background samples on the same day over the same time interval as the indoor samples. Geomatrix will attempt to perform the other regional background air sampling on the same day, but this is contingent on access requirements from the current facility owner and tenants.

Notes:

MRL = federal minimum risk level
RBC = risk-based concentration
RfC = reference concentration

Original Table Prepared by Geomatrix

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Table 2 - Risk Assessment Tiers and Values for Non-Carcinogenic Compounds
Phoenix-Goodyear Airport North Superfund Site
Goodyear, Arizona

	Acetone	1,1-Dichloroethene	*cis*-1,2-Dichloroethene	*trans*-1,2-Dichloroethene	Methyl-ethyl-ketone
Tier 1 (ug/m^3)					
Background (ambient air) (1)	10.2	0.062	0.096	0.0087 [4]	0.71 [4]
Tier 2 (ug/m^3)					
Interim exposure criteria (noncancer endpoints)					
Acute MRL	62,780	NA	NA	794	NA
Intermediate MRL	31,390	79.4	NA	794	NA
Occupational RBC (derived from RfDi) (2)(3	8,840 - 11,500	560 - 730	98 - 128	197 - 256	13,760 - 17,890
RfDi (mg/kg-day)	0.9	0.057	0.01	0.02	1.4
Source of RfDi	IRIS, RTR	IRIS	PPRTV, RTR	IRIS	IRIS
US EPA Region 9 Ambient Air PRGs	3,300	210	37	73	5,100

Notes:

Adapted from Original Table Prepared by Geomatrix

ug/m^3 = micrograms per cubic meter
MRL = minimal risk level
PRG = preliminary remediation goal
RBC = risk-based concentration
RfDi = inhalation reference dose
IRIS = US EPA's Integrated Risk Information System (IRIS) database, 2004
RTR = route-to-route extrapolation
PPRTV = US EPA's Provisional Peer Reviewed Toxicity Values (PPRTV) database, 2004

CTE = central tendency exposure
RME = reasonable maximum exposure

1. Average background concentration based on site-specific data. Non-detect concentrations assumed to equal one-half the detection limit. Complete data for all background locations provided in Table 7.
2. The highest RBCs incorporate CTE assumptions and the lowest RBCs incorporate RME assumptions; CTE = inhalation rate of 8 m^3/day and an exposure duration of 6.6 years; RME = inhalation rate of 10 m^3/day and an exposure duration of 21.9 years.
3. The equation to derive the risk-based concentration for noncancer endpoints and an indoor occupational worker is as follows:

$$\frac{THQ \times RfDi \times BWa \times ATnc \times 1000\,\mu g/mg}{EFocc \times EDocc \times INHocc}$$

where:
THQ = target hazard quotient (1)
RfDi = Reference Dose, mg/kg-day (chemical-specific)
BWa = Bodyweight of an adult indoor worker, kg (70)
ATnc = Averaging time for noncarcinogens, days (EFocc x 365)
EFocc = Exposure Frequency for indoor occupational workers, days (250)
EDocc = Exposure Duration for indoor occupational workers, years (6.6 - CTE; 21.9 - RME)
INHocc = Indoor air Inhalation Rate for occupational workers, m^3/day (8 - CTE; 10.4 - RME)

4. Chemical not detected in ambient air. Value reported is the average of one-half the detection limits.

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Table 3 - Risk Assessment Tiers and Values for Potentially Carcinogenic Compounds
Phoenix-Goodyear Airport North Superfund Site
Goodyear, Arizona

	Tetrachloroethene	Trichloroethene	Vinyl Chloride
Tier 1 (ug/m^3)			
Background (ambient air) (1)	0.41	0.18	0.0065 [4]
Tier 2 (ug/m^3)			
Interim exposure criteria (noncancer endpoints)			
Acute MRL	1,360	10,740	1,280
Intermediate MRL	NA	537	76.8
Occupational RBC (derived from RfDi) (2)(3)	98 - 128	98 - 128	281 - 365
RfDi (mg/kg-day)	0.01	0.01	0.029
Source of RfDi	IRIS, RTR	NCEA & PRGs	IRIS
Tier 3 (ug/m^3)			
Cancer-based exposure criteria			
$1x10^{-4}$ (2)(3)	150 - 650	4.8, 450, 1940 [5]	196 - 847
$1x10^{-6}$ (2)(3)	1.5 - 6.5	0.048, 4.5, 19.4 [5]	2 - 8.5
US EPA Region 9 Ambient Air PRG	0.32	0.017	0.11
US EPA Region 9 Provisional Air PRG for Comm. W	NA	0.048 to 4.8	NA
US EPA Region 9 CAL-Modified PRG	NA	0.96	NA
CSFi (mg/kg-day)$^{-1}$	0.021	0.4, 0.007	0.016 (adult)
Source of CSFi	Cal-EPA OEHHA, PRGs	NCEA, Cal-EPA	IRIS

Adapted from Original Table Prepared by Geomatrix

Notes:

Cal-EPA = California EPA Office of Environmental Health Hazard Assessment (OEHHA), 2004
CTE = central tendency exposure
MRL = minimal risk level
RBC = risk-based concentration
RfDi = inhalation reference dose
RME = reasonable maximum exposure
mg/m^3 = micrograms per cubic meter
IRIS = US EPA's Integrated Risk Information System (IRIS) database, 2004
NCEA = US EPA's National Center for Environmental Assessment
PRGs = US EPA Region 9 Preliminary Remediation Goals, October 2004
RTR = route-to-route extrapolation

1. Average background concentration based on site-specific data. Complete data for all background locations provided in Table 7.

2. The highest RBCs incorporate CTE assumptions and the lowest RBCs incorporate RME assumptions for an occupational worker

3. The equation to derive the risk-based concentration for an indoor occupational worker is as follows:

$$\frac{TR \times BWa \times ATc \times 1000 \mu g/mg}{EFocc \times EDocc \times INHocc \times CSFi}$$

where:

TR = target excess cancer risk ($1x10^{-6}$)
CSFi = Cancer Slope Factor, (mg/kg-day)$^{-1}$ (chemical-specific)
BWa = Bodyweight of an adult indoor worker, kg (70)
ATc = Averaging time for noncarcinogens, days (25550)
EFocc = Exposure Frequency for indoor occupational workers, days (250)
EDocc = Exposure Duration for indoor occupational workers, years (6.6 - CTE; 21.9 - RME; 25 - EPA)
INHocc = Indoor air Inhalation Rate for occupational workers, m^3/day (8 - CTE; 10.4 - RME; 15 - EPA)

4. Chemical not detected in ambient air. Value reported is the average of one-half the detection limits.

5. RBCs are as follows: EPA Region 9 Provisional Air PRG for commercial workers, occupational RBC calculated using RME assumptions, occupational RBC calculated using CTE assumptions

Table 4 - Comparison of Indoor Air Sampling Results to Site-Specific Background Ambient Air

Location	Parameter	Samples	Average	Background % difference	Parametric (1)	<> Background (2)
250 North	TCE	8	0.186	-19	Y	No
190 North	TCE	8	0.140	-39	N	No
140 North	TCE	6	0.153	-34	Y	No
Background	TCE	10	0.230			
250 North	PCE	8	0.341	-4	Y	No
190 North	PCE	8	0.318	-10	Y	No
140 North	PCE	6	0.451	27	Y	No
Background	PCE	10	0.354			

Notes

1. Y indicates that the data are normality distributed and a t-test was used; N indicates that the nonparametric WRS test was used
2. See Attachment 1

PCE = tetrachloroethene
TCE = trichloroethene
WRS - Wilcoxon Rank-Sum test

Table 5 - Comparisons of 2003 and 2005 TCE and PCE Indoor Air Results

		Average TCE				Average PCE			
Building	Sample Pairs	2003	2005	Percent Change	p-value	2003	2005	Percent Change	p-value
250 North	4	0.294	0.079	-73	**0.04**	0.356	0.325	-9	0.3
190 North	4	0.175	0.105	-40	0.3	0.246	0.390	59	**0.004**
140 North	3	0.201	0.104	-48	0.1	0.405	0.497	23	0.7
Combined	11	0.225	0.095	-58	**0.004**	0.329	0.395	20	0.3

Notes:
PCE = tetrachloroethene
TCE = trichloroethene
Bold p-values indicate a significant difference between values

Table 6 - Comparison of Indoor Air Results and Regional Background Data
Phoenix-Goodyear Airport North Superfund Site
Goodyear, Arizona

Sample Locations	September 2003 Sampling		February 2005 Sampling Event	
	TCE µg/m^3	PCE µg/m^3	TCE µg/m^3	PCE µg/m^3
Average Indoor Air and Background Concentrations (1)				
Building 250 North	0.279	0.355	0.076	0.330
Building 190 North	0.175	0.246	0.098	0.386
Building 140 North	0.174	0.357	0.105	0.508
Perimeter & Background Samples	0.339	0.183	0.184	0.413
Local/Regional Ambient Air Data - **Annual Mean (2)**				
Phoenix (33 W Tamarisk Avenue)	0.16	0.37	0.13	0.41
Phoenix (3940 West Broadway Road)	0.16	0.81	0.16	0.44
Phoenix (4530 N 17th Avenue)	0.19	0.98	0.13	1.22
Queen Valley (Pinal County)	0.18	0.37	0.13	0.17
Maximum Indoor Air and Background Concentrations				
Building 250 North	0.435	0.414	0.094	0.350
Building 190 North	0.333	0.359	0.120	0.480
Building 140 North	0.253	0.746	0.130	0.610
Perimeter & Background Samples	0.457	0.244	0.660	0.760
Local/Regional Ambient Air Data - **Quarterly Maximum (3)**				
Phoenix (33 W Tamarisk Avenue)	0.16	1.02	0.13	1.02
Phoenix (3940 West Broadway Road)	0.16	1.02	0.54	1.02
Phoenix (4530 N 17th Avenue)	0.38	3.05	0.13	3.05
Queen Valley (Pinal County)	0.16	0.34	0.13	0.34

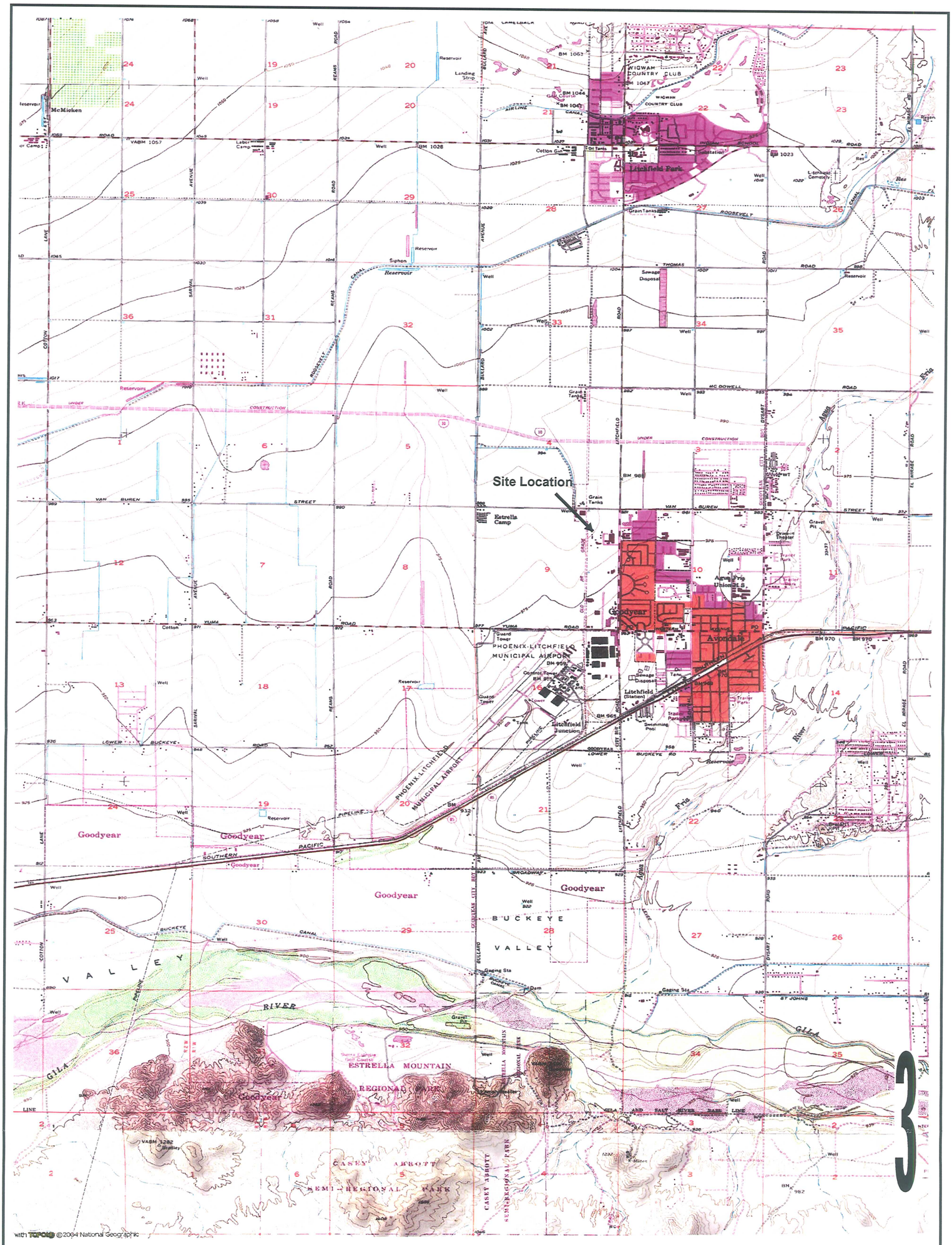
Notes
1. Average values calculated using one-half the detection limit for nondetect results
2. Annual mean for 2003 and 2004, respectively. Data for 2005 not available
3. Quarterly maximum results for Sept 2003 and Feb 2004. Data for 2005 not available.
DCE = dichloroethene
MEK = methyl ethyl ketone (2-butanone)
PCE = tetrachloroethene
TCE = trichloroethene
µg/m^3 = micrograms per cubic meter

Table 7 - Results for VOCs in Indoor Air and Comparison to Tier 2 and 3 Criteria
Phoenix-Goodyear Airport North Superfund Site
Goodyear, Arizona

Sample Locations	September 2003 Sampling Event (1)		February 2005 Sampling Event							
	TCE µg/m^3	PCE µg/m^3	TCE µg/m^3	PCE µg/m^3	1,1-DCE µg/m^3	MEK µg/m^3	Acetone µg/m^3	cis-1,2-DCE µg/m^3	trans-1,2-DCE µg/m^3	Vinyl chloride µg/m^3
Building 250 North										
Chicago Title	0.365	0.373	0.083	0.33	0.020 U	1.5 U	27	0.020 U	0.020 U	0.013 U
Corner Bistro	0.435	0.414	0.094	0.34	0.20 U	1.5 U	75	0.020 U	0.020 U	0.013 U
USAF Recruiter (2)	0.236	0.366	0.072	0.32	0.020 U	1.5 U	19	0.020 U	0.020 U	0.013 U
Whitetank PT	0.140	0.271	0.066	0.31	0.020 U	1.5 U	24	0.020 U	0.020 U	0.013 U
Roof	0.220	0.353	0.066	0.35	0.020 U	1.5 U	6 U	0.020 U	0.020 U	0.013 U
Building 190 North										
COG Reception	0.107	0.237	0.10	0.35	0.020 U	1.5 U	24	0.020 U	0.020 U	0.013 U
COG Break Rm (2)	0.333	0.190	0.088	0.34	0.020 U	1.5 U	24	0.020 U	0.020 U	0.013 U
COG Bldg Safety	0.129	0.359	0.12	0.48	0.20 U	3.6	34	0.020 U	0.020 U	0.013 U
COG Finance	0.129	0.197	0.11	0.39	0.020 U	1.5 U	19	0.020 U	0.020 U	0.013 U
Roof			0.072	0.37	0.020 U	1.5 U	13	0.020 U	0.020 U	0.013 U
Building 140 North										
Medical Admin (east end) (2)	0.177	0.210	0.083	0.45	0.020 U	3	21	0.020 U	0.020 U	0.013 U
Radiology (2)	0.172	0.258	0.13	0.61	0.20 U	28	31	0.020 U	0.020 U	0.013 U
Doctor Suite 101	0.253	0.746	0.10	0.43	0.020 U	3.6	60	0.020 U	0.020 U	0.013 U
Roof - East	0.129	0.190	0.11	0.58	0.20 U	1.5 U	14	0.020 U	0.020 U	0.013 U
Roof - West	0.140	0.380	0.10	0.47	0.020 U	1.5 U	13	0.020 U	0.020 U	0.013 U
Perimeter & Background Samples										
Fenceline	0.269	0.149	0.072	0.29	0.020 U	1.5 U	6 U	0.020 U	0.020 U	0.013 U
Main Treatment System			0.66	0.3	0.020 U	1.5 U	6 U	0.020 U	0.020 U	0.013 U
Courtyard	0.457	0.244	0.13	0.45	0.20 U	1.5 U	17	0.020 U	0.020 U	0.013 U
MW-07	0.290	0.156	0.15	0.55	0.20 U	1.5 U	6 U	0.020 U	0.020 U	0.013 U
RR tracks and Yuma Road			0.22	0.76	0.20 U	1.5 U	23	0.020 U	0.020 U	0.013 U
Van Buren & Dysart			0.001 U	0.20 U	0.013	1 U	20 U	0.61	0.0014 U	0.013 U
Van Buren & Litchfield			0.055	0.44	0.20 U	1.5 U	19	0.020 U	0.020 U	0.013 U
EPA Region 9 PRGs										
Ambient air PRG (3)	0.017	0.32	0.017	0.32	210	5,100	3,300	37	73	0.11
Provisional PRG for commercial worke	0.048	NA	0.048	NA	NA	NA	NA	NA	NA	NA
CAL-modified PRG	0.96	NA	0.96	NA	NA	NA	NA	NA	NA	NA
Occupational RBC	4.5	1.5	4.5	1.5	560	13,760	8,840	98	197	2

Notes
1. Measured values converted to ug/m^3 as reported by Geomatrix Consultants, Inc., Air Sampling Report-December 2003
2. Samples were from locations that varied from the September 2003 sample event.
3. All residential exposure pathways are incomplete. Values provided, but not applicable for decision making purposes
DCE = dichloroethene
MEK = methyl ethyl ketone (2-butanone)
PCE = tetrachloroethene
TCE = trichloroethene
U = chemical was not detected, reporting limit is presented
µg/m^3 = micrograms per cubic meter

FIGURES



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Property Location Map

Phoenix-Goodyear Airport-North Superfund Site
Goodyear, Arizona

Figure
1

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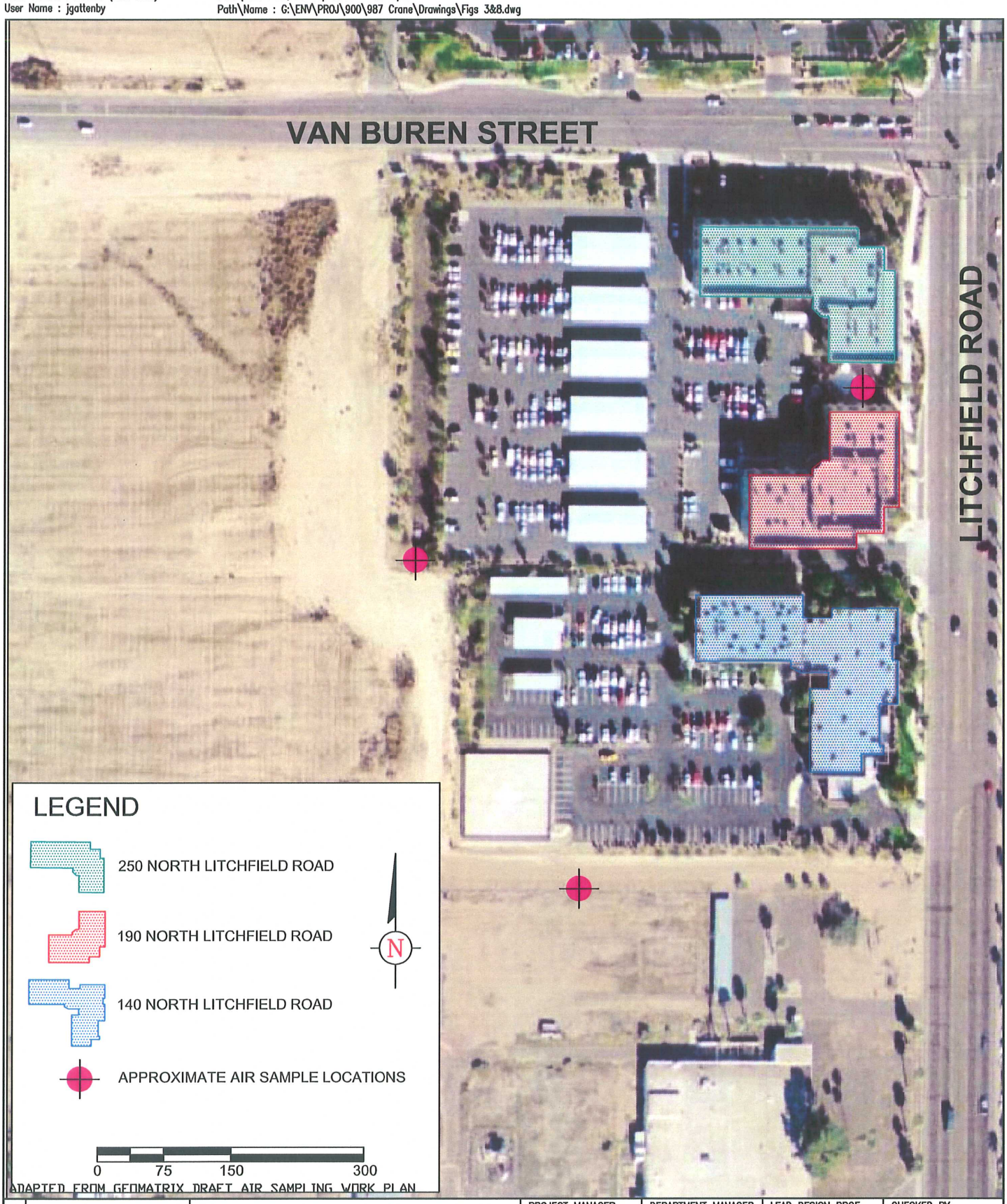

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R. MONGRAIN	R. MONGRAIN	D. KUDLICKI	R. JONES
BUILDING LOCATIONS AND PERIMETER AIR QUALITY SAMPLING LOCATIONS		TASK/PHASE NUMBER PLAN.0001	DRAWN BY D. KUDLICKI
		PROJECT NUMBER AZ000987	FIGURE 2

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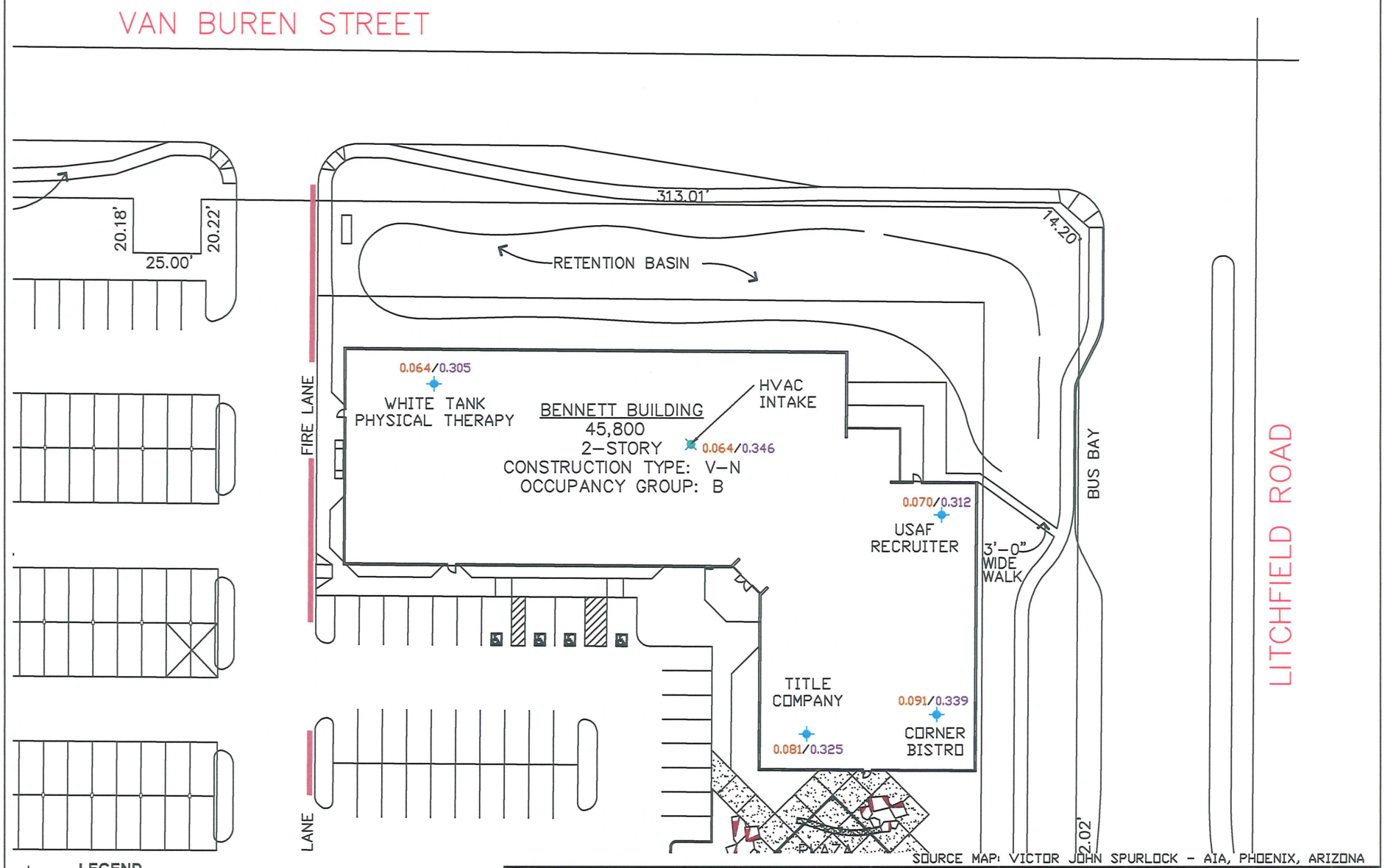

SOURCE MAP: VICTOR JOHN SPURLOCK - AIA, PHOENIX, ARIZONA

LEGEND

- APPROXIMATE FIRST FLOOR INDOOR AIR SAMPLE LOCATIONS
- APPROXIMATE ROOF TOP AIR SAMPLE LOCATIONS (ROOF)
- 0.064/0.305 TCE/PCE CONCENTRATIONS IN ug/m3

N

0 25' 50'
SCALE: 1 INCH = 50 FEET

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AIR QUALITY
SAMPLING LOCATIONS
250 NORTH LITCHFIELD ROAD

PROJECT MANAGER	DEPARTMENT MANAGER	LEAD DESIGN PROF.	CHECKED BY
R. MONGRAIN	R. MONGRAIN	D. KUDLICKI	R. MONGRAIN
		TASK/PHASE NUMBER	DRAWN BY
		TASK/PHASE NUMB	D. KUDLICKI
		PROJECT NUMBER	FIGURE
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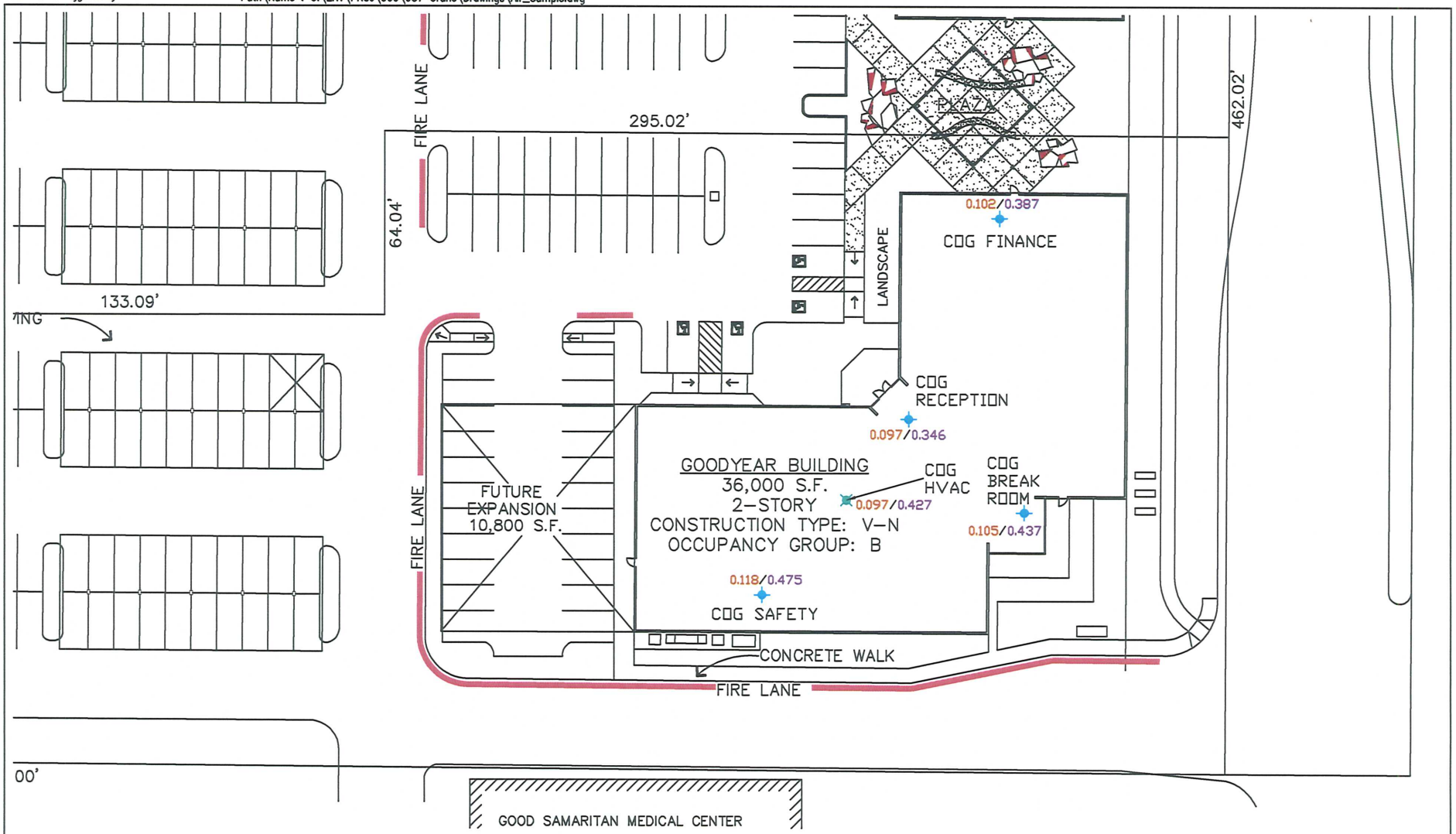

LEGEND

- APPROXIMATE FIRST FLOOR INDOOR AIR SAMPLE LOCATIONS
- APPROXIMATE ROOF TOP AIR SAMPLE LOCATIONS (ROOF)
- 0.064/0.305 TCE/PCE CONCENTRATIONS IN ug/m3

N

0 25' 50'
SCALE: 1 INCH = 50 FEET

SOURCE MAP: VICTOR JOHN SPURLOCK - AIA, PHOENIX, ARIZONA

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AIR QUALITY
SAMPLING LOCATIONS
190 NORTH LITCHFIELD ROAD

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R. MONGRAIN	R. MONGRAIN	D. KUDLICKI	R. MONGRAIN
		TASK/PHASE NUMBER	DRAWN BY
		TASK/PHASE NUMB	D. KUDLICKI
		PROJECT NUMBER	FIGURE
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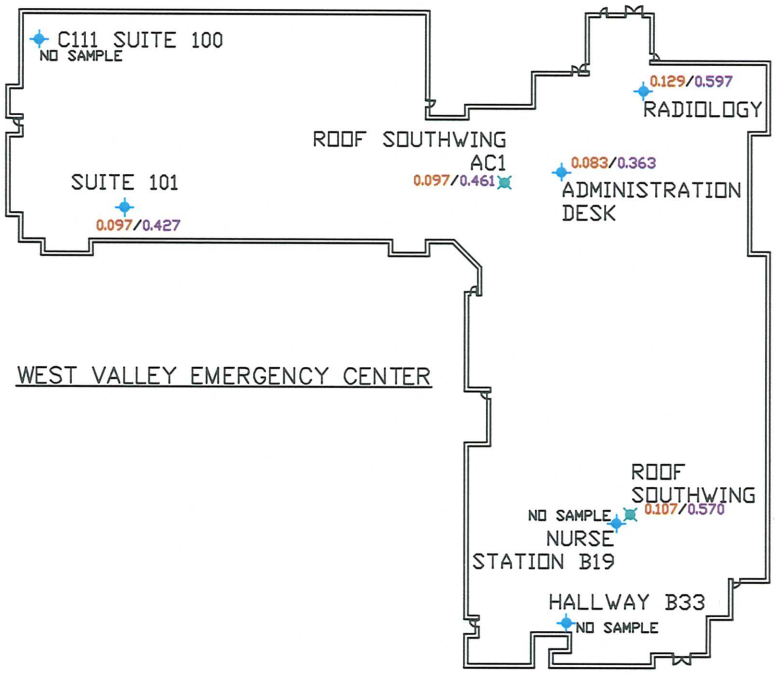

LEGEND

APPROXIMATE FIRST FLOOR INDOOR AIR SAMPLE LOCATIONS

APPROXIMATE ROOF TOP AIR SAMPLE LOCATIONS (ROOF)

0.064/0.305 TCE/PCE CONCENTRATIONS IN ug/m3

N

0 25' 50'

SCALE: 1 INCH = 50 FEET

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R. MONGRAIN	R. MONGRAIN	D. KUDLICKI	R. MONGRAIN
AIR QUALITY SAMPLING LOCATIONS 140 NORTH LITCHFIELD ROAD		TASK/PHASE NUMBER TASK/PHASE NUMB	DRAWN BY J. SPITZINGER
		PROJECT NUMBER AZ000987	FIGURE 5

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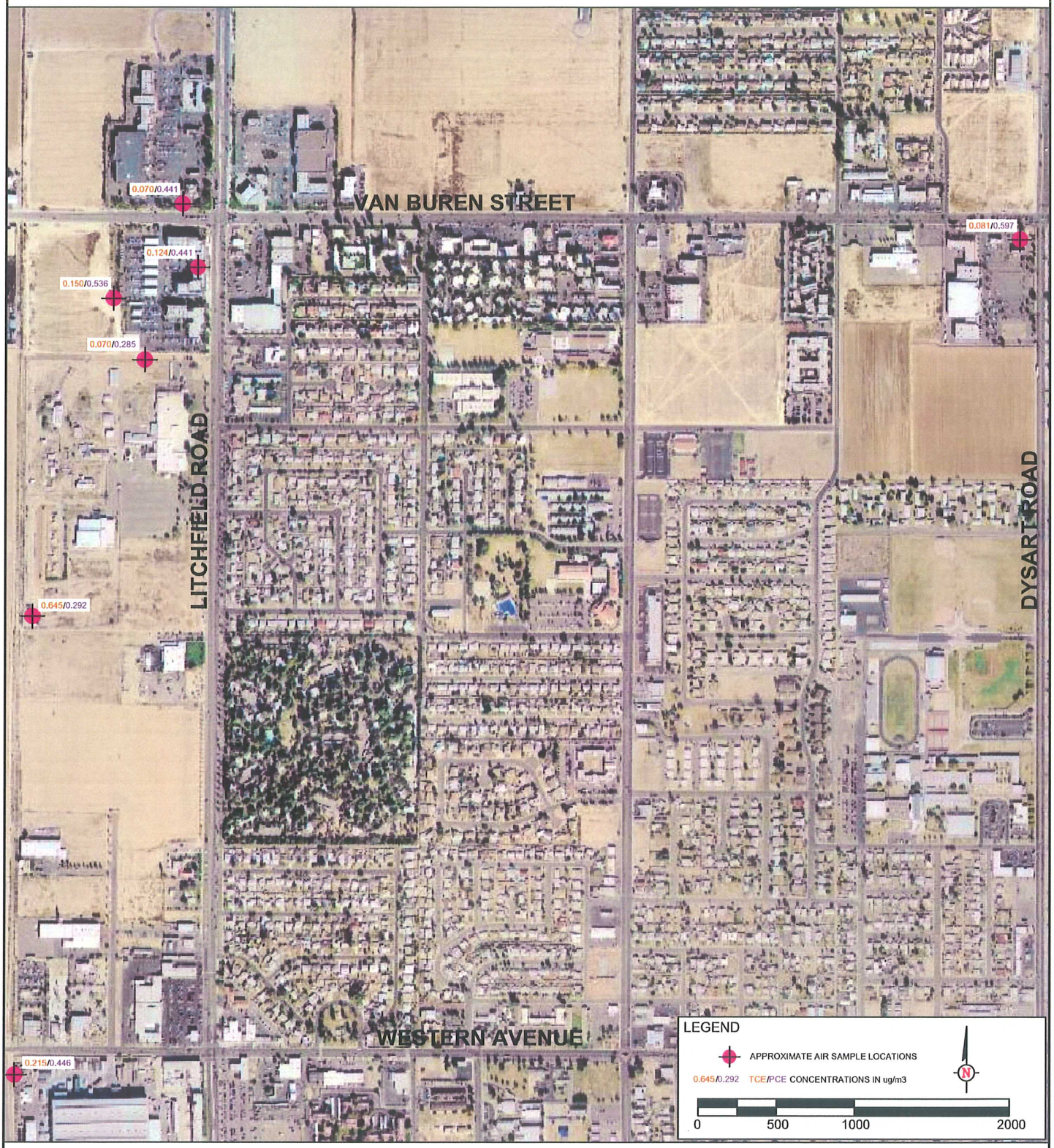

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R. MONGRAIN	R. MONGRAIN	D. KUDLICKI	R. JONES
BACKGROUND AIR SAMPLING LOCATIONS		TASK/PHASE NUMBER PLAN.0001	DRAWN BY D. KUDLICKI
		PROJECT NUMBER AZ000987	FIGURE 6