CIMARRON CORPORATION

P.O. BOX 25861 • OKLAHOMA CITY, OKLAHOMA 73125

S. JESS LARSEN
VICE PRESIDENT

October 6, 1998

Mr. Ken Kalman, Project Manager
Facilities Decommissioning Section
Low-Level Waste & Decommissioning Projects Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Re: Docket No. 70-925; License No. SNM-928
Response to NRC Comment Regarding Residential Inhalation Dose from Concrete Rubble in Sub-Area "F"

Dear Mr. Kalman:

Attached please find our response to the NRC Staff Comment that was transmitted to us by your letter dated September 10, 1998.

We have provided a dose assessment for an on-site resident, as requested. Even with the unrealistic compounding of several ultra conservative assumptions, the potential inhalation dose for each of the three assumed on-site residence locations is less than 1 mrem/year. As this is the last remaining issue concerning the concrete in Sub-Area "F", we look forward to prompt NRC Staff approval for release of the Subarea "F" concrete rubble.

Please feel free to contact me if there are any additional questions or concerns.

Sincerely,

Jess Larsen

Jess Larsen
Vice President

Enclosures (4)
jl100698.le1

SEE RPTS

1/1

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PDR ADOCK 07000925
C PDR

140147

CIMARRON CORPORATION LETTER OF TRANSMITTAL

DATE: 10/07/98

TO: **U.S. Nuclear Regulatory Commission**
Washington, DC 20555
Attention: Document Control Desk

FROM: **Mickey Hodo, Quality Assurance Manager**
Cimarron Corporation
P.O. Box 315
Crescent, OK 73028

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☐ Overnight--Fed Ex ☐ UniShippers ☐ Second Day Air--UPS
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COPY NO.	DATE	DESCRIPTION
1	10/06/98	Response to NRC Comment Regarding Residential Inhalation Dose from Concrete Rubble in Sub-Area "F". Docket No. 70-925; License No. SNM-928

These are transmitted as checked below:

☐ For Approval ☐ Approved as submitted ■ For your use
☐ As requested ☐ Returned for corrections ☐ Return ____ corrected prints
☐ Disapproved ☐ For review and comment ☐ Controlled Copy

REMARKS The above items are for your use. Please sign and return transmittal letter to me.

NOTE:

SIGNATURE: Mickey Hodo

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CIMARRON CORPORATION LETTER OF TRANSMITTAL

DATE: 10/07/98

TO: **M r. Ken Kalman, Project Manager**
Low Level Waste & Decommissioning Project Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
MAIL DROP T2F27

FROM: **Mickey Hodo, Quality Assurance Manager**
Cimarron Corporation
P.O. Box 315
Crescent, OK 73028

☐ First Class Mail ☐ Internal ☐ Overnight--UPS
☐ Overnight--Fed Ex ☐ UniShippers ☐ Second Day Air--UPS
☐ Second Day--Fed Ex ■Other **Certified Mail** ☐ UPS---Ground

COPY NO.	DATE	DESCRIPTION
2	10/06/98	Response to NRC Comment Regarding Residential Inhalation Dose from Concrete Rubble in Sub-Area "F". Docket No. 70-925; License No. SNM-928
		SEE ABOVE

These are transmitted as checked below:

☐ **For Approval** ☐ **Approved as submitted** ■ **For your use**
☐ **As requested** ☐ **Returned for corrections** ☐ **Return ____ corrected prints**
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REMARKS **The above items are for your use. Please sign and return transmittal letter to me.**

NOTE:

SIGNATURE Mickey Hodo

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PRINTED NAME OF RECIPIENT: Ken KALMAN

SIGNATURE OF RECIPIENT: Ken Kalman

DATE RECEIVED: 10/14/98

220013

Resident Inhalation Dose Scenario

The resident inhalation dose scenario assumes that reference man breathes airborne radioactive materials resuspended from concrete rubble located in Sub-Area "F". This scenario also assumes that the individual has a residence which is located in the plume centerline at potential residential sites located at the edge of the special flood hazard area (980 foot elevation). The concrete rubble was evaluated using techniques presented by D. Bruce Turner in "Workbook of Atmospheric Dispersion Estimates"[1]. The modeling allows for a considerable reduction in calculational effort, and provides an upper bound estimate of annual dose rate to a hypothetical resident. Calculations and supporting information are provided in this evaluation to demonstrate that the annual dose rate to potential future residents in areas near the concrete will be insignificant.

Dose Model Description

When viewed from above, the concrete rubble in Sub-Area "F" has an irregular "footprint", as shown in Drawing No. 98FCRS. Due to the irregular shape, a model was developed, incorporating calculational techniques presented by D. Bruce Turner[1], to simplify the evaluation and to streamline the required calculations. The concrete rubble was modeled as two square sources measuring 35 m x 35 m on each side, as shown in Drawing No. 98FCRS. The total source term for the concrete rubble was calculated as previously described in Cimarron's submittal dated June 15, 1998[2], as summarized below. The total emission source term was then evenly divided between the two square source areas (i.e., Source Area #1 (S_1) and Source Area #2 (S_2)). Three locations were selected for potential future residences based upon construction potential and wind direction.

The calculational techniques provided by Turner[1] offers a method for treating a large area with multiple sources as an area containing a single point source having an initial horizontal standard deviation, σ_{y0}. Turner[1] states that:

> "A virtual distance, x_y, can then be found that will give this standard deviation. This is just the distance that will yield the appropriate value for σ_y from Table 3.2. Values of x_y will vary with stability. Then equations for point sources may be used, determining σ_y as a function of $x + x_y$, a slight deviation of the Suggestion by Holland (1953). This procedure treats the area source as a cross-wind line source with a normal distribution, a fairly good approximation for the distribution across an area source. The initial standard deviation can be approximated by $\sigma_{y0} \approx s/4.3$, where s is the length of a side of the area...".

Assumptions

1. The average concentration of total uranium in the uppermost 1/8 inch layer of concrete is approximately 140 pCi/g. This is equivalent to the average concentration previously calculated for the 6 inch layer of concrete rubble, and is based upon the

random sample results (i.e., 2.9 pCi/g multiplied by a factor of 48) to account for the fact that all of the activity is being concentrated in the uppermost layer[2,3].

2. The concrete will weather at a rate equivalent to marble, or 10 mm in 150 years[2,4]. The weathering rate is time independent.
3. The estimated surface area of the concrete in Sub-Area "F" is 3,350 m^2, based upon 134 grid areas with 25 m^2 of surface area[2,3].
4. All of the weathered material is respirable and becomes airborne.
5. The density of the concrete rubble is 1.8 g/cm^3.
6. The Stability Class is Class D, based upon actual site average weather conditions[2].
7. The average wind speed, u, is 5.6 m/s based upon Cimarron wind rose data from Oklahoma City WSFO Airport, Station ID 723530, 1945-1990 (See Attachment 1).
8. The potential future resident is located at the edge of the special flood hazard area, which is at an elevation of approximately 980 feet msl[5] (See Attachments 2 and 5).
9. The emission is from two point sources located at the center of Source Area #1 (S_1) and Source Area #2 (S_2), as shown in Drawing #98FCRS.
10. The Dose Conversion Factor (DCF) for total uranium $\approx DCF_{238} \approx DCF_{235} \approx DCF_{234}$ = 3.58 E-05 Sv/Bq (Class Y).[6]
11. The breathing rate is 1.2 m^3/h for the resident during all activities (indoors and outdoors, including gardening).
12. The resident spends 100% of his/her time in the immediate vicinity of the residence.
13. No source reduction factor (e.g., due to filtration/dust control) is assumed for indoor activities.
14. Wind blows from each source (S_1 and S_2) directly toward the residence of interest with a frequency which was determined by summing all possible wind frequencies, as given in Attachment 1. This assumption adds conservatism to the calculations. Wind frequencies and totals used in the calculations are summarized in Attachment 3.

Potential Future Residence Locations

Contiguous areas to the North, South, and West of the concrete rubble are within the Special Flood Hazard Area (Zone A) as shown in Attachment 2. Consequently, these areas do not contain areas suitable for building. Assistance was obtained from the Logan County Conservation District and the United States Department of Agriculture-Natural Resources Conservation Service, in determining the estimated upper elevation of the Special Flood Hazard Area as shown on Attachment 2, as well as the associated construction requirements.

Mrs. Kathy Schmidt of the Logan County Conservation District provided the information contained in Attachment 4 concerning requirements to be met prior to building in or adjacent to a Special Flood Hazard Area. For residential structures, the lowest floor (including the basement) is required to be elevated at or above the base flood elevation. In addition, a certification is required from a registered engineer, architect, or land surveyor, that the lowest floor elevation is at or above the 100 year base flood elevation. When building in or adjacent to a Special Flood Hazard Area, the landowner would be required to perform an engineering study to specifically identify the 100 year base flood

elevation for the area of construction. These studies have not been performed in the vicinity of the concrete rubble.

Mr. Clifford Frick of the United States Department of Agriculture, Natural Resources Conservation Service, provided an estimate (See Attachment 5) of the upper elevation for the Special Flood Hazard Area (See Attachment 2). Mr. Frick estimated that the upper elevation of the Special Flood Hazard Area was between 980 to 990 feet msl (See Attachment 5). The calculations presented in this evaluation utilize the most conservative elevation (i.e., the lower estimate of 980 feet msl).

Three potential future residence locations were evaluated at the edge of the Special Flood Hazard Area in order to determine potential impacts from the inhalation of resuspended particulates originating from the concrete rubble. Three hypothetical residence locations were selected so that a worst case range of potential dose rates could be determined. For purposes of this evaluation, reference man is conservatively assumed to spend 100 percent of his time adjacent to the Special Flood Hazard Area (i.e., at 980 feet msl). No credit is taken for time spent away from the residence or for filtration effects that normally occur due to windows, doors, and air handling systems.

Locations for the modeled residences are depicted on Drawing No. 98FCRS. The table below presents the three projected residential locations as well as distances from each of the two point sources, S_1 and S_2, as calculated using standard trigonometric methods. (Note: S_1 and S_2 are located at the center of each square source area).

Residence #	Northing	Easting	Distance from S_1	Distance from S_2
1	890	1500	99 m	85.5 m
2	855	1500	99 m	70 m
3	820	1505	115 m	75 m

Source Term Calculation

The volume of concrete that is removed by weathering from the surface of the rubble, each year, is estimated as:

$$3{,}350\ m^2\ (10mm/150y)\ (m/1000mm) = 0.22\ m^3/y.$$

The total uranium source term activity that is assumed to become airborne each second, due to resuspension from weathering, is:

$$Q = (0.22\ m^3/y)\ (1.8g/cm^3)\ (10^6\ cm^3/m^3)\ (140\ pCi/g)\ (y/365d)\ (d/24h)\ (h/3600s)$$

$$Q = 1.8\ pCi/s, \text{ or } 1.8\ E\text{-}12\ Ci/s.$$

Therefore, the source term for each of the Source Areas is:

$S_1 = S_2 = 1.8$ E-12 Ci/s ÷ 2 = 9 E-13 Ci/s.

Residence #1 Inhalation Dose Calculation

Using the methods presented in Turner[1],

$\sigma_{yo} \approx s/4.3 = 35$ m/4.3 = 8.1

Source #1:

From data presented above in the "Potential Future Residence Locations" section:

$x_{1\rightarrow1} = 99$ m.

From Attachment 6, $x_{y1} \approx 100$ m.

From Attachment 6, $\sigma_{y1} = \sigma_{y(100m+99m)} \approx 15$ m

From Attachment 7, $\sigma_{z1} = \sigma_{99m} \approx 4.6$ m

Source #2:

$x_{2\rightarrow1} = 85.5$ m.

From Attachment 6, $x_{y2} \approx 100$ m.

From Attachment 6, $\sigma_{y2} = \sigma_{y(100m+85.5m)} \approx 10.5$ m

From Attachment 8, $\sigma_{z2} = \sigma_{85.5m} \approx 3.4$ m

From Turner[1], the basic atmospheric dispersion equation for a ground level source at the plume centerline is:

$\chi = Q \div (2\pi)(\sigma_y)(\sigma_z)(u)$, where Q will be replaced by either S_1 or S_2, as necessary.

For distances of at least 100m, sigma y and sigma z were estimated using Figures 3-2 and 3-3 in Turner[1] (Attachments 6 and 7), using the Class D atmospheric stability curves. Estimates of σ_y and σ_z for distances less than 100 m were obtained using the equations from Table 11.3.4 of "The Health Physics and Radiological Health Handbook"[7]. The power functions given in the table were used to provide estimates using neutral stability at the required distance from the assumed point source (see Attachment 8).

The concentration of airborne total uranium, χ, is calculated for each source→residence:

$\chi_{1\to1}$ = {9 E-13 Ci/s ÷ (2π)(15m)(4.6m)(5.6m)} = 7.4 E-16 Ci/m^3.

$\chi_{2\to1}$ = {9 E-13 Ci/s ÷ (2π)(10.5m)(3.4m)(5.6m)} = 1.4 E-15 Ci/m^3.

The effective dose can be calculated using the dose conversion factors from EPA Federal Radiation Guidance Report No. 11[6]. The dose conversion factors for U-234, U-235, and U-238 are similar. Therefore, the dose conversion factor for U-234 (inhalation Class Y) was utilized as this is the most conservative dose conversion factor.

Effective Dose to the Resident = {(7.4 E-16 Ci/m^3) (0.16) + (1.4 E-15 Ci/m^3) (0.315)}

(1.2 m^3/h) (24 h/d) (365 d/y) (3.58 E-05 Sv/Bq) (3.7 E+09 mrem/μCi per Sv/Bq)

(10^6 μCi/Ci) = **0.8 mrem/y**.

The conservative evaluation indicates that the upper estimate of dose to the hypothetical resident at Residence #1 is 0.8 mrem/y, which is insignificant.

Residence #2 Inhalation Dose Calculation

Using the methods presented in Turner[1],

$\sigma_{yo} \approx s/4.3 = 35\ m/4.3 = 8.1$

Source #1:

$x_{1\to2}$ = 99 m.

From Attachment 6, $x_{y1} \approx$ 100 m.

From Attachment 6, $\sigma_{y1} = \sigma_{y(100m+99m)} \approx$ 15 m.

From Attachment 7, $\sigma_{z1} = \sigma_{99m} \approx$ 4.6 m.

Source #2:

$x_{2\to2}$ = 70 m.

From Attachment 6, $x_y \approx$ 100 m.

From Attachment 6, $\sigma_{y2} = \sigma_{y(100m+70m)} \approx$ 13 m.

From Attachment 8, $\sigma_{z2} = \sigma_{70m} \approx 2.9$ m.

The concentration of airborne total uranium, χ, is calculated for each source→residence:

$\chi_{1\to2} = \{9$ E-13 Ci/s ÷ $(2\pi)(15m)(4.6m)(5.6m)\} = 7.4$ E-16 Ci/m^3.

$\chi_{2\to2} = \{9$ E-13 Ci/s ÷ $(2\pi)(10.5m)(3.4m)(5.6m)\} = 1.4$ E-15 Ci/m^3.

Effective Dose to the Resident = {(7.4 E-16 Ci/m^3) (0.152) + (1.4 E-15 Ci/m^3) (0.16)}

(1.2 m^3/h) (24 h/d) (365 d/y) (3.58 E-05 Sv/Bq) (3.7 E+09 mrem/μCi per Sv/Bq)

(10^6 μCi/Ci) = **0.5 mrem/y**.

The conservative evaluation indicates that the upper estimate of dose to the hypothetical resident at Residence #1 is 0.5 mrem/y, which is insignificant.

Residence #3 Inhalation Dose Calculation

Using the methods presented in Turner[1],

$\sigma_{yo} \approx s/4.3 = 35$ m/4.3 = 8.1

Source #1:

$x_{1\to3} = 115$ m.

From Attachment 6, $x_{y1} \approx 100$ m.

From Attachment 6, $\sigma_{y1} = \sigma_{y(100m+115m)} \approx 16.5$ m.

From Attachment 7, $\sigma_{z1} = \sigma_{115m} \approx 5.3$ m.

Source #2:

$x_{2\to3} = 75$ m.

From Attachment 6, $x_y \approx 100$ m.

From Attachment 6, $\sigma_{y2} = \sigma_{y(100m+75m)} \approx 13.5$ m.

From Attachment 8, $\sigma_{z2} = \sigma_{75m} \approx 3.1$ m.

The concentration of airborne total uranium, χ, is calculated for each source→residence:

$\chi_{1\to3}$ = {9 E-13 Ci/s ÷ (2π)(16.5m)(5.3m)(5.6m)} = 5.8 E-16 Ci/m^3.

$\chi_{2\to3}$ = {9 E-13 Ci/s ÷ (2π)(13.5m)(3.1m)(5.6m)} = 1.2 E-15 Ci/m^3.

Effective Dose to the Resident = {(5.8 E-16 Ci/m^3) (0.233) + (1.2 E-15 Ci/m^3) (0.152)}

(1.2 m^3/h) (24 h/d) (365 d/y) (3.58 E-05 Sv/Bq) (3.7 E+09 mrem/μCi per Sv/Bq)

(10^6 μCi/Ci) = **0.4 mrem/y**.

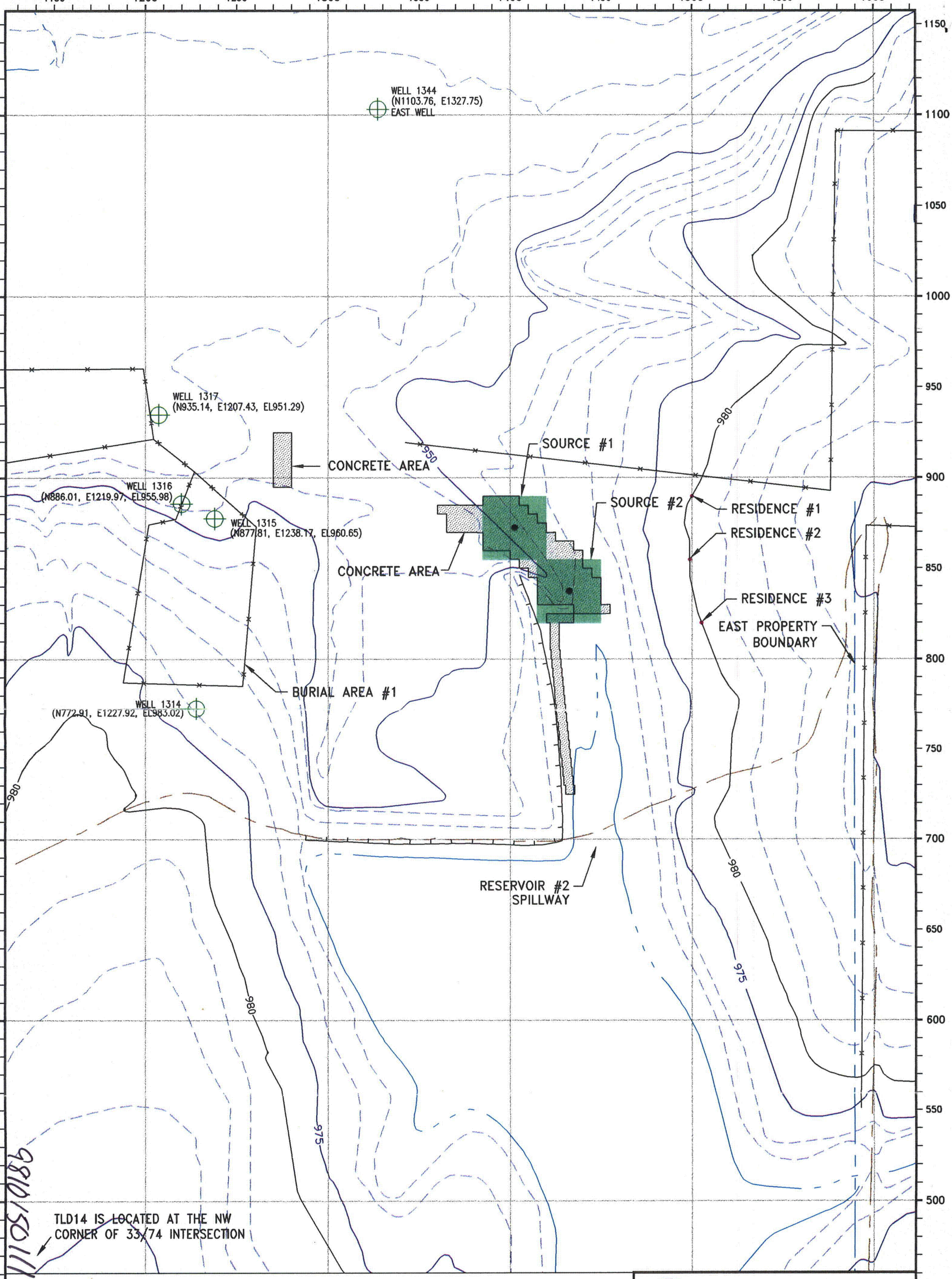
The conservative evaluation indicates that the upper estimate of dose to the hypothetical resident at Residence #1 is 0.4 mrem/y, which is insignificant.

Conclusion

In summary, the potential for inhalation dose to a hypothetical resident from the concrete rubble placed in Sub-Area "F" drainage areas is negligible in comparison to background. The very conservative dose modeling assumptions and calculations presented in this evaluation indicate that potential future residential inhalation doses would be less than 1 mrem TEDE.

References

1. Turner, D. B., "Workbook of Atmospheric Dispersion Estimates," U. S. Department of Health, Education, and Welfare, Cincinnati, OH, 1969.
2. Cimarron Corporation, "Response to NRC Comments on the Final Status Survey Report for Concrete Rubble in Sub-Area F", transmitted to Mr. Ken Kalman, NRC by letter from Mr. Jess Larsen dated June 15, 1998.
3. Cimarron Corporation, "Final Status Survey Report for Concrete Rubble in Sub-Area F", March, 1998.
4. Seymour, A. B., and Wonneberger, B., "Laboratory Evaluation of Building Stone Weathering," Journal of the American Society of Civil Engineers, 1977, pages 85-104.
5. Facsimile dated September 29, 1998 from Mr. Clifford Frick, United States Department of Agriculture, Natural Resources Conservation Office, Guthrie Field Office, Guthrie, OK, to Mr. Harry Newman, NEXTEP Environmental, Inc.
6. Environmental Protection Agency, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," EPA-520/1-88-020, Federal Guidance Report No. 11, September, 1988.
7. Schlein, B. (Editor), "The Health Physics and Radiological Health Handbook," Scinta, Inc., 1992.



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APERTURE CARD
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SUB-AREA F CONCRETE
RESIDENTIAL DOSE SENARIO

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JE	10/1/98	AS SHOWN	
JOB NO.	DRAWING NO.		REV.
	98FCRS		0

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ATTACHMENT 1

ATTACHMENT 1

FREQUENCY DISTRIBUTION

	SPEED						Total	Mean Wind Speed (m/s)
	1-3	4-6	7-10	11-16	17-21	>21		
N	.2	1.3	2.9	3.5	1.6	.9	9.9	6.3
NNE	.1	.6	1.7	1.9	.5	.2	5.3	5.9
NE	.1	.8	1.6	1.1	.2	0	3.9	5.2
ENE	.1	.7	1.3	.6	.1	0	2.9	4.6
E	.2	.8	1.3	.6	.1	0	2.9	3.9
ESE	.1	1.0	1.5	.7	.1	0	3.5	4.3
SE	.2	1.8	3.5	2.1	.4	.1	8.6	4.8
SSE	.2	2.4	6.5	6.5	1.8	.5	18.1	5.7
S	.3	2.3	5.4	6.5	2.4	1.0	17.3	6.1
SSW	.2	.9	1.8	2.7	1.2	.8	7.7	6.6
SW	.2	.8	1.0	1.0	.3	.1	3.3	5.9
WSW	.1	.4	.5	.4	.1	.1	1.6	5.0
W	.1	.5	.4	.3	.1	0	1.4	4.1
WNW	.1	.5	.8	.4	.1	.1	1.8	5.2
NW	.2	.8	1.1	.9	.5	.4	3.7	6.1
NNW	.1	.9	1.6	1.9	1.0	.6	6.5	6.6
VA	0	0	0	0	0	0	0	
CLM	0	0	0	0	0	0	1.7	
ALL	2.6	16.4	33.1	31.1	10.4	4.7	100	5.6
FREQUENCY OF CALMS .017 = 1.7%								

STATION ID: 723530 WIND ROSE-OKLAHOMA CITY WSFO AP, OK, US
YEARS: 1945-1990

ATTACHMENT 2

NATIONAL FLOOD INSURANCE PROGRAM

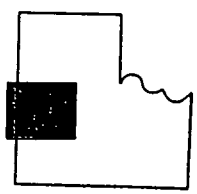
FIRM
FLOOD INSURANCE RATE MAP

LOGAN COUNTY, OKLAHOMA AND INCORPORATED AREAS

PANEL 125 OF 250
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CRESCENT, CITY OF	400098	0125	D
UNINCORPORATED AREAS	400096	0125	D



PANEL LOCATION

MAP NUMBER
40083C0125 D

EFFECTIVE DATE:
DECEMBER 5, 1989

Federal Emergency Management Agency

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding; velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year floodplain.
- **ZONE D** — Areas in which flood hazards are undetermined.

Floodplain Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*

RM 7x — Elevation Reference Mark

•M1.5 — River Mile

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for possible updated flood hazard information prior to use of this map for property purchase or construction purposes.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of special flood hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Elevation reference marks are described in the Flood Insurance Study Report.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For community map revision history prior to countywide mapping, see section 6.0 of the Flood Insurance Study Report.

For adjoining map panels see separately printed Map Index.

MAP REPOSITORY

Refer to Repository Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

DECEMBER 5, 1989

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

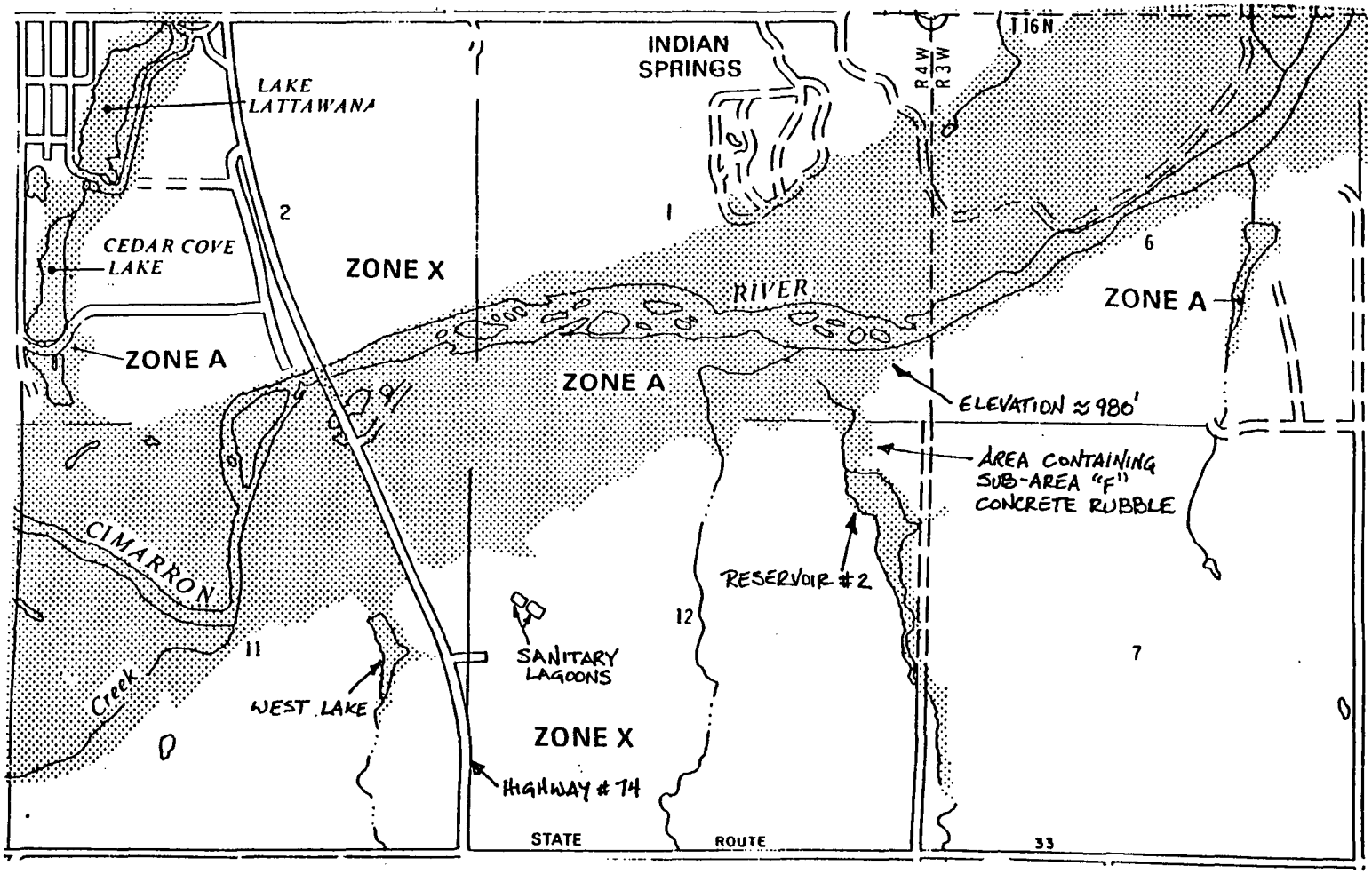
Refer to the Flood Insurance Rate Map Effective date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE

2000 0 2000 FEET

ATTACHMENT 2



ATTACHMENT 2

ATTACHMENT 3

ATTACHMENT 3

SUMMARY OF WIND DIRECTIONS AND FREQUENCIES			
Residence #	**Source #**	**Wind Direction (from)**	**Frequency (%)**
1	1	SSW	7.7
		SW	3.3
		WSW	1.8
		W	1.4
		WNW	1.8
		TOTAL	**16**
	2	S	17.3
		SSW	7.7
		SW	3.3
		WSW	1.8
		W	1.4
		TOTAL	**31.5**
2	1	WSW	1.8
		W	1.4
		WNW	1.8
		NW	3.7
		NNW	6.5
		TOTAL	**15.2**
	2	SSW	7.7
		SW	3.3
		WSW	1.8
		W	1.4
		WNW	1.8
		TOTAL	**16**
3	1	W	1.4
		WNW	1.8
		NW	3.7
		NNW	6.5
		N	9.9
		TOTAL	**23.3**
	2	NNW	6.5
		NW	3.7
		WNW	1.8
		W	1.4
		WSW	1.8
		TOTAL	**15.2**

ATTACHMENT 4

APPENDIX D-1

INSTRUCTIONS FOR PERMIT APPLICATION

For Proposed Development on Lands Located in a Community Within Floodplain Areas

TO COMPLY WITH FLOODPLAIN MANAGEMENT REGULATIONS AND TO MINIMIZE POTENTIAL FLOOD DAMAGE, IF YOU ARE BUILDING WITHIN AN IDENTIFIED FLOOD HAZARD AREA, YOU MUST AGREE TO CONSTRUCT YOUR PROPOSED DEVELOPMENT IN ACCORDANCE WITH THE FOLLOWING SPECIAL PROVISIONS:

SPECIAL FLOODPLAIN PROVISIONS:

1. For RESIDENTIAL structures, the lowest floor (including basement) must be elevated to or above the base flood elevation (100-year flood elevation). See provisions for manufactured homes in local regulations.

2. For NON-RESIDENTIAL structures, the lowest floor must be elevated to or above the base flood elevation, or floodproofed to withstand the flood depths, pressures, velocities, impact and uplift forces associated with the 100-year flood.

3. For ALL STRUCTURES, the foundation and the materials used must be constructed to withstand the pressures, velocities, impact and uplift forces associated with the 100-year flood.

4. All utility supply lines, outlets, switches and equipment must be installed and elevated so as to minimize damage from potential flooding. Water and sewer connections must have automatic back flow devices installed.

5. You must submit certification on the attached form(s) from a REGISTERED ENGINEER, ARCHITECT or LAND SURVEYOR, that the floor elevation and/or floodproofing requirements have been met. Failure to provide the required certification is a violation of this permit.

6. Other Provisions -- See attached list _____ None _____

AUTHORIZATION

I have read or had explained to me and understand the above special provisions for floodplain development. Authorization is hereby granted the permitting authority and their agents or designees, singularly or jointly, to enter upon the property described on the Application during daylight hours for the purpose of making inspections or for any reason consistent with the issuing authority's floodplain management regulation. I further verify that the information proviced by me on the Application is true and accurate to the best of my knowledge and belief.

_____

Signature of Applicant

APPENDIX D-2

PERMIT APPLICATION

For Proposed Development on Lands Located in a Community Within Floodplain Areas

Date:_____ Permit No:_____

Applicant:_____

Address:_____

_____

Construction Started:_____ Permit Fee:_____

Has Permit Fee Been Collected? Yes No (please circle one)

Engineer:_____

Contractor:_____

Name of Community:_____

NFIP Community No:_____

Applicant Requests That (To):

_____ Construct	_____ Mine	_____ Construct Addition
_____ Remodel	_____ Elevate	_____ Drilling
_____ Demolish	_____ Add Fill	_____ Manufactured Housing (Placement)
_____ Storage (Equipment or Supplies)		

List Type and Purpose of Constriction/Obstruction:_____

Located:_____

Is Property to be Located in an Identified Special Flood Hazard Area (Regulatory Floodplain)?

Yes No (Please Circle One)

If Yes, Complete the Following and Require Certified Elevation of Lowest Floor (Including Basement) and Lowest Adjacent Grade:

Base Food Elevation: _____ Proposed Lowest Floor Elevation _____

Flood Map Effective Date: _____ Flood Zone Type : A B C X Other_____
(circle one)

Lowest Finished Floor Elevation_____ Lowest Adjacent Grade: _____

Plans, specifications and application for permit filed by the applicant shall constitute by reference, a part of this permit.

Approved By:_____

Date:_____ _____
Signature of Applicant

ATTACHMENT 5

SUE 557-7615

ATTACHMENT 5

USDA - NATURAL RESOURCES CONSERVATION SERVICE

GUTHRIE FIELD OFFICE
GUTHRIE, OK

PHONE (405) 282-1650 FAX (405) 282-6251

TO: Harry Newman

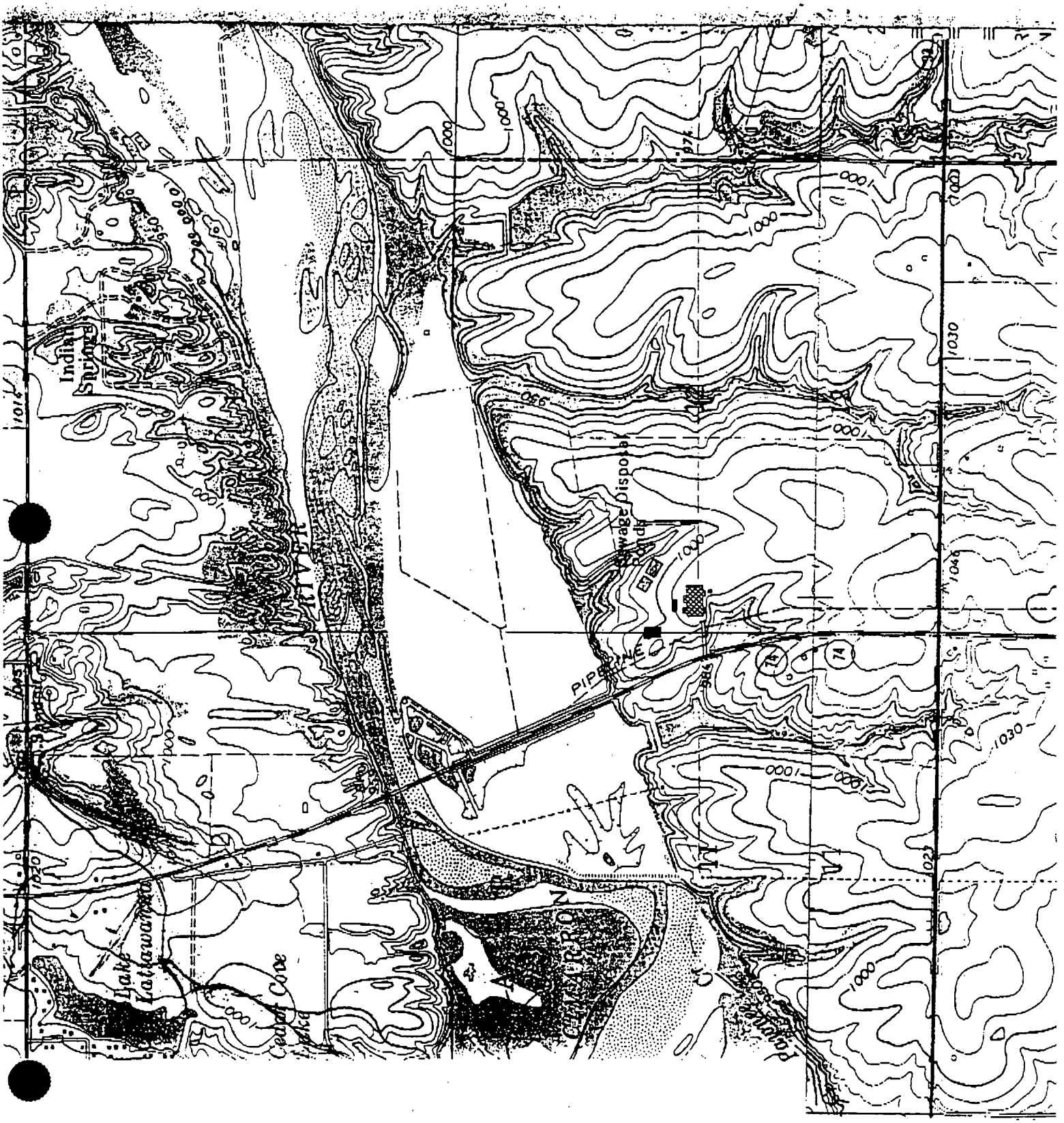
FROM: Cliff Fnck

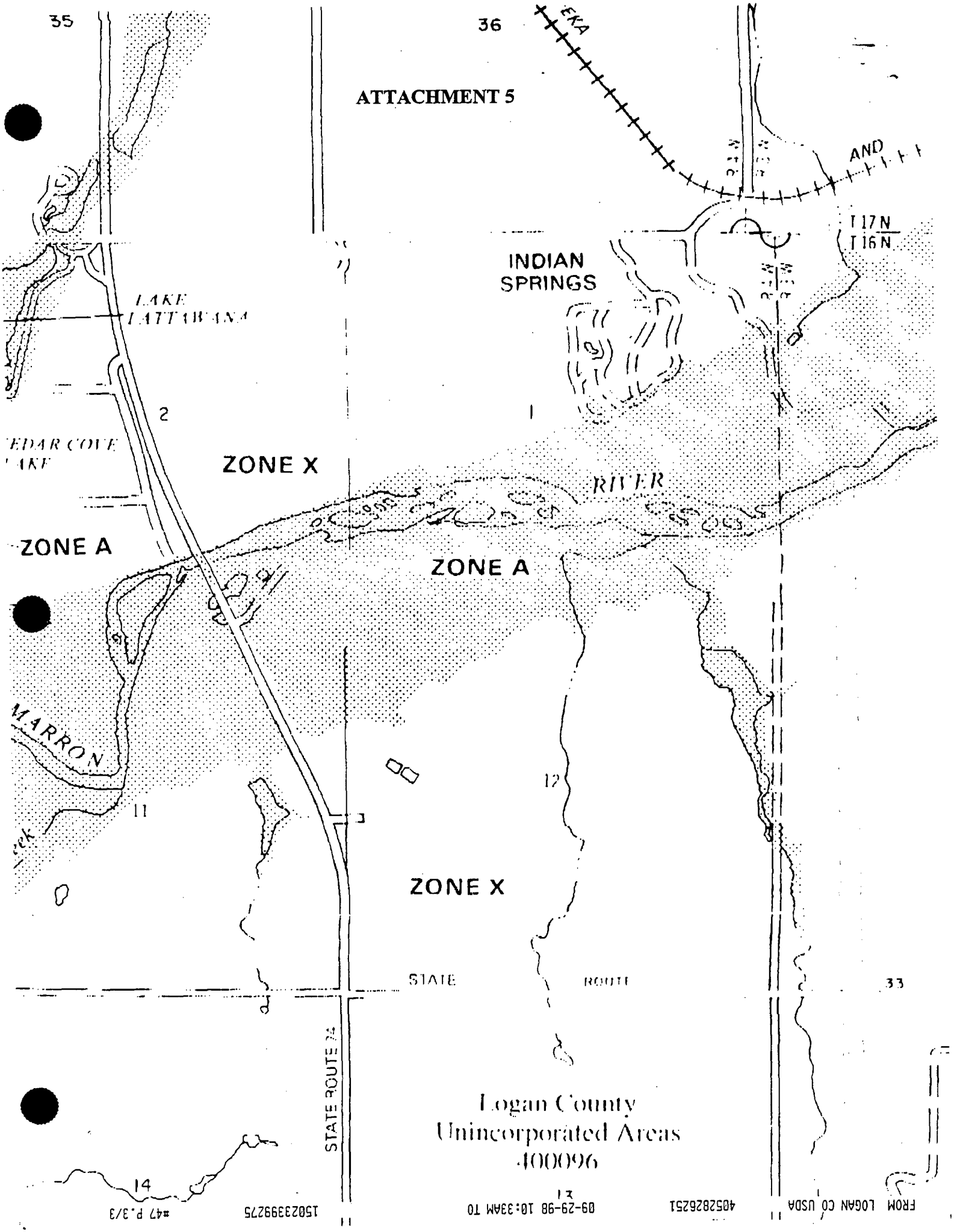
COMMENTS Rough guess = 980-990

PAGES INCLUDING THIS ONE 3

DATE 9/29/98

ATTACHMENT 5




ATTACHMENT 5
35
36
EKA
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T16N
INDIAN SPRINGS
LAKE LATTAWANA
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ZONE X
RIVER
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ZONE X
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Logan County
Unincorporated Areas
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ATTACHMENT 6

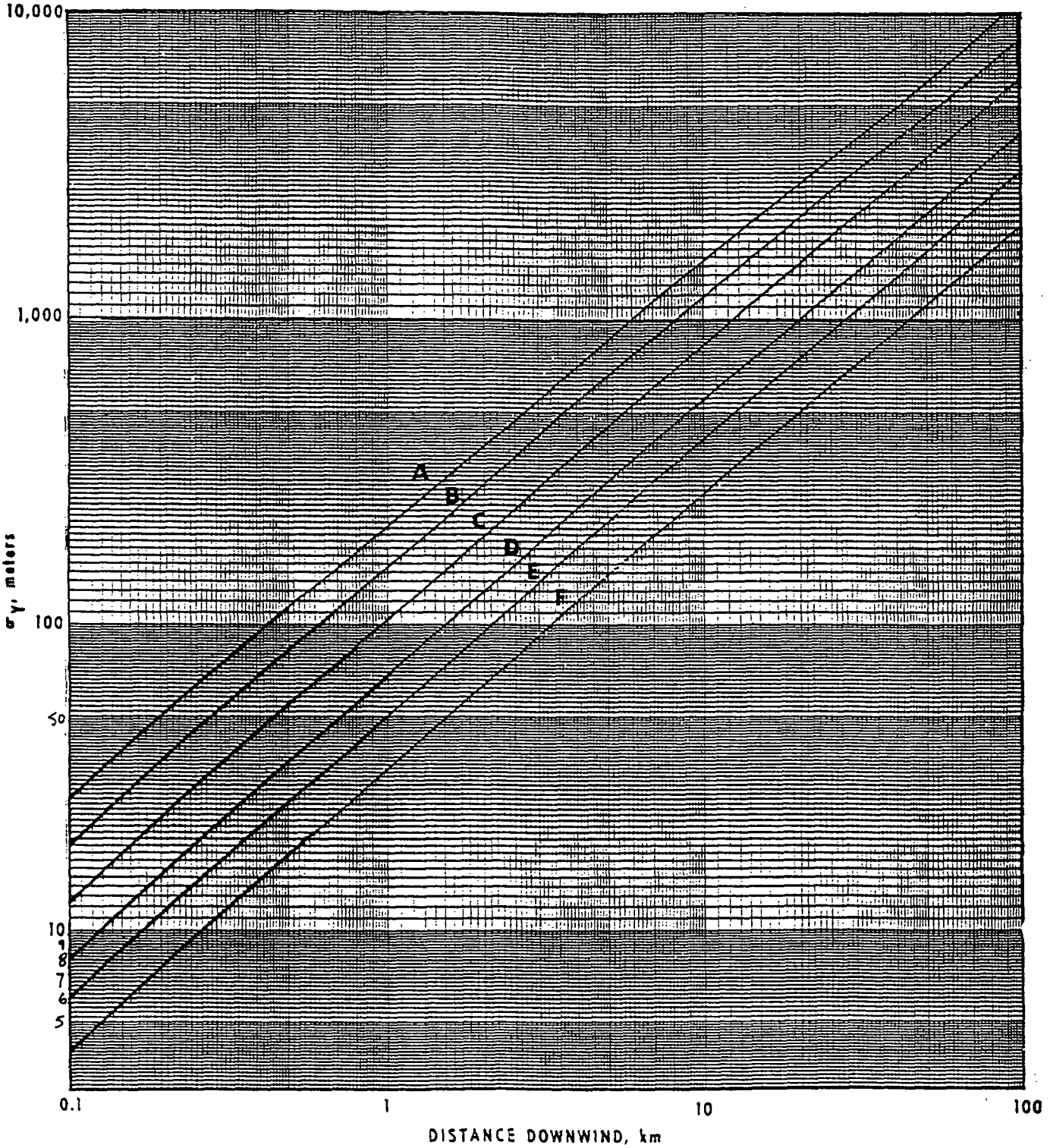

Figure 3-2. Horizontal dispersion coefficient as a function of downwind distance from the source.

ATTACHMENT 7

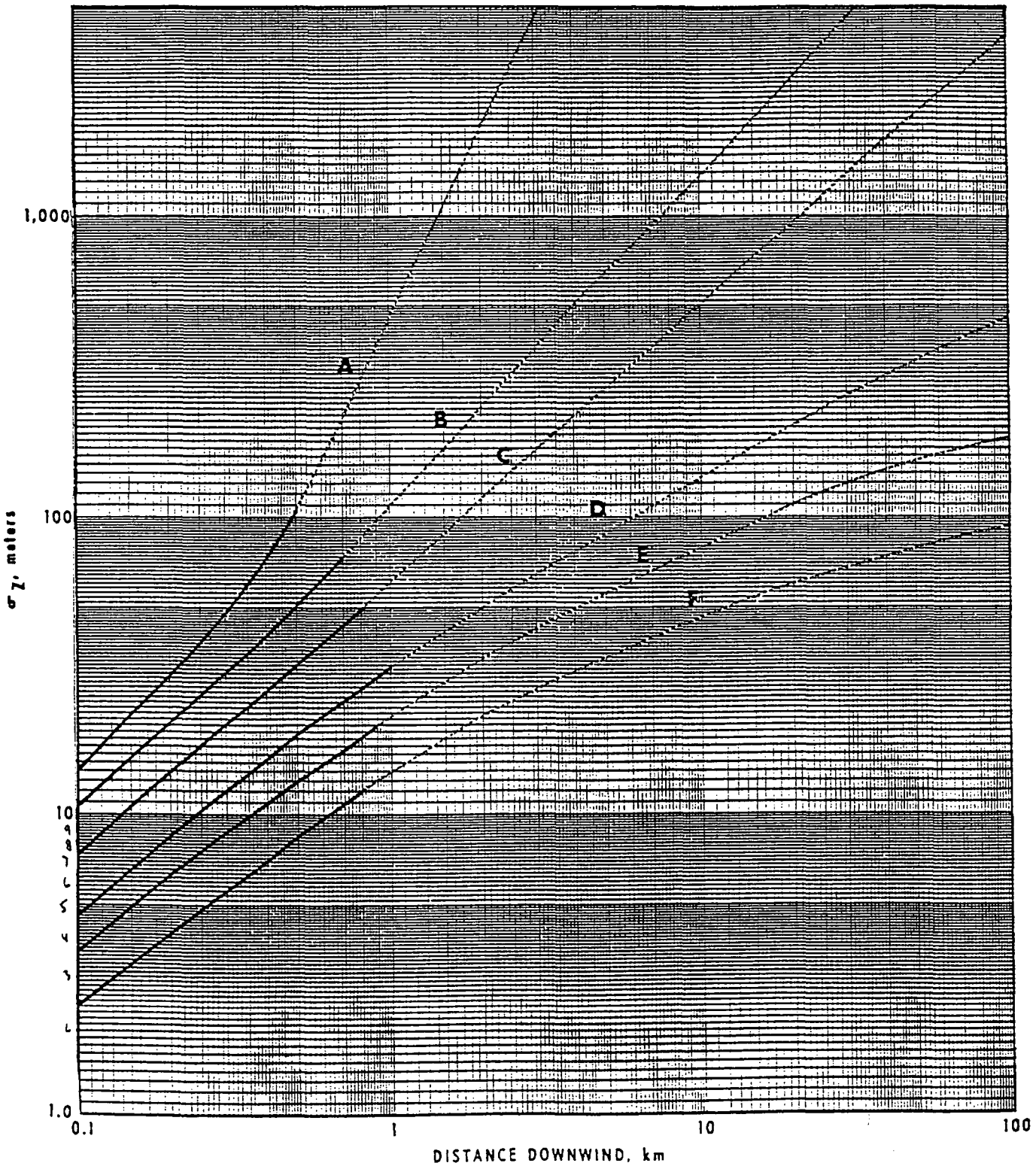

Figure 3-3. Vertical dispersion coefficient as a function of downwind distance from the source.

339-901 O - 68 - 2

ATTACHMENT 8

ATTACHMENT 8

Distance (meters)	sigma y (meters)	sigma z (meters)
50	2.19	2.32
60	2.59	2.64
70	2.99	2.94
75	3.19	3.08
80	3.38	3.22
85.5	3.59	3.38
90	3.77	3.50
100	4.15	3.77

Notes:

1) Sigma y = 0.06x^(0.92) per "The Health Physics and Radiological Health Handbook", page 440.

2) Sigma z = 0.15x^(0.70) per "The Health Physics and Radiological Health Handbook", page 440.

3) Distance is downwind from the point souce in plume centerline.