Ensuring Quality of Air Emissions Data Using Good Engineering Practice

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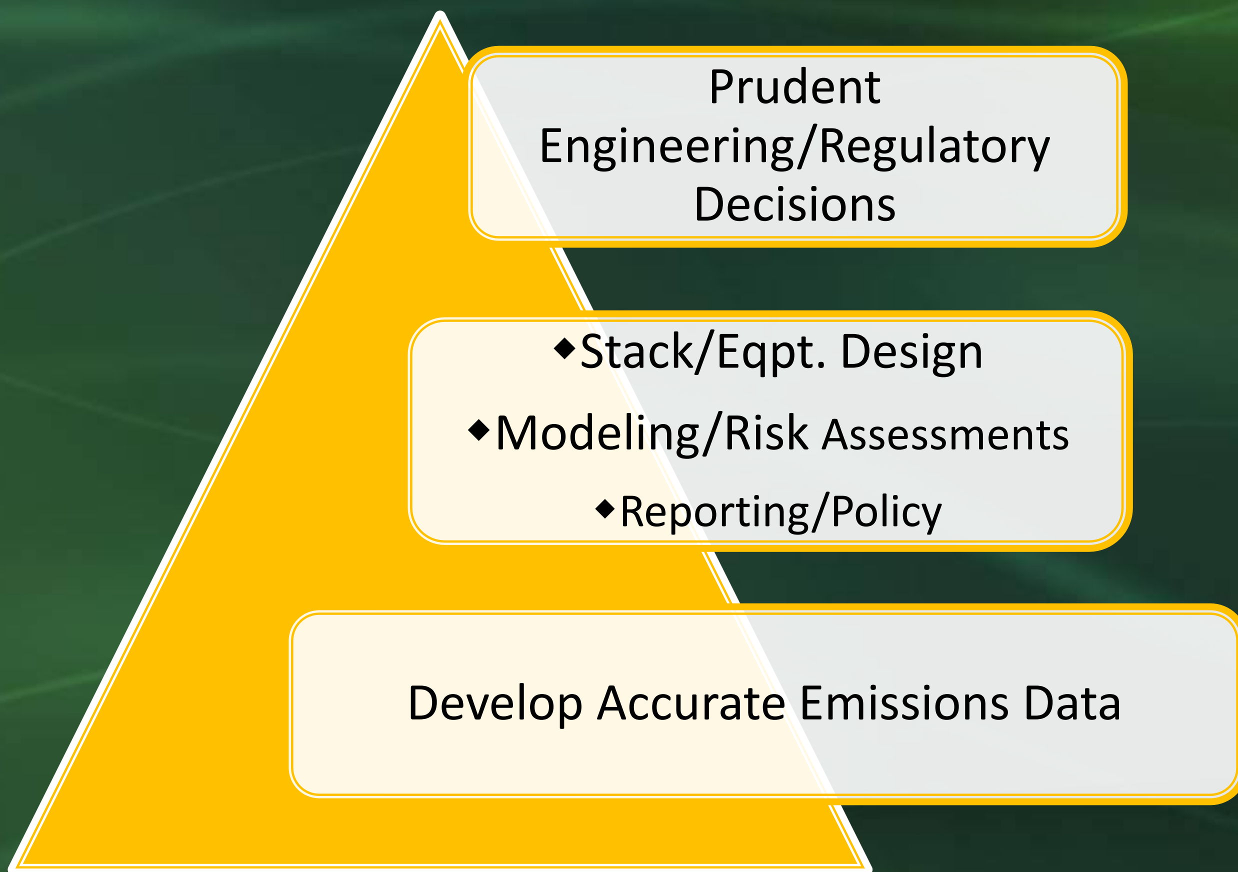
Purpose

- Awareness of Value/Importance of Accurate Data
- Consequences of Using Inaccurate Data
- Value of Engineering and Measurements
- Recommendations for Improvement

Value of Accuracy in Air Emissions Data

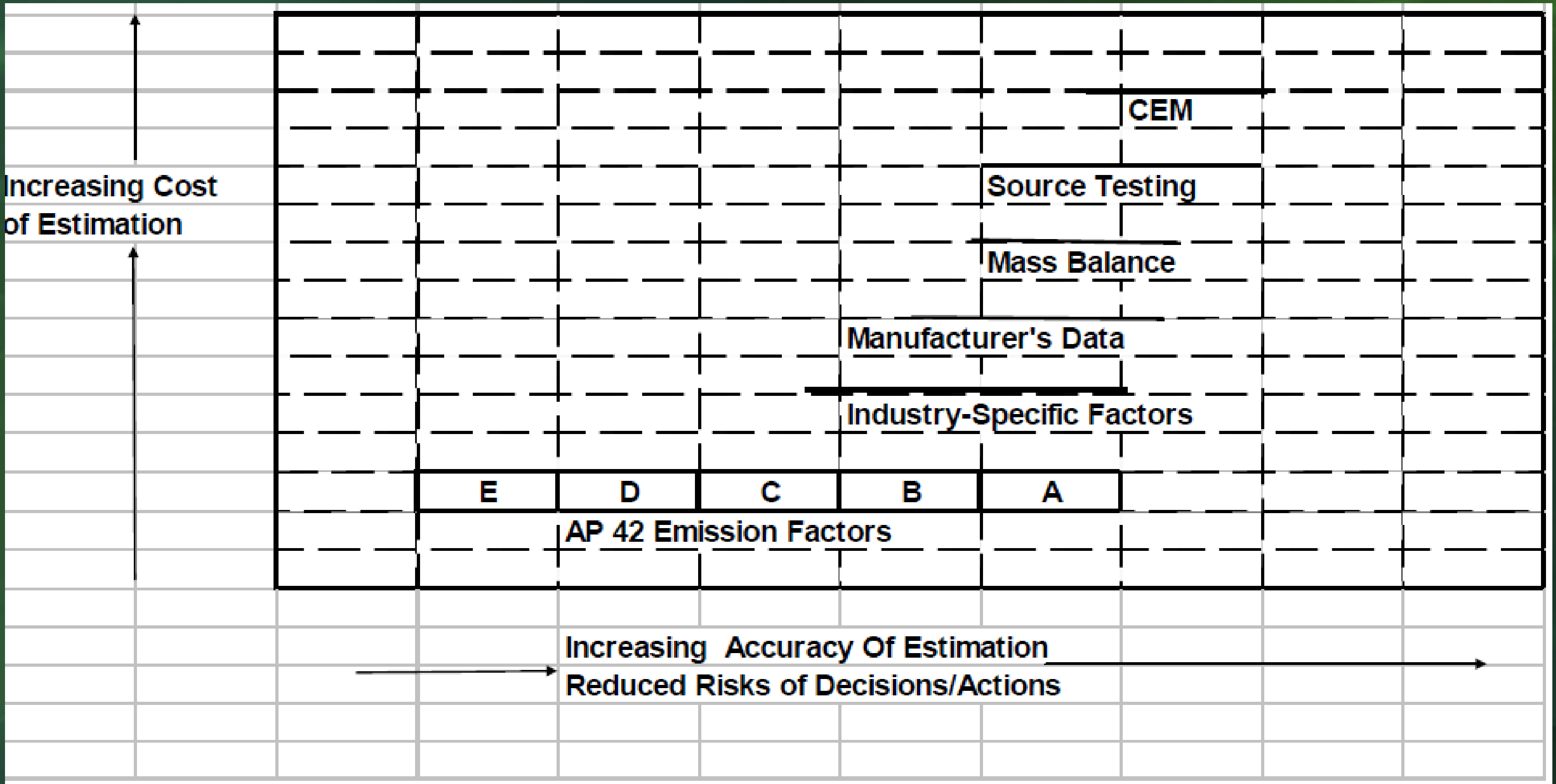


FOUNDATION OF ALL AQ MGMT. PLANS

CONSEQUENCES

Data/Source	Inaccuracies in Emissions	Consequences
NPRI	Fugitive - VOC from petrochemical industry under-reported. Use of inaccurate emission factors	Air quality impact
Urban Air Initiative (Kansas/Nebraska)	EPA model erroneous in estimating emissions from using ethanol blended fuel	Economic impact to agriculture industry
Texas Commission on Environmental Quality	Toxic chemicals for petrochemicals industry under-reported	Air quality impact
EPA estimates of flared emissions	EPA to revise formulas and reissue emission estimates by 2018	Smog forming emissions under reported. Legal action against EPA
VW diesel cars	Defeat device (software) - underestimate emissions	Legal action. Business/reputation. Impact to diesel industry
O_3 non-attainment in the US 1970 - 1980	VOC underestimated, NOx overestimated	Adoption of less than optimal control technology
Emissions from airlines	Under global scrutiny - under reporting	Air quality impact

Estimation Methods/Reliability



http://www.epa.gov/ttn/chief/ap42/c00s00.pdf

Engineering Responsibility to Use Reliable Method

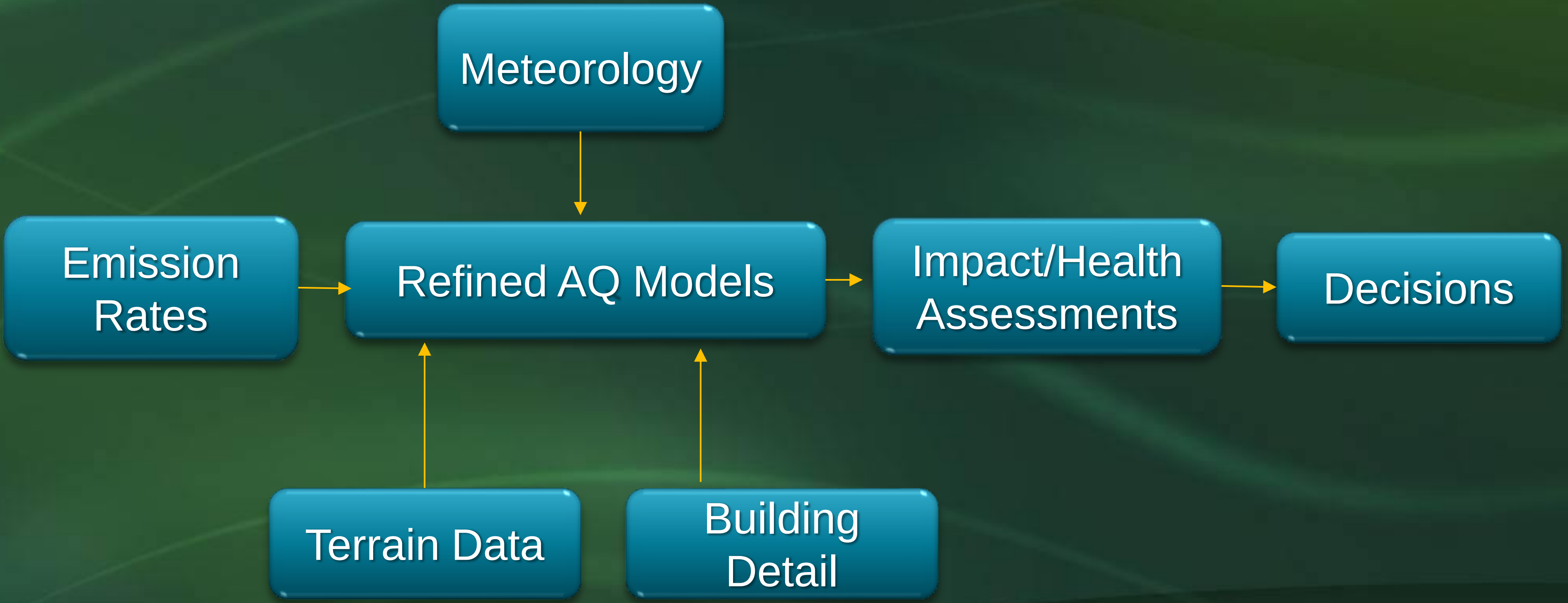
AP 42 Emission Factors

- Simple to use
- Minimal costs/effort
- Understand risks for your use
- Not recommended unless A or B rated

AP-42 Factor	Count	% of Total
A	2,542	9.36
B	2,236	8.23
C	3,523	12.97
D	6,413	23.61
E	7,502	27.62
U*	4833	17.79
Total	27,164	100

A: Excellent; B: Above average; C: Average; D: Below average, E: Poor; U: Unrated

Error Propagates



Q ;[Emissions] [Meteorology]

Key Terms About Quality Expectations

- Accuracy: Closeness to true value
- Bias: Prediction of systematic error
- Error: True value – Observed value
- Confidence Level: Range of uncertainty (μ, σ, % confidence)

RELATIVE CONFIDENCE LEVELS

Source	SO_2	NOx	VOC	HAP
Utilities	H	M-H	M-H	M
Vehicular	M	M-H	M	L-M
Area	L	L	L	L-M
Biogenic	L	L	L	L

H = High, M = Medium, L = Low

Ref: NARSTO. Improving Emission Inventories for Effective Air Quality Management Across North America; NARSTO: Oak Ridge, TN, 2005

ESTIMATING ABSOLUTE UNCERTAINTY

Independent Parameters

$U(abs)_{(X,\ Y \ldots N)} = \text{Sq. Rt.}(U_x^2 + U_y^2 + \ldots U_N^2)$

Related Parameters

$U(related)_{(X,\ Y)} = \text{Sq. Rt.}(U_x^2 + U_y^2 + 2rU_xU_y)$

r = Coefficient of regression between X and Y

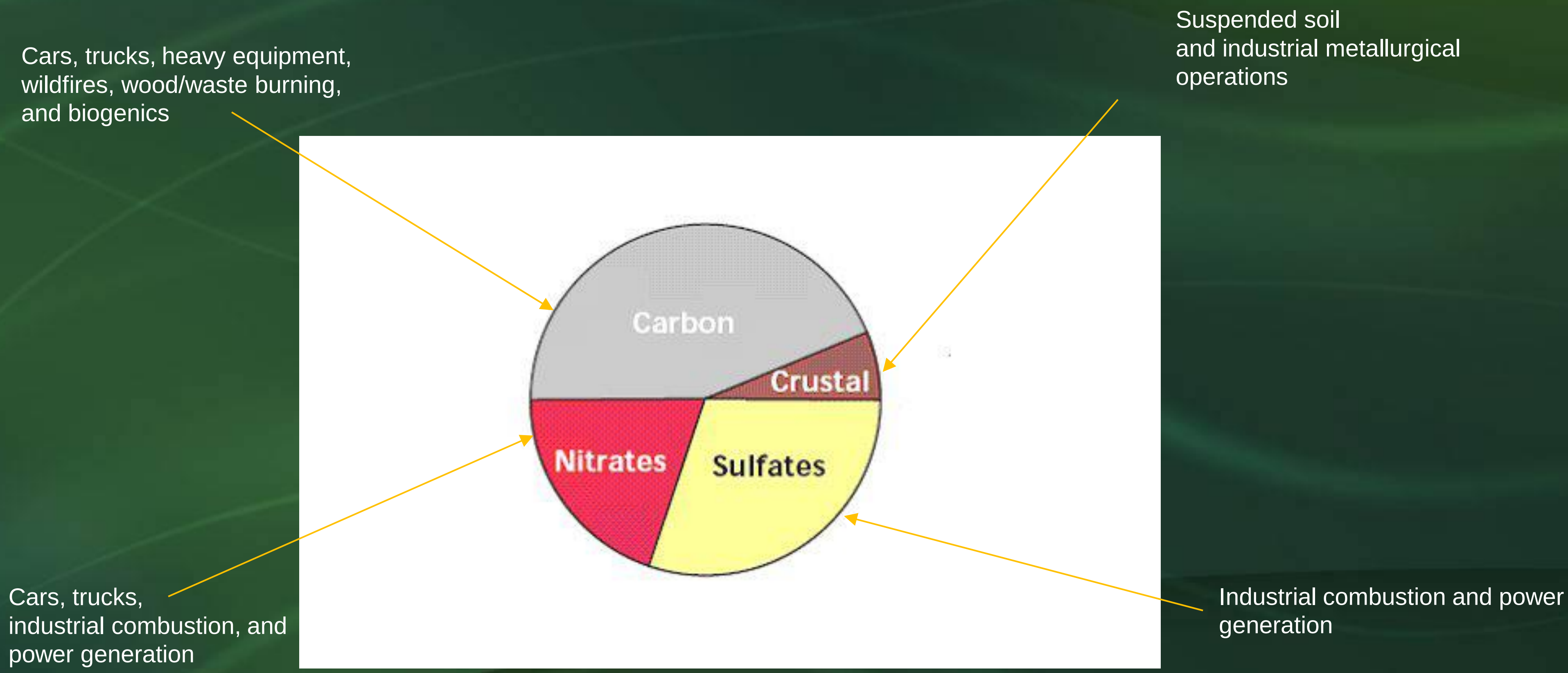
EXAMPLE: FLARED EMISSIONS UNCERTAINTY

Emission Parameter	% Error (U)	U^2
Pressure	2.00	4.00
Temperature	0.10	0.01
Gas composition	2.00	4.00
Flowmeter	1.40	1.96
Installation Effects	0.50	0.25
Square rt. of sum of U^2	10.22%	
Square rt. of sum of U^2	3.20%	

http://www.ipieca.org/ publication/greenhouse-gas-emissions-estimation-and-inventories-addressing-uncertainty-and-accuracy

$PM_{2.5}$

$PM_{2.5}$ = (Primary + Secondary (chemical reactions from NOx and SOx))
Exists in solids (filterable) + liquids (non filterable)
1 μ = 10^{-6} meter



Source: The Particulate Matter Report, EPA-454-R-04-002, Fall 2004

Challenges in Modeling $PM_{2.5}$

- Of the $PM_{2.5}$ emissions factors in AP-42, there are no A-rated factors and only 2.7% of the factors are B-rated
- EPA Method 201A for stack testing limited by stack temperature (~ < 250 °C)
- $PM_{2.5}$ testing generally not required in approvals in AB at the present
- Your process activity may not fit into EPA categories for using emission factors
- Several other sources: vehicular, road blown dust, harvesting, non-approved combustion sources, secondary
- Mfr. data on baghouses generally good
- Receptor (monitored) based approach meaningful until such time $PM_{2.5}$ emission estimates are improved (or measurements are made where possible)

US EPA EIIP: PRIORITIES

- $PM_{2.5}$
- Air Toxic
- Area Sources
- Mobile Sources
- Biogenic
- Training
- Data Management
- QA

Regulatory

- NPRI: Statement of Certification but no specific requirements on QA/QC or accuracy
- Alberta AMD: QA/QC expectation to be met
- EC Guidance on GHG reporting: Statement of Certification but no specific requirements on QA/QC or accuracy
- ISO 14064(3): Materiality requirement (+/- 5%)
- EU: Error thresholds on GHG emissions

HOW DO WE GET THERE? QA – QC

Quality Assurance	Quality Control
Goal/Expectation	Maintenance
Mgmt. support	Calibrations - checks
Resources/staff	Additional measurements
Training	Data gathering
Audit	Reduction/validity checks
Ongoing improvement	Estimation/procedures/assumptions
	Accuracy assessments
	Engineering - QP review
	Reporting
	Record keeping

Engineers’ Role

- Data needs
- Data review for quality, consistency, completeness, representativeness
- Establish most appropriate estimation tools, procedures and measurements
- Procedure for accuracy – minimization for errors
- Selection of verifies/validators. Eng. Staff essential on team
- Help with eqpt. design, performance, GEP practice and BACT
- Training/Supervision
- Peer review of emission/engineering input to models
- Adhere to engineering/professional code (good judgment, best knowledge, protection of public safety)

Innovation

Drone used to Monitor air quality on wastewater system
http://scentroid.com/scentroid-sampling-drone/

Conclusions

- Raising awareness of the importance of value of accurate emissions data
- Clearer regulatory expectations on quality/accuracy
- Well defined and documented QA/QC program in place
- Stay away from using poor-avg. quality factors
- Move to measurements (spending small $ to avoid huge liability costs/risks)
- Engineering/QP review necessary