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REDFIELD RIFLE SCOPES: A CASE HISTORY

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- **Colorado Department of Public Health and Environment**
- **August 2000**

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INDOOR AIR IMPACT FROM RELEASES AT THE REDFIELD RIFLE SCOPE FACILITY

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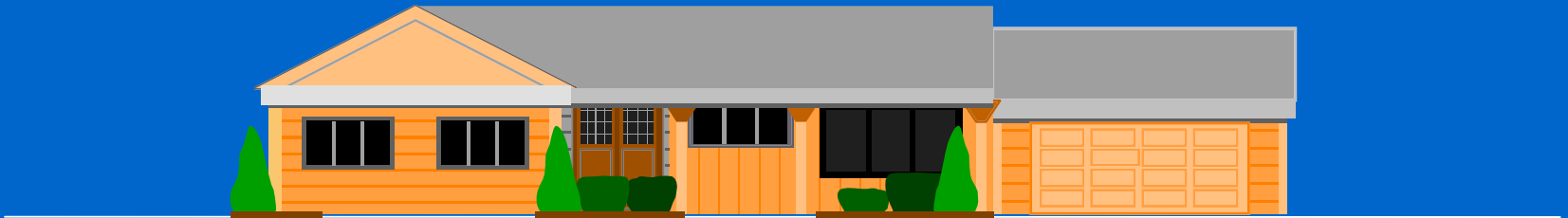
- **WHERE VOC CONTAMINATION HAS MOVED FROM GROUND WATER INTO RESIDENCES VIA THE VAPOR PATHWAY.**

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THE PROBLEM:

GROUND WATER PLUME

**NO DRINKING WATER
TARGETS**



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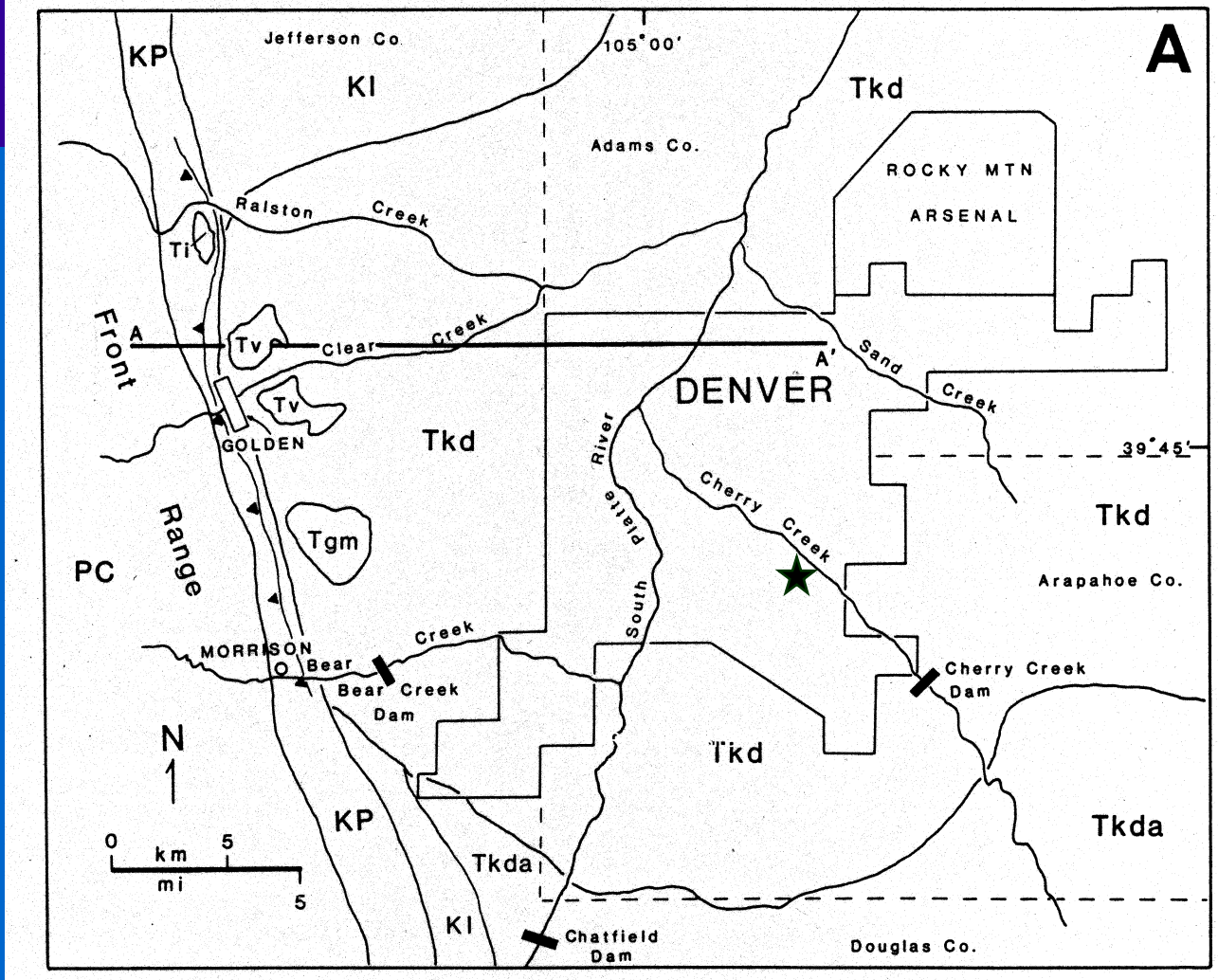
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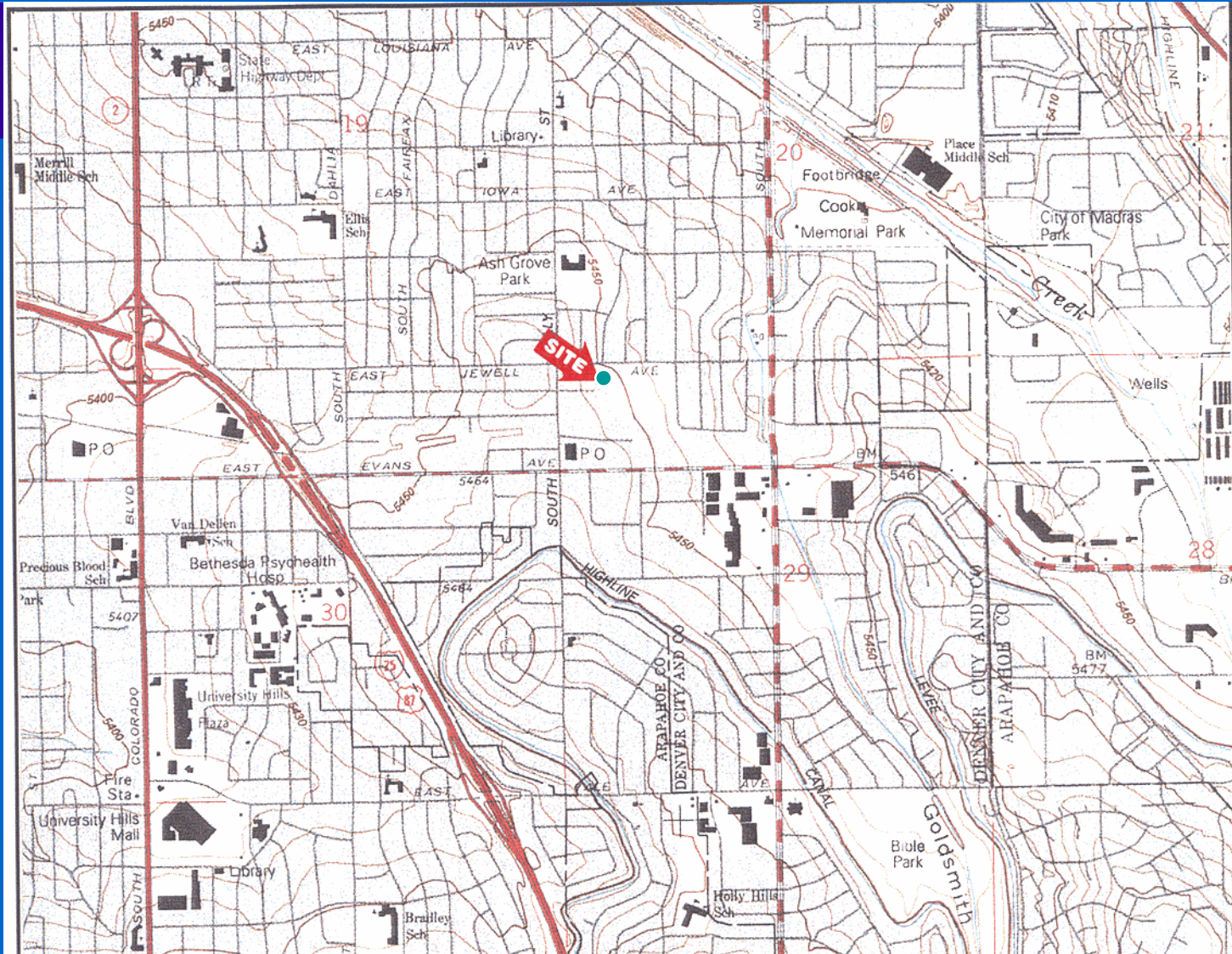
• FACILITY SETTING

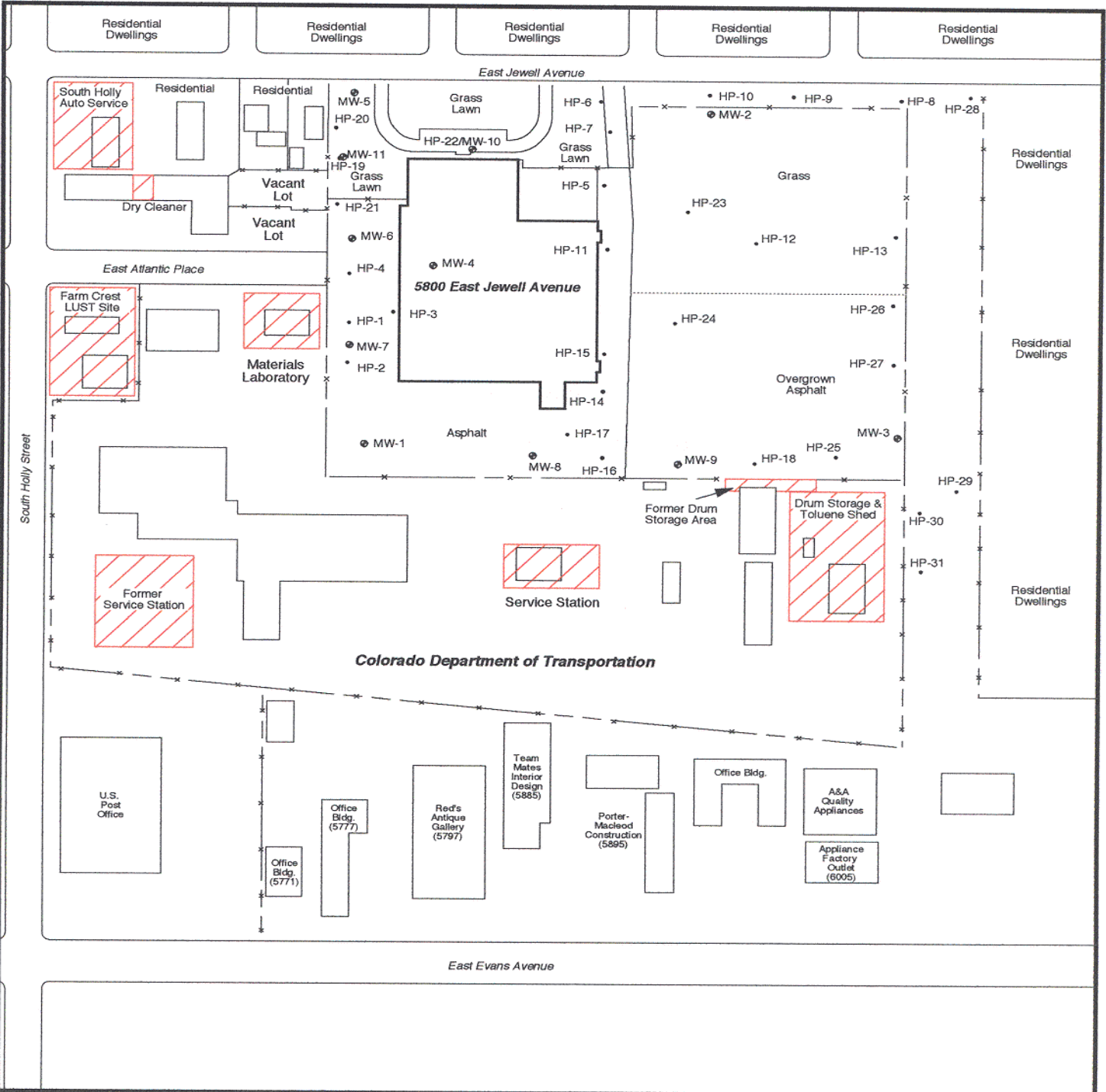


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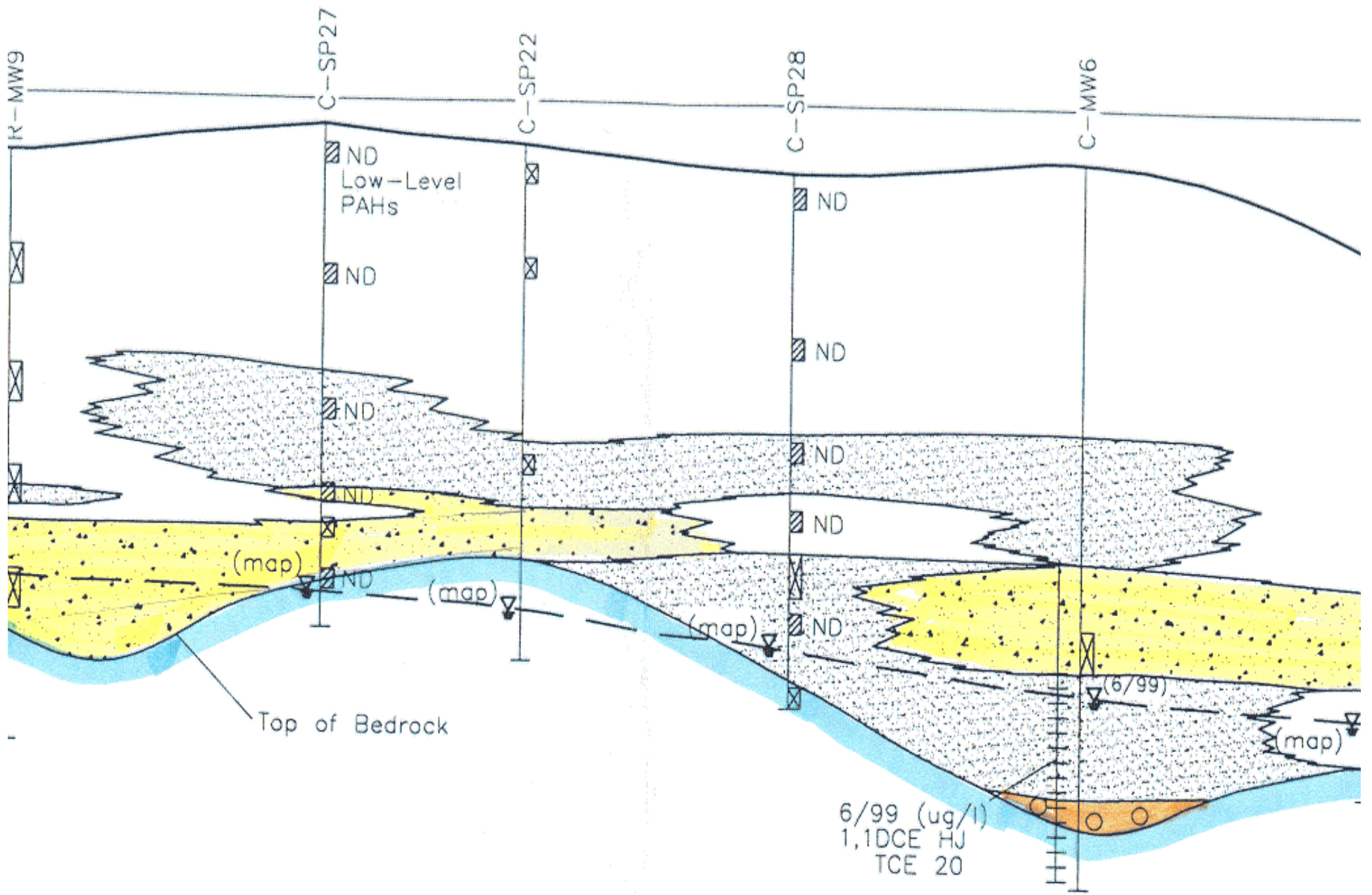
FACILITY HISTORY

- **Built in 1957 as a light manufacturing facility**
- **manufactured metal and optical parts from the mid-1960s.**
- **Used chlorinated solvents for metal cleaning.**
- **Ground water contamination found in 1993.**

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•GEOLOGY

- **10 TO 30 FEET OF WIND AND STREAM DEPOSITS OVER BLOCKY MUDSTONE AND SILTSTONE.**
- **FRACTURED AND PARTED.**
- **SEDIMENTS BECOME CHEMICALLY REDUCING WITH DEPTH.**
- **GROUND WATER AT 20 TO 30 FEET BGS.**



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AIR SAMPLING METHOD



- **SUMMA CANISTER**
- **EPA Method TO- 15**
- **High Resolution**
- **Selective Ion Monitoring**

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CHEMICALS OF CONCERN

**ORIGINAL
CHEMICALS
RELEASED**

**BREAKDOWN OR
TRANSFORMATION
PRODUCTS**

Trichloroethene

1,1,1 - Trichloroethane

Tetrachloroethene

1,1 - Dichloroethene

1,1 - Dichloroethane

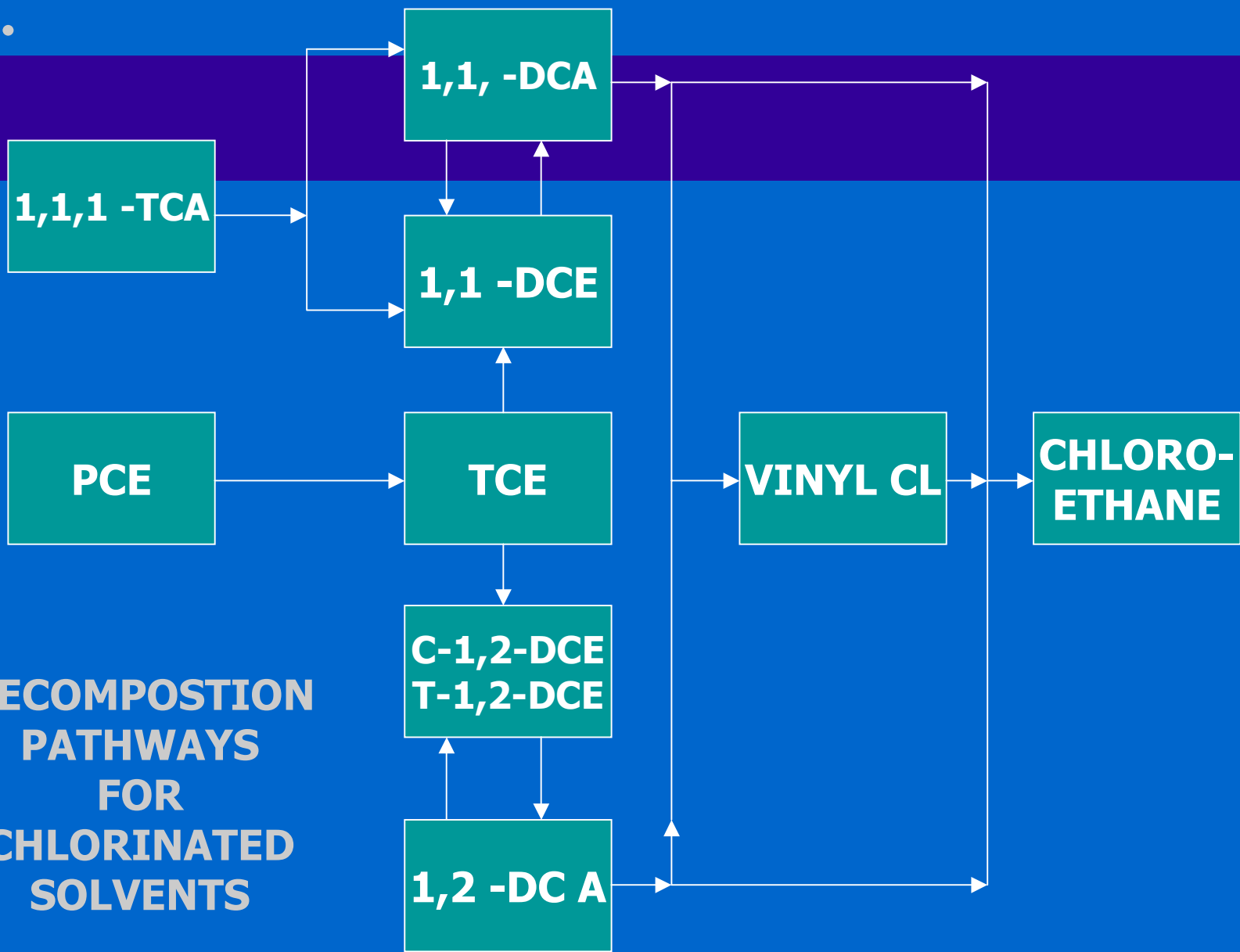
1,2 - Dichloroethane

Vinyl Chloride

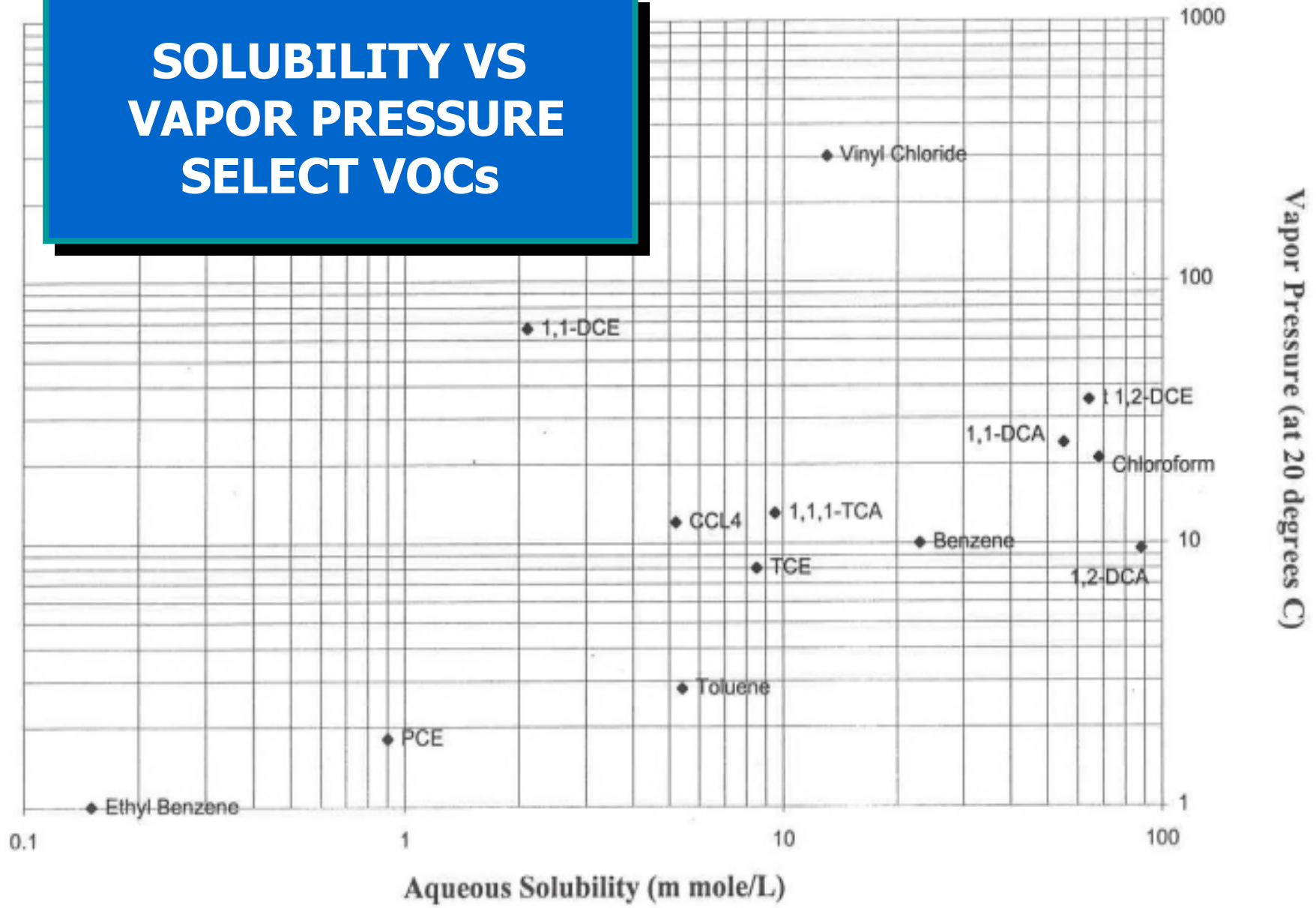
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DECOMPOSITION
PATHWAYS
FOR
CHLORINATED
SOLVENTS



SOLUBILITY VS VAPOR PRESSURE SELECT VOCs



CHRONIC EXPOSURE

AIR BENCHMARKS

AT 10⁻⁵ RISK LEVEL

<u>SUBSTANCE</u>	<u>*ug/M³</u>	<u>PPB</u>
PCE	43	6.35
TCE	14	2.61
1,1 - DCE	0.49	0.12
1,2 - DCA	0.94	0.23
Vinyl Chloride	0.29	0.11
Methylene Chl	3.1	0.89

$$*ug/M^3 = \frac{ppb \times MW}{24.45}$$

24.45

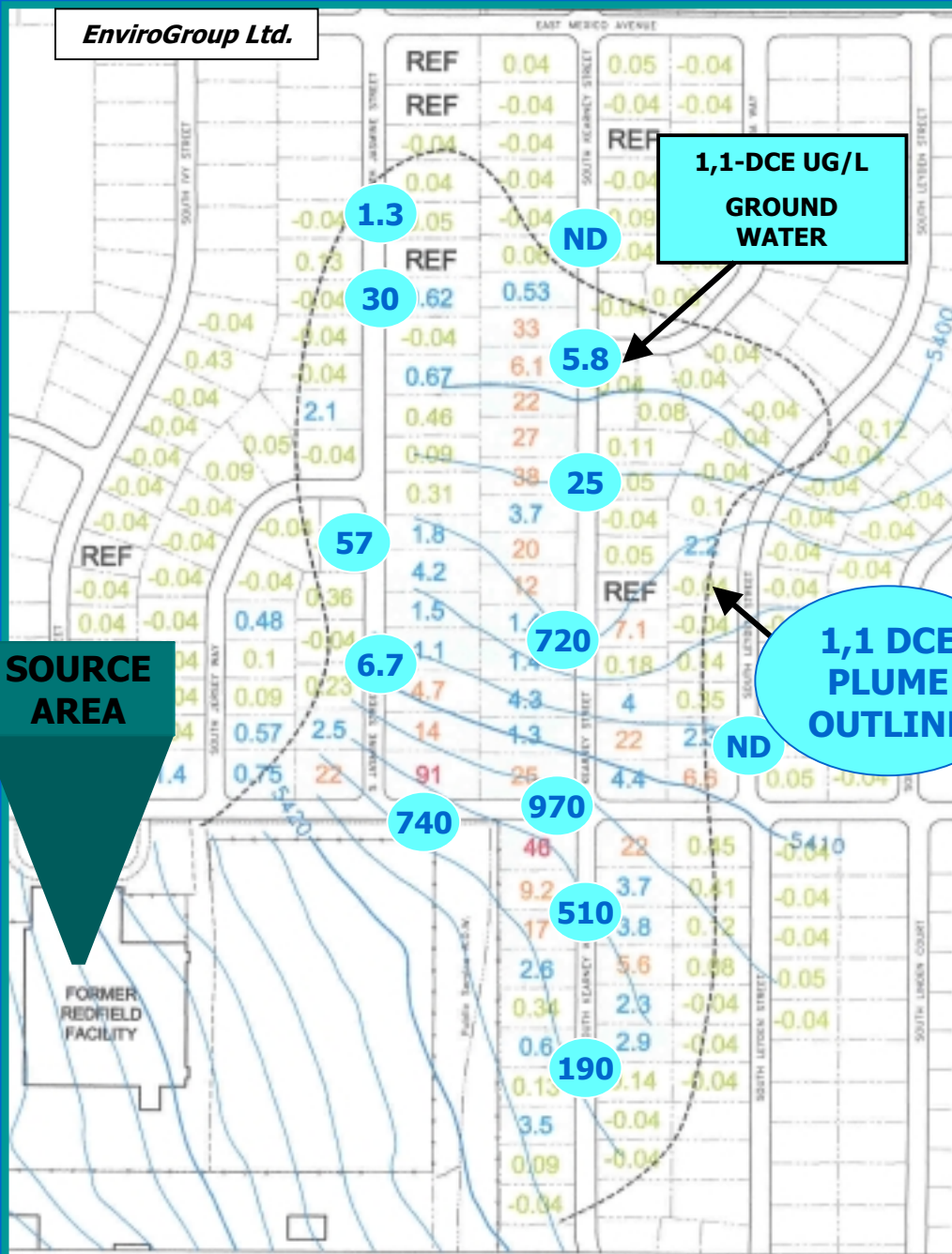
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FINDINGS



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REDFIELD SITE

170 HOMES TESTED

DEPTH TO GW >20'

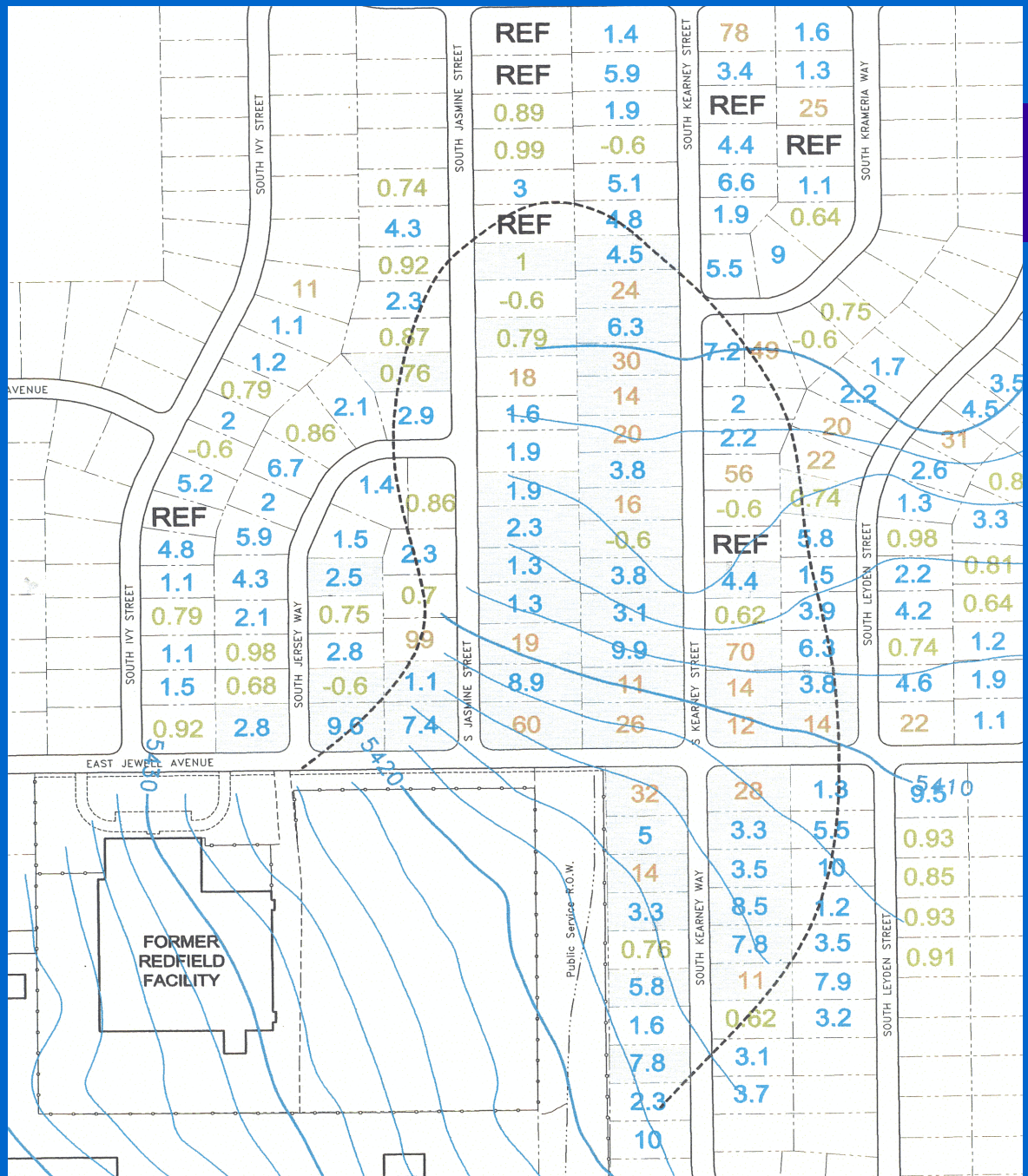
62 REMEDIATION SYSTEMS INSTALLED IN SINGLE FAMILY HOMES

SOURCE AREA

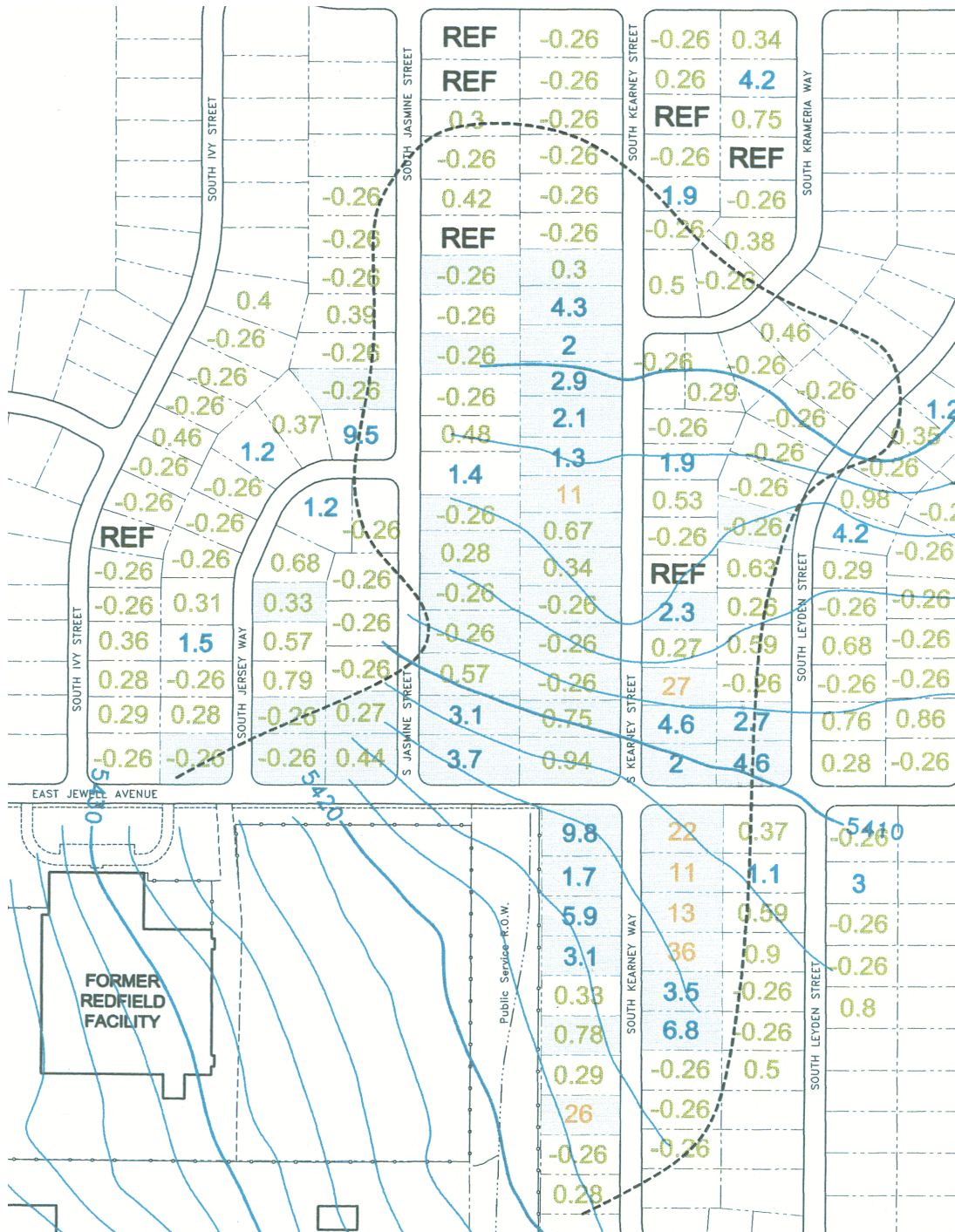
1,1-DCE UG/L GROUND WATER

1,1 DCE PLUME OUTLINE

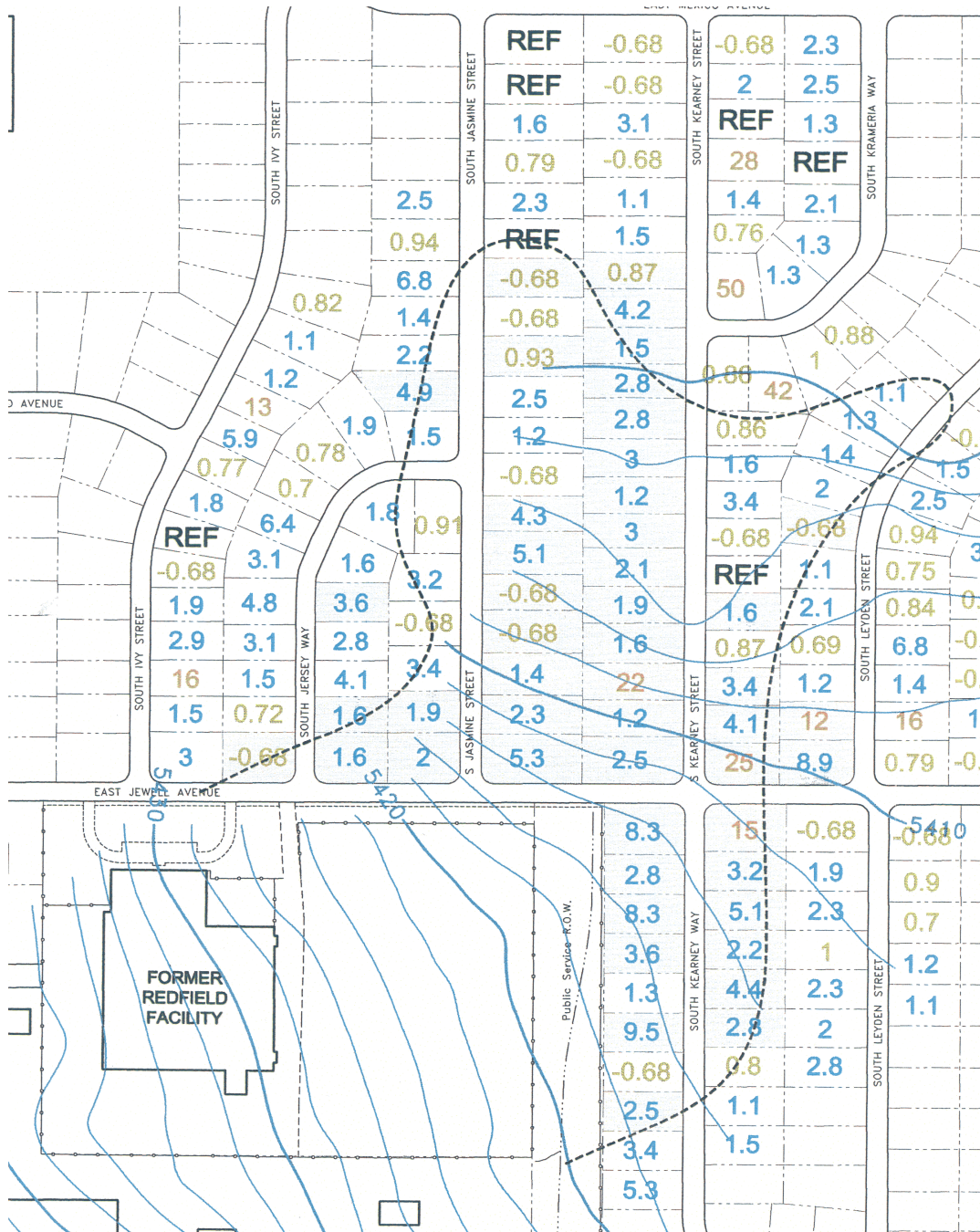
INDOOR AIR
1,1-DCE UG/M³
RED > 45
ORANGE 4.6 TO 45
BLUE 0.46 TO 4.5



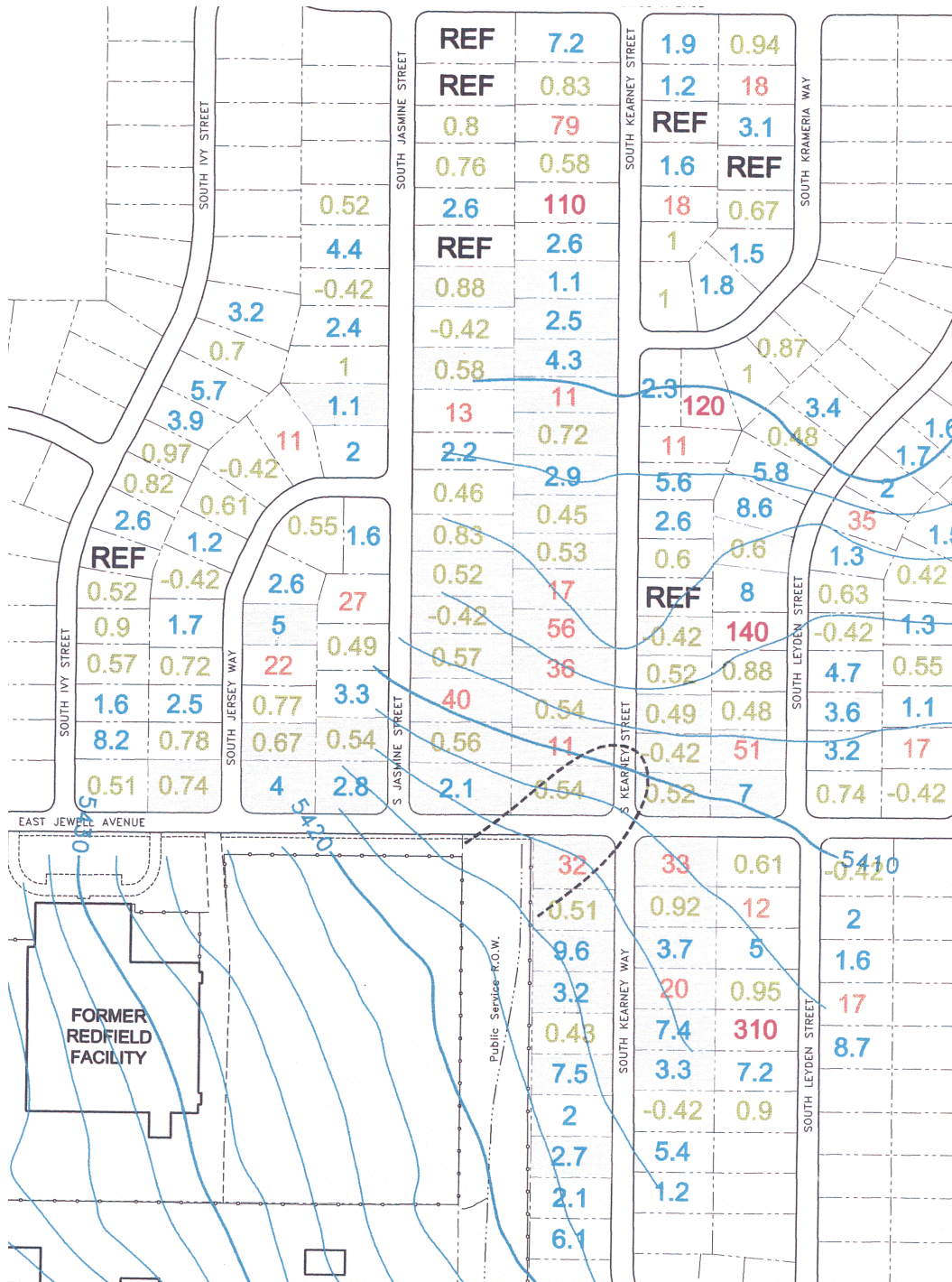
- 1,1,1-TCA
- Initial indoor air concentrations



- TCE
- Initial Indoor-Air Concentrations

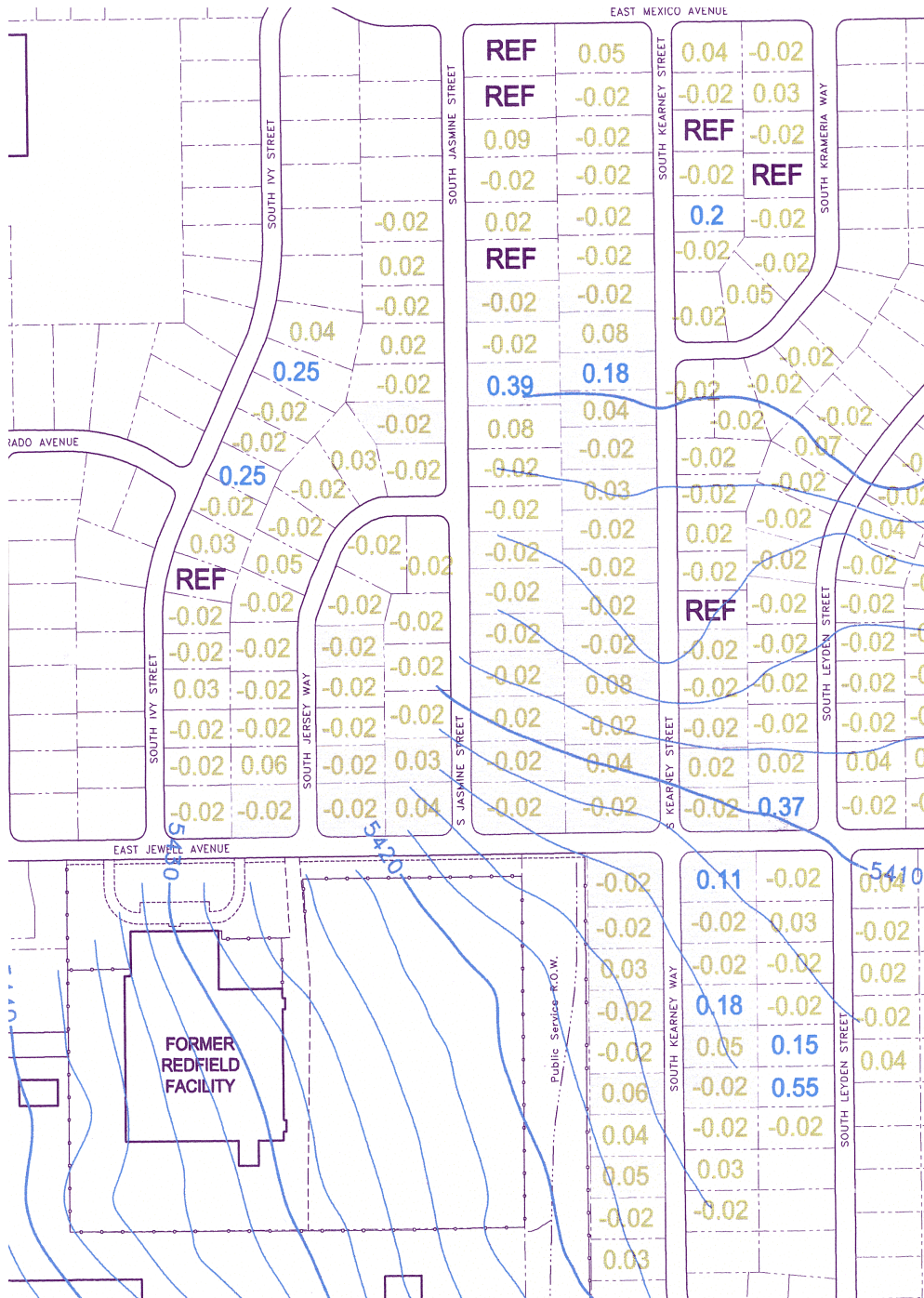


- PCE
- Initial Indoor-Air Concentrations



• METHYLENE CHLORIDE

• Initial Indoor-Air Concentrations



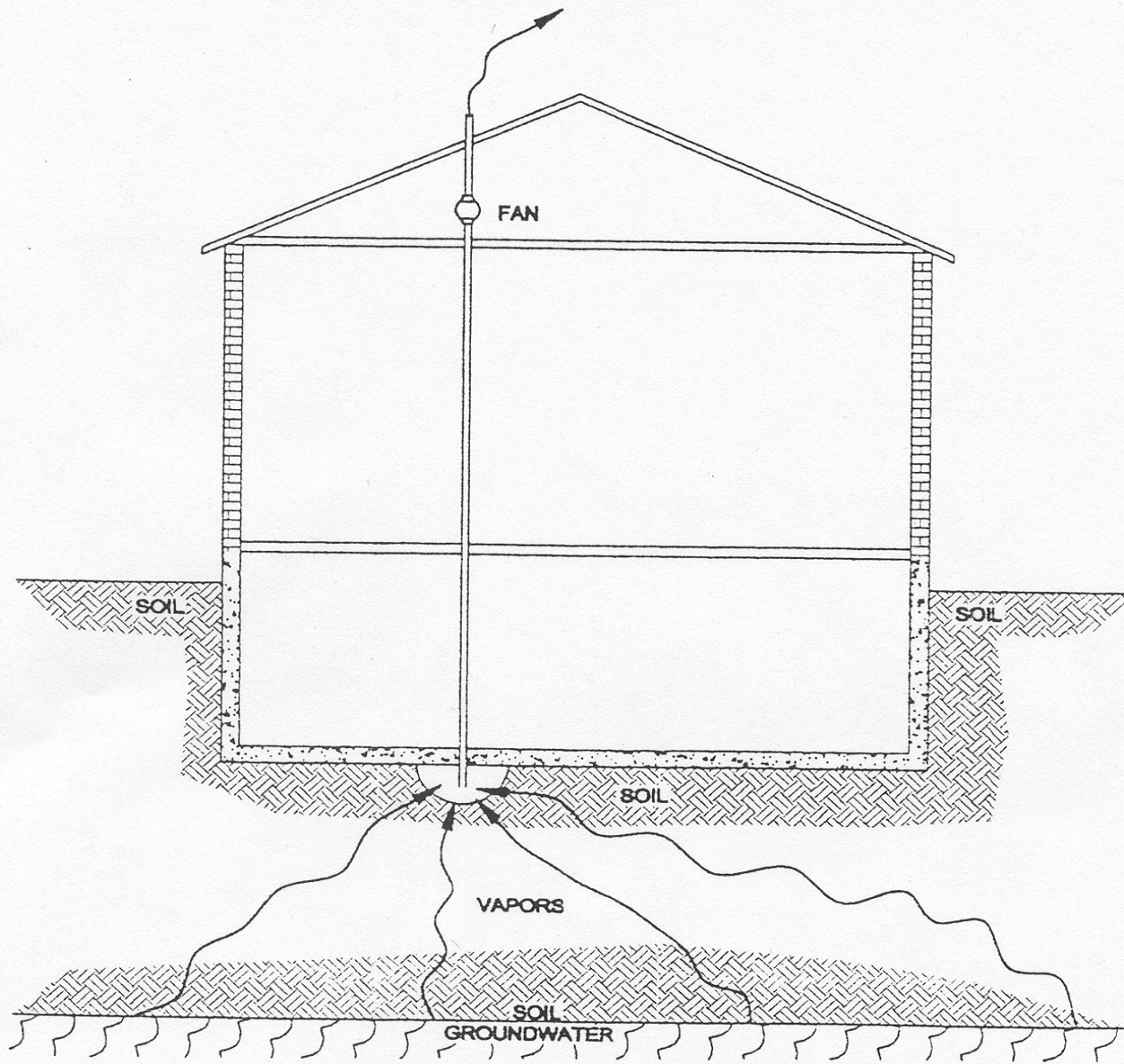
• VINYL CHLORIDE

• Initial Indoor-Air Concentrations

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MITIGATION SYSTEM

- **RADON ABATEMENT SYSTEM**
- **CREATE A LOW PRESSURE ZONE BELOW THE HOUSE EITHER THROUGH SUB-SLAB OR SUB-GRADE DE-PRESSURIZATION.**



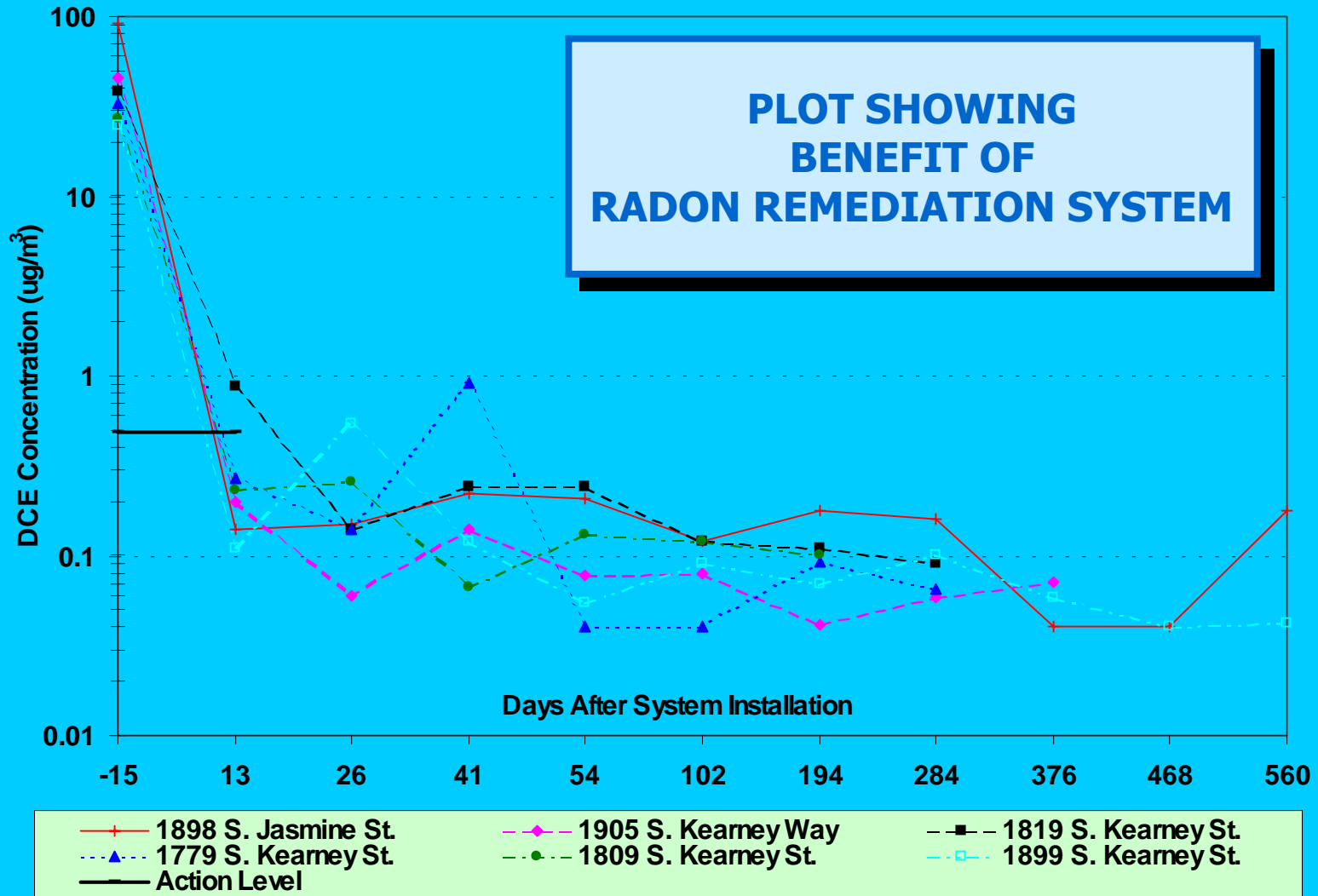
INTAKE IN BASEMENT

FAN IN ATTIC

REDFIELD SITE

REDFIELD IAQ TEST DATA
INITIAL DCE = >24 UG/M3

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COMMUNITY INVOLVEMENT

- **There is inherent community interest.**
- **Organize the means of communication**
- **Name and advertise the Company contact and the regulator.**
- **Have regular public information meetings and newsletters. Use neighborhood associations.**

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VERIFICATION MONITORING

- **HOUSES WITH MITIGATION SYSTEMS ARE SAMPLED QUARTERLY, AT LEAST, TO DEMONSTRATE MITIGATION SYSTEM EFFECTIVENESS.**

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BOUNDARY MONITORING

- **HOUSES ADJACENT TO IMPACTED HOMES ARE ALSO TESTED QUARTERLY, SEMI-ANNUALLY, OR ANNUALLY DEPENDING ON GROUND WATER FLOW DIRECTION AND SEVERITY OF THE LOCAL CONTAMINATION.**

OBSERVATIONS

- General correlation with ground water but not reliable on house specific basis
- Modeling is not reliable
- Correlation with soil gas inconclusive
- Action level of 0.49 ug/M³ for 1,1-DCE can be exceeded with GW conc. below 10 ug/L
- Impacts where water table deeper than 20 feet.
- Radon Type Systems offer effective remedy

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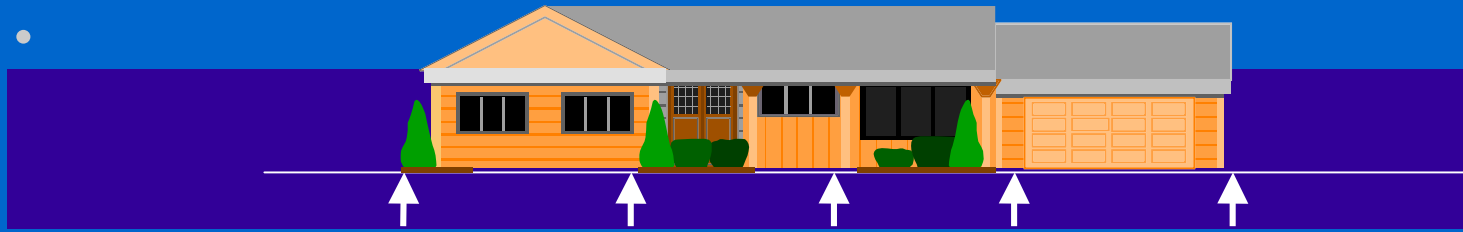
EXPOSURE CAN OCCUR WHEN...

CONVENTIONAL THINKING...

- **Very High Concentrations or Product in GW**
- **Very Shallow GW**
- **Basements & Crawl Spaces**

DATA SUGGESTS...

- **Moderate to Low Concentrations - Dissolved Phase**
- **Shallow to Moderately Deep Ground Water**
- **Any Construction**



GROUND WATER PLUME

CONCLUSION

- VOC Ground Water plumes result in actual impacts to indoor air
- Site Assessment should address the indoor air pathway



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•END OF REDFIELD PRESENTATION



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