

Using ARCON96 for Control Room Radiological Habitability Assessments

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Outline



- Introduction
- Executing ARCON96
- Experience from Reviewing ARCON96
Analyses
- Conclusion

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Introduction



- Why licensees are choosing to update their CR Habitability Analyses
 - Alternative Source Term (AST) Implementation
 - Power Uprate Submittals
 - Generic Letter 2003-01
 - Physical changes to CR ventilation system

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ARCON96 Guidance



- ARCON96 User's Guide
 - NUREG/CR-6331, Revision 1 (May 1997)
- Staff does not endorse all of the illustrative examples in the ARCON96 User's Guide as regulatory positions
- Subsequent Staff Guidance
 - NRC letter to Westinghouse (July 1997)
 - NRC/NEI Public Meeting (March 2000)
 - Draft Regulatory Guide DG-1111 (December 2001)
 - Regulatory Guide 1.194 (June 2003)

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Executing ARCON96



□ Release Type

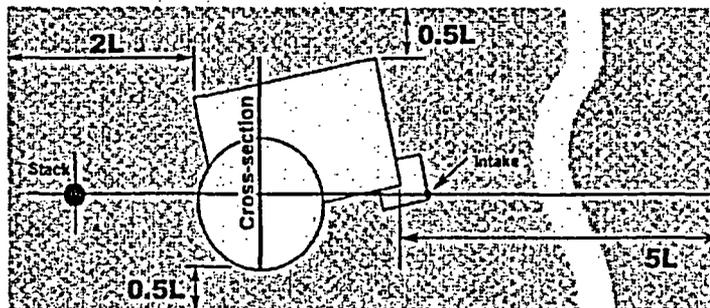
- Ground
- Vent (don't use)
- Stack
 - More than $2\frac{1}{2}$ times the height of adjacent structures, or
 - Outside the zone of influence of adjacent structures

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Executing ARCON96



□ Zone of Influence for Stacks



L is the height or width, whichever is less, of the building cluster cross-section perpendicular to the wind. A stack located inside the zone should be $2\frac{1}{2}$ times the height of the structure that causes the building wake.

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Executing ARCON96



□ Release Height

- Calculate plume rise separately and add to the vent/stack physical height
 - Plume buoyancy and/or vertical velocity should be maintained throughout the release

□ Building Area

- Use a value of 0.01 m³ if a building area of zero is desired

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Executing ARCON96



□ Surface Roughness

- Use 0.2 m in lieu of the default value of 0.1 m
 - Reasonable values range from 0.1 m to 0.5 m

□ Averaging Sector Width Constant

- Use 4.3 in lieu of the default value of 4.0

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Executing ARCON96



- Direction to Source
 - Use direction from receptor back to the release point
 - Ensure direction entered has same reference point as the wind directions reported in the meteorological database (i.e., true north versus plant north)

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Executing ARCON96



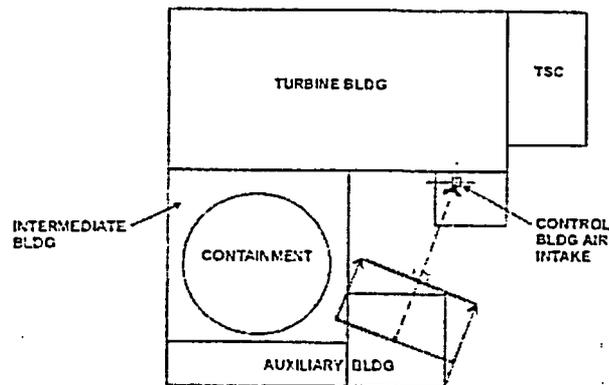
- Diffuse Area Sources
 - Initial Diffusion Coefficients (σ_y and σ_z)
 - Use one sixth of the cross-sectional area width and height
 - Direction to Source
 - Use line-of-sight from center of cross-sectional area to receptor
 - Distance to Receptor
 - Move cross-sectional area forward along line-of-sight until it intercepts the closest point on the building surface

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Executing ARCON96



□ Diffuse Area Sources



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Experience from Reviewing ARCON96 Analyses



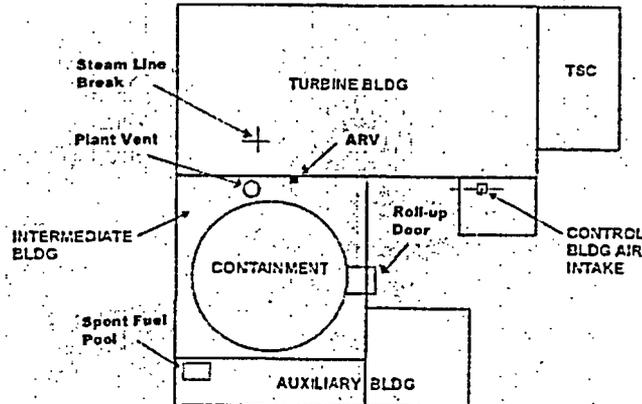
- Multiple ARCON96 Runs
 - Multiple ARCON96 runs were made to handle multiple data files (multiple years of data)
- Wind Speed Units
 - The default setting of m/sec was used instead of switching to the database units of mph
 - Database units changed from mph to m/sec during analyzed period of record
- Building Area
 - All release points were assumed to be within the building wake of the containment

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Experience from Reviewing ARCON96 Analyses



□ Release Points versus Building Area



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Experience from Reviewing ARCON96 Analyses



□ Upper Wind Data

- Upper wind data not provided nor identified as missing with a field of "9"s

□ Delta-T Data Conversion to Stability Class

- Conversion from °F/XYZ ft to °C/100 m performed incorrectly

□ Meteorological Data Quantity

- Less than five years of data provided
- Annual data recovery rates less than 90%

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Experience from Reviewing ARCON96 Analyses



□ Meteorological Data Quality

- Missing or duplicate hourly records
- Inconsistent identification of missing data (e.g., using values of zero instead of "9"s)
- Wind data remaining unchanged for several hours
- Inconsistent wind speed, wind direction, or stability class frequency distributions from year to year
- Stable conditions during the day/unstable conditions at night

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Experience from Reviewing ARCON96 Analyses



□ Meteorological Data Quality (continued)

- Extended periods of extremely unstable (stability class A) conditions
- Upper level wind speeds less than lower level wind speeds
- Poor correlation between lower level and upper level wind direction frequency distributions
- Inconsistent joint frequency distributions between ARCON96 input data and PAVAN input data

□ Wind Direction Values

- Values ranged from 0° to 359° instead of 1° to 360°

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Conclusion



- ❑ This presentation is intended to help licensees avoid common mistakes and improve the quality and acceptability of their submittals
- ❑ Staff does not endorse all of the illustrative examples in the ARCON96 User's Guide as regulatory positions
- ❑ Significant deviations from regulatory guidance can result in delays in obtaining staff approval