# ATTACHMENT 4-1 TRANSPORTATION EVALUATION

Page A4-1-1 Revision 0

#### **Explanation of RADTRAN Input**

The routing code WebTRAGIS (used in this analysis and in most RADTRAN analyses) provides routing data in two different forms: (1) combined rural, combined suburban, and combined urban route segments (links) and population densities for each state transited, and (2) a much more precise output that provides rural, suburban, and urban segments for node-to-node distances, one to about 15 km long. The second method was used in the WCS analysis because it identifies the receptor population much more precisely that the state-to-state routing data. However, this output consists of several hundred links and can have more than a thousand links. The RADTRAN graphical user interface RadCat cannot accommodate more than 60 links in a single analysis, and even if it could, creates an environment in which user input errors are easy to make and difficult to find. RADTRAN itself can accommodate thousands of links, but is equally input error-prone, and the output becomes difficult to read and interpret.

In order to take advantage of the increased precision, the input to RADTRAN for the WCS analyses used a unit risk factor (URF) approach, structured in the same way as the input to NUREG 2125 (NRC, 2014), as follows:

- A unit risk factor (URF) radiation population dose was calculated by the RADTRAN code. The
  URF population dose is the dose to a population density of one person per square kilometer
  (km²) on a rural, a suburban, and an urban link, each one km. long. This unit population density
  was also used to calculate doses at representative stops.
- 2. Population dose is then calculated for each link and each stop using a spreadsheet that allows multiplication of the unit risks by link length and link (or stop) population.

The RADTRAN input and output text files that accompany this explanation are the URF files. The relevant spreadsheets are included in the material sent.

<u>Reference:</u> U.S. Nuclear Regulatory Commission (NRC), "Spent Fuel Transportation Risk Assessment," NUREG-2125, Nuclear Regulatory Commission, Rockville, MD.

## **Evaluation of Transportation Routes from Shut Down Nuclear Generating Stations**

#### **Ruth Weiner**

## How the transportation routes were evaluated

The purpose of this study was to compare the routes and assess which parameters were most influential. Collective (population) radiation dose to residents along the routes during routine, incident-free transportation provided the means of comparison. Unit doses, doses sustained by a population density of one person per square km, from a vehicle traveling one kilometer per hour, were used to calculate collective doses to residents within a half mile (800 meters) of the route, from a vehicle traveling along the route. Rural, suburban, and urban route segments were analyzed separately and the resulting collective doses were added. Doses were calculated both with and without addition of doses from changes of transportation mode (rail to or from barge, rail to or from heavy haul truck).

The routing code WebTRAGIS, developed by the Oak Ridge National Laboratory (ORNL) was used to analyze the routes. The section of the WebTRAGIS output used in this study was RouteDensityByState, which provides the length and resident population density of each route segment. Unit doses used had been calculated, using the code RADTRAN, version 6.02, for a previous study. Table 1 lists the routing parameters for the present study. Highway routes for San Onofre and Humboldt Bay could not be run in WebTRAGIS; the reason for this could not be determined. Population densities for the appropriate population block (rural, suburban, urban) were used to determine the doses to transfer residents near the mode rather than attempting to estimate the population densities at the mode transfer locations.

**Table 1. Parameter Values** 

| Parameter                      | Parameter | Units           | Comment/Referen      |
|--------------------------------|-----------|-----------------|----------------------|
|                                | value     |                 | ce                   |
| Rural/suburban unit risk       | 9.11E-08  | Person-rem      | Previous WCS         |
|                                | 9.11E-06  | Person-Sv       | study                |
| Urban unit risk                | 2.05E-09  | Person-rem      | Previous WCS         |
|                                | 2.05E-07  | Person-Sv       | study                |
| Rail speed                     | 50        | mph             | DOE, 2002            |
| Barge speed                    | 8         | mph             | NRC, 2014            |
| Heavy haul speed               | 20        | mph             | DOE, 2002            |
| Rural residential shielding    | 1         | unitless        | Weiner, et al., 2014 |
|                                |           |                 |                      |
|                                |           | ·               |                      |
| Suburban residential shielding | 0.87      | unitless        | Weiner, et al., 2014 |
| Urban residential shielding    | 0.018     | unitless        | Weiner, et al,, 2014 |
| Mode transfer area             | 2         | Km <sup>2</sup> | Analyst estimate     |
| Mode transfer time             | 8         | hours           | Analyst estimate     |

#### Results

Table 2 shows the summarized results.

Table 2. Summarized results

| Nuclear                | Populati       | on Dose (Pe     | rson-rem)               | Includi        | ng Mode T       | ransfer                 | Includi                    | ng Mode T       | ransfer                 |  |
|------------------------|----------------|-----------------|-------------------------|----------------|-----------------|-------------------------|----------------------------|-----------------|-------------------------|--|
| Power Plant<br>Origins |                |                 |                         | Populatio      | n Dose (Pe      | rson-rem)               | Population Dose (Person-Sy |                 |                         |  |
| Origins                | Direct<br>Rail | Rail +<br>Barge | Rail +<br>Heavy<br>Haul | Direct<br>Rail | Rail +<br>Barge | Rail +<br>Heavy<br>Haul | Direct<br>Rail             | Rail +<br>Barge | Rail +<br>Heavy<br>Haul |  |
| Maine<br>Yankee        | 5.13E-02       | 5.13E-02        |                         | 5.13E-02       | 5.25E-02        |                         | 5.13E-04                   | 5.13E-04        |                         |  |
| Yankee<br>Rowe         |                |                 | 2.26E-02                |                |                 | 2.38E-02                |                            |                 | 2.38E-04                |  |
| Connecticut<br>Yankee  |                | 7.21E-03        | 2.94E-02                |                | 9.07E-03        | 9.07E-03                |                            | 9.07E-05        | 9.07E-05                |  |
| Humboldt<br>Bay        |                | 1.93E-02        |                         |                | 1.94E-02        |                         |                            | 1.94E-04        |                         |  |
| Big Rock<br>Point      |                | 2.72E-02        | 2.79E-02                |                | 2.87E-02        | 2.79E-02                |                            | 2.87E-04        | 2.79E-04                |  |
| Rancho<br>Seco         | 1.80E-02       |                 |                         | 1.80E-02       |                 |                         | 1.80E-04                   |                 |                         |  |
| Trojan                 | 2.79E-02       | 2.76E-02        |                         | 2.79E-02       | 2.77E-02        |                         | 2.79E-04                   | 2.77E-04        |                         |  |
| La Crosse              | 1.51E-02       | 2.94E-03        |                         | 1.51E-02       | 3.80E-03        |                         | 1.51E-04                   | 3.80E-05        |                         |  |
| Zion                   | 1.55E-02       | 2.05E-02        |                         | 1.55E-02       | 2.27E-02        |                         | 1.55E-04                   | 2.27E-04        |                         |  |
| Crystal<br>River       | 1.59E-02       | 1.08E-02        |                         | 1.59E-02       | 1.10E-02        |                         | 1.59E-04                   | 1.10E-04        |                         |  |
| Kewaunee               |                | 2.50E-02        | 2.57E-02                |                | 3.22E-02        | 2.76E-02                |                            | 3.22E-04        | 2.76E-04                |  |
| San Onofre             | 1.07E-02       |                 |                         | 1.07E-02       |                 |                         | 1.07E-04                   |                 |                         |  |

Collective dose depends of on the size of the exposed population, which in turn depends on the length of the route and the bandwidth. The collective doses in Table 2 are small; the largest calculated collective dose is 0.0513 person-rem, and this dose is spread over approximately 550,000 people and 2200 miles of railroad. All of the collective doses appear to be of the same order of magnitude. Nor does the introduction of a slower vehicle like a barge appear to have a significant impact: Half of the Crystal River dose is from barge travel and half from rail travel, and the total collective dose is similar in magnitude to the others.

This confirms that the most important parameters in estimating risks of routing transportation are the distance traveled and the size of the exposed population, and that all of the collective doses are less than 0.006person-rem (0.00006 person-Sv. The exception is the population dose in urban areas. The urban residential shielding factor, a measure of the gamma energy transmitted to residents, is two orders of magnitude less than the residential shielding to rural residents.

He collective doses that have been calculated are insignificant when compared to background. For example, a rail trip from Maine Yankee to WCS takes six days and results in a dose of 0.0476 person-rem to a population of 110,650; and an average natural background dose of 0.311 rem, the collective background dose is 0.311\*(6/365)\*110650 = 471 person-rem..

# **Bibliography**

USDOE, Final Environmental Impact Statement for a Geologic Repository Yucca Mountain, for the Disposal of Spent Fuel at Yucca Mountain, Nye County, Nevada, DOE/EIS-0250F, U.S. Department of Energy, Washington, DC, 2002.

USNRC, Spent Fuel Transportation Risk Assessment, NUREG 2125, U. S. Nuclear Regulatory Commission,

Weiner, R.F., Neuhauser, K.S.. Heames, T.J., O'Donnell, B.M., Dennis. M.L., *RADTRAN 6 Technical Manual* SAND2013-0780, Sandia National Laboratories, Albuquerque, NM, 2014

## Maine Yankee

|            |               |             |           |             | Suburban    |            |             | Urban    |             |
|------------|---------------|-------------|-----------|-------------|-------------|------------|-------------|----------|-------------|
| State      | Rural PD      | Rural Dist. | Rural p   | Suburban PD | Dist.       | Suburban P | Urban PD    | Dist.    | Urban P     |
| AR         | 37.5          | 204.7       | 3838.125  | 953.3       | 96.22       | 45863.263  | 5509.4      | 4.02     | 11073.894   |
| IL         | 28.2          | 183.15      | 2582.415  | 721.8       | 44.9        | 16204.41   | 3785.7      | 0.69     | 1306.0665   |
| IN         | 46.3          | 64.76       | 1499.194  | 1361.1      | 87.14       | 59303.127  | 10054.7     | 10.6     | 53289.91    |
| MA         | 51.1          | 52.47       | 1340.6085 | 1298.7      | 98.75       | 64123.3125 | 8695.9      | 45.63    | 198396.9585 |
| ME         | 85.9          | 27.7        | 1189.715  | 973.5       | 55.93       | 27223.9275 | 5644.1      | 7.35     | 20742.0675  |
| MO         | 28.2          | 76.03       | 1072.023  | 774.2       | 17.92       | 6936.832   | 0           | 0        | 0           |
| NH         | 91.4          | 5.9         | 269.63    | 873.1       | 25.62       | 11184.411  | 5916.1      | 3.27     | 9672.8235   |
| NY         | 61.9          | 210.68      | 6520.546  | 1056.2      | 166.21      | 87775.501  | 5671.9      | 22.95    | 65085.0525  |
| ОН         | 46.4          | 139.61      | 3238.952  | 1400.2      | 109.2       | 76450.92   | 4135.9      | 20.48    | 42351.616   |
| PA         | 61.2          | 18.89       | 578.034   | 1760        | 19.45       | 17116      | 5934.1      | 5.51     | 16348.4455  |
| TX         | 34.3          | 401.83      | 6891.3845 | 1192.8      | 185.53      | 110650.092 | 6694.6      | 25.77    | 86259.921   |
| total dist |               | 1385.72     |           |             | 906.87      |            |             | 146.27   |             |
| km         |               | 2230.104447 |           |             | 1459.468594 |            |             | 235.3992 |             |
| populatio  | n             |             | 29020.627 |             |             | 522831.796 |             |          | 504526.755  |
| PD (metri  | c; 26.0262492 |             |           | 716.4687179 |             |            | 4286.563065 |          |             |
| person-re  | m             |             | 2.64E-03  |             |             | 4.76E-02   |             |          | 1.03E-03    |

| Ra  | n | -h  | Se     | CO |
|-----|---|-----|--------|----|
| ı٧u |   | -11 | $\sim$ | v  |

| State      | Rural         | Rural Dist. | Rural P   | Suburban    | Suburban Dist | Suburban P  | Urban       | <b>Urban Dist</b> | Urban P     |
|------------|---------------|-------------|-----------|-------------|---------------|-------------|-------------|-------------------|-------------|
| AZ         | 18.6          | 314.42      | 2924.106  | 1046.6      | 70.53         | 36908.349   | 4273.7      | 5.19              | 11090.2515  |
| CA         | 36            | 407.21      | 7329.78   | 1300.5      | 189.83        | 123436.9575 | 5223.9      | 73.43             | 191795.4885 |
| NM         | 7.1           | 156.66      | 556.143   | 917.5       | 10.86         | 4982.025    | 0           | 0                 | 0           |
| TX         | 9             | 207.14      | 932.13    | 1058        | 28.63         | 15145.27    | 6508.8      | 14.08             | 45821.952   |
| total dist |               | 1085.43     |           |             | 299.85        |             |             | 92.7              |             |
| km         |               | 1746.83361  |           |             | 482.5627243   |             |             | 149.1865          |             |
| populatio  | n             |             | 11742.159 |             |               | 180472.6015 |             |                   | 248707.692  |
| PD (metri  | c¦ 13.4439353 |             |           | 747.9757238 |               |             | 3334.185514 |                   |             |
| person-re  | em            |             | 1.07E-03  |             |               | 1.64E-02    |             |                   | 5.10E-04    |

¥

| Trojan     |       |      |             |           |             |               |             |             |                   |             |
|------------|-------|------|-------------|-----------|-------------|---------------|-------------|-------------|-------------------|-------------|
| State      | Rural |      | Rural Dist. | Rural P   | Suburban    | Suburban Dist | Suburban P  | Urban       | <b>Urban Dist</b> | Urban P     |
| AZ         |       | 18.6 | 314.42      | 2924.106  | 1046.6      | 70.53         | 36908.349   | 4273.7      | 5.19              | 11090.2515  |
| CA         |       | 35.6 | 612.1       | 10895.38  | 1245.4      | 278.52        | 173434.404  | 5102.3      | 94.7              | 241593.905  |
| NM         |       | 7.1  | 156.66      | 556.143   | 917.5       | 10.86         | 4982.025    | 0           | 0                 | 0           |
| OR         |       | 29.9 | 254.54      | 3805.373  | 1044.9      | 91.89         | 48007.9305  | 6650.1      | 31.22             | 103808.061  |
| TX         |       | 9    | 207.14      | 932.13    | 1058        | 28.63         | 15145.27    | 6508.8      | 14.08             | 45821.952   |
| total dist |       |      | 1544.86     |           |             | 480.43        |             |             | 145.19            |             |
| km         |       |      | 2486.215942 |           |             | 773.1786214   |             |             | 233.6611          |             |
| population | n     |      |             | 19113.132 |             |               | 278477.9785 |             |                   | 402314.1695 |
| PD (metric |       | 2791 |             |           | 720.3457798 |               |             | 3443.569881 |                   |             |
| person-rei | ·     |      |             | 1.74E-03  |             |               | 2.54E-02    |             |                   | 8.25E-04    |

e

## LaCrosse

| Laciosse   |              |             |           |             | Suburban      |            |             | Urban             |             |
|------------|--------------|-------------|-----------|-------------|---------------|------------|-------------|-------------------|-------------|
| State      | Rural        | Rural Dist. | Rural P   | Suburban    | Dist.         | Suburban P | Urban       | Dist.             | Urban P     |
| IA         | 57.3         | 14.28       | 409.122   | 478.6       | 5.51          | 1318.543   | 0           | 0                 | 0           |
| IL         | 24           | 165.61      | 1987.32   | 675.9       | 27.81         | 9398.3895  | 4469.4      | 1.46              | 3262.662    |
| KS         | 23.8         | 169.24      | 2013.956  | 1209.1      | 52.29         | 31611.9195 | 4157.9      | 6.81              | 14157.6495  |
| MO         | 28.1         | 176.88      | 2485.164  | 783.3       | 18.12         | 7096.698   | 8523.2      | 3.96              | 16875.936   |
| OK         | 38.8         | 168.52      | 3269.288  | 1240.4      | 62.87         | 38991.974  | 4791        | 16.2              | 38807.1     |
| TX         | 32.2         | 305.57      | 4919.677  | 1034.1      | 119.34        | 61704.747  | 6083.7      | 12.96             | 39422.376   |
| WI         | 19.2         | 84.85       | 814.56    | 691.2       | 8.22          | 2840.832   | 0           | 0                 | 0           |
| total dist |              | 985.82      |           |             | 280.43        |            |             | 41.39             |             |
| km         |              | 1586.526546 |           |             | 451.3092039   |            |             | 66.61088          |             |
| populatio  | n            |             | 14675.405 |             |               | 148803.728 |             |                   | 112525.7235 |
| PD (metric | ; 18.5000434 |             |           | 659.4313908 |               |            | 3378.599121 |                   |             |
| person-re  | m            |             | 1.34E-03  |             |               | 1.36E-02   |             |                   | 2.31E-04    |
| Zion       |              |             |           |             |               |            |             |                   |             |
| State      | Rural        | Rural Dist. | Rural P   | Suburban    | Suburban Dist | Suburban P | Urban       | <b>Urban Dist</b> |             |
| IA         | 45.2         | 204.71      | 4626.446  | 863.8       | 90.19         | 38953.061  | 3794.6      | 3.33              | 6318.009    |
| IL         | 42.4         | 65.96       | 1398.352  | 1498.1      | 71.02         | 53197.531  | 4892.8      | 28.62             | 70015.968   |
| KS         | 28.5         | 124.58      | 1775.265  | 1194.3      | 30.92         | 18463.878  | 3876.6      | 5.26              | 10195.458   |
| MO         | 28.9         | 108.12      | 1562.334  | 1447        | 20.75         |            | 8156.5      | 2.38              | 9706.235    |
| OK         | 29.6         | 187.56      | 2775.888  | 1107.5      | 54.46         |            | 3532.1      | 1.87              | 3302.5135   |
| TX         | 31.5         | 314.73      | 4956.9975 | 1033.2      | 131.95        | 68165.37   | 5142.5      | 17.2              | 44225.5     |
| total dist |              | 690.93      |           |             | 267.34        |            |             | 41.46             |             |
| km         |              | 1111.946183 |           |             | 430.2428505   |            |             | 66.72353          | _           |
| population | า            |             | 12138.285 |             |               | 155784.32  |             |                   | 99538.1835  |
| PD (metric | 21.8325045   |             |           | 724.1692445 |               |            | 2983.600631 |                   |             |
| person-re  | m            |             | 1.11E-03  |             |               | 1.42E-02   |             |                   | 2.04E-04    |

# Maine Yankee rail

| State      | Rural       | Rural Dist. | Rural P   | Suburban | Suburban | uburbam P   | Urban    | <b>Urban Dist</b> | Urban P     |
|------------|-------------|-------------|-----------|----------|----------|-------------|----------|-------------------|-------------|
| AR         | 37.5        | 204.7       | 3838.125  | 953.3    | 96.22    | 45863.263   | 5509.4   | 4.02              | 11073.894   |
| IL         | 28.2        | 183.15      | 2582.415  | 721.8    | 44.9     | 16204.41    | 3785.7   | 0.69              | 1306.0665   |
| IN         | 46.3        | 64.76       | 1499.194  | 1361.1   | 87.14    | 59303.127   | 10054.7  | 10.6              | 53289.91    |
| MA         | 51.1        | 52.47       | 1340.6085 | 1298.7   | 98.75    | 64123.3125  | 8695.9   | 45.63             | 198396.9585 |
| ME         | 81.7        | 22.94       | 937.099   | 1045.4   | 49.47    | 25857.969   | 5644.1   | 7.35              | 20742.0675  |
| MO         | 28.2        | 76.03       | 1072.023  | 774.2    | 17.92    | 6936.832    | 0        | 0                 | 0           |
| NH         | 91.4        | 5.9         | 269.63    | 873.1    | 25.62    | 11184.411   | 5916.1   | 3.27              | 9672.8235   |
| NY         | 61.9        | 210.68      | 6520.546  | 1056.2   | 166.21   | 87775.501   | 5671.9   | 22.95             | 65085.0525  |
| ОН         | 46.4        | 139.61      | 3238.952  | 1400.2   | 109.2    | 76450.92    | 4135.9   | 20.48             | 42351.616   |
| PA         | 61.2        | 18.89       | 578.034   | 1760     | 19.45    | 17116       | 5934.1   | 5.51              | 16348.4455  |
| TX         | 34.3        | 401.83      | 6891.3845 | 1192.8   | 185.53   | 110650.092  | 6694.6   | 25.77             | 86259.921   |
| total dist |             | 1380.96     |           |          | 900.41   |             |          | 146.27            |             |
| km         |             | 2222.444    |           |          | 1449.072 |             |          | 235.3992          |             |
| populatio  | n           |             | 28768.011 |          |          | 521465.8375 |          |                   | 504526.755  |
| PD (metric | c; 25.88863 |             |           | 719.7237 |          |             | 4286.563 |                   |             |
| person-re  | m           |             | 2.62E-03  |          |          | 4.75E-02    |          |                   | 1.03E-03    |

Trojan from Portland

| State      | Rural    | Rural Dist. F | Rural P   | Suburban | Suburban | Suburban P | Urban    | <b>Urban Dist</b> | Urban P     |
|------------|----------|---------------|-----------|----------|----------|------------|----------|-------------------|-------------|
| AZ         | 18.6     | 314.42        | 2924.106  | 1046.6   | 70.53    | 36908.349  | 4273.7   | 5.19              | 11090.2515  |
| CA         | 35.6     | 612.1         | 10895.38  | 1245.4   | 278.52   | 173434.404 | 5102.3   | 94.7              | 241593.905  |
| NM         | 7.1      | 156.66        | 556.143   | 917.5    | 10.86    | 4982.025   | 0        | 0                 | 0           |
| OR         | 28.1     | 234.88        | 3300.064  | 1110.3   | 79.88    | 44345.382  | 6629.5   | 30.97             | 102657.8075 |
| TX         | 9        | 207.14        | 932.13    | 1058     | 28.63    | 15145.27   | 6508.8   | 14.08             | 45821.952   |
| total dist |          | 1525.2        |           |          | 468.42   |            |          | 144.94            |             |
| km         |          | 2454.576      |           |          | 753.8504 |            |          | 233.2588          |             |
| population | )        |               | 18607.823 |          |          | 274815.43  |          |                   | 401163.916  |
| PD (metric | 15.16174 |               |           | 729.0981 |          |            | 3439.647 |                   |             |
| person-rer | n        |               | 1.70E-03  |          |          | 2.50E-02   |          |                   | 8.22E-04    |

# LaCrosse from Rock Island

| State      | Rural       | Rural Dist. | Rural P  | Suburban | Suburban | Suburban P | Urban    | Urban Dist | Urban P    |
|------------|-------------|-------------|----------|----------|----------|------------|----------|------------|------------|
| IA         | 57.3        | 14.28       | 409.122  | 478.6    | 5.51     | 1318.543   | 0        | 0          | 0          |
| IL         | 23          | 81.87       | 941.505  | 1164.8   | 24.07    | 14018.368  | 3979.7   | 3.12       | 6208.332   |
| KS         | 23.8        | 169.24      | 2013.956 | 1209.1   | 52.29    | 31611.9195 | 4157.9   | 6.81       | 14157.6495 |
| МО         | 28.1        | 176.88      | 2485.164 | 783.3    | 18.12    | 7096.698   | 8523.2   | 3.96       | 16875.936  |
| OK         | 38.8        | 168.52      | 3269.288 | 1240.4   | 62.87    | 38991.974  | 4791     | 16.2       | 38807.1    |
| TX         | 32.2        | 305.57      | 4919.677 | 1034.1   | 119.34   | 61704.747  | 6083.7   | 12.96      | 39422.376  |
| total dist |             | 916.36      |          |          | 282.2    |            |          | 43.05      |            |
| km         |             | 1474.741    |          |          | 454.1577 |            |          | 69.28239   |            |
| population | n           |             | 9119.035 |          |          | 21451.8    |          |            | 76049.0175 |
| PD (metri  | c; 12.36696 |             |          | 94.4685  |          |            | 2195.335 |            |            |
| person-re  | m           |             | 8.31E-04 |          |          | 1.95E-03   |          |            | 1.56E-04   |

|       | •      |         |
|-------|--------|---------|
| Zion  | trom   | chicago |
| _1011 | 110111 | CHICAGO |

| State      | Rural      | Rural Dist. |            | Suburban | Suburban Di | st.        | Urban    | Urban Dist. |             |
|------------|------------|-------------|------------|----------|-------------|------------|----------|-------------|-------------|
| IL         | 26.2       | 205.63      | 2693.753   | 1268     | 74.38       | 47156.92   | 4836     | 27.09       | 65503.62    |
| KS         | 28.5       | 124.58      | 1775.265   | 1194.3   | 30.92       | 18463.878  | 3876.6   | 5.26        | 10195.458   |
| МО         | 32.4       | 212.71      | 3445.902   | 1313.8   | 61.8        | 40596.42   | 7196.5   | 15.62       | 56204.665   |
| ОК         | 29.6       | 187.56      | 2775.888   | 1107.5   | 54.46       | 30157.225  | 3532.1   | 1.87        | 3302.5135   |
| TX         | 31.5       | 314.73      | 4956.9975  | 1033.2   | 131.95      | 68165.37   | 5142.5   | 17.2        | 44225.5     |
|            |            |             | 0          |          |             |            |          |             |             |
| total dist |            | 1045.21     |            |          | 353.51      |            |          | 67.04       |             |
| km         |            | 1682.106    |            | •        | 568.9203    |            |          | 107.8906    |             |
| population | า          |             | 15647.8055 |          |             | 204539.813 |          |             | 179431.7565 |
| PD (metric | ; 18.60502 |             |            | 719.0456 |             |            | 3326.179 |             |             |
| person-rei | m          |             | 1.43E-03   |          |             | 1.86E-02   |          |             | 3.68E-04    |