Evidence Based Need for Improving Compliance

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Reduce NPDES SNC Rate By Learning

We may each have stories, anecdotes, some data, common sense views, and our professional judgements about how to improve compliance.

There is growing body of behavioral science theory and empirical research on what improves compliance.

Let's integrate these to advance our knowledge of what works and increase our compliance assurance tool box.

- This is called Evidence Based Government

Limits of Common Sense and Professional Judgments

Common Sense and our professional judgment may be effective basis to design and implement environmental compliance programs, except when they are not.

Problem is we do not know when our common sense and professional judgments will be accurate and when they will not be.

- Consider some examples in the next slides:

Field experiments may overturn conclusions from experience or non-experimental empirical studies

- Steroid Injections for Head Injuries: Dominant approach for decades. Reduce swelling - don't want swelling inside the skull.
  - RCT (2005): steroid injections increase death rate.

- Scared Straight: Studies -> Participants less likely to commit crimes after participating in SS.
  - Several RCTs: SS increased criminal activity

Minneapolis Domestic Violence Experiment

- **Problem**: Enforcement Action or Assistance?
- **Population**: Domestic violence offenders with probable cause to make an arrest
- **Treatments**: Officers randomly selected 1/3 for arrest (jail), 1/3 for advice & mediation, and 1/3 for 8-hour separation from their domestic partner.
  - Follow-up in 6 months with interviews and incident reports.
  - **Which was most effective in reducing repeat offending**?

Minneapolis Domestic Violence Experiment

- **Problem**: Enforcement Action or Compliance Assistance?
- **Population**: Domestic violence offenders with probable cause to make an arrest
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  - Follow-up in 6 months with interviews and incident reports.

  - **Arrest was most effective in reducing repeat offending**.
  - Replicated in 5 cities: arrests associated with up to 25% reduction in repeat offending
  - Subsequently, many states and police units enacted polices for mandatory arrest, without a warrant, for domestic violence cases where there was probable cause that crime had been committed.

Clinical Drug Trials Often Do Not Succeed

- New drugs identified for testing based on theory for why it could be effective in treating disease X
- Tested with randomized control studies (sometimes double blind).
- Overall about 14% of new drugs that enter Phase 1 clinical trial are approved.
  - Chi Heem Wong, Kien Wei Siah, Andrew W Lo, Estimation of clinical trial success rates and related parameters, Biostatistics, Volume 20, Issue 2, April 2019, Pages 273–286,.

Why Common Sense and Professional Judgment May Be Inaccurate

- Extensive research demonstrating our cognitive biases. Two examples:
  - **Confirmation Bias:**
    - Our tendency to focus on and be more accepting of information that confirms our prior views compared to information that is inconsistent.
  - **Availability heuristic**:
    - Our probability judgment is based on what is most easily available in our memory: more recent and vivid things, especially if personally experienced given greater weight than if time was invested to recall or gather empirical data.
  - Reviewing those biases is a separate presentation or course.

Why Common Sense and Professional Judgment May Be Inaccurate - continued

Behavior of individuals, organizations and communities is complicated and our understanding of the compliance drivers may be incomplete or not accurate.

NPDES compliance may be multi-factorial and our existing programs may only be addressing some factors or perhaps not the most important factors.

- Do we have a theory for why our compliance approach will be effective?
- Have we evaluated the existing empirical evidence for our theory?

Factors that impact Compliance –

1. Design of the Regulation.
   - Complex or ambiguous?
   - Is there self-monitoring (feedback)?
2. Government monitoring & enforcement to create deterrence
3. Voluntary compliance assistance (in contrast to mandatory training)
4. Public accountability via transparency
5. Costs of complying: are there immediate and "substantial" costs to the regulated entity?
6. Benefits of compliance: are the benefits primarily in the future and to others (e.g., public)?

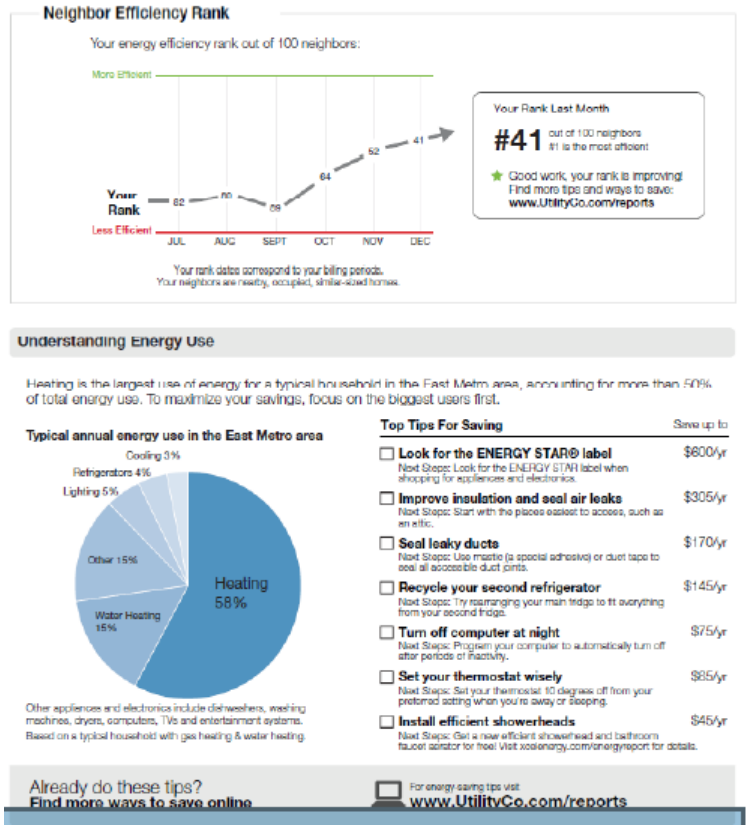
Factors that impact compliance - continued

7. Awareness of regulation and/or how to comply.
8. Disagree with the law
9. "Comply with Spirit of Law".
   - "I'm special" mindset" or Cognitive Dissonance .
10. Some competitors not subject to rule
11. Perception that peers or competitors are not complying.
12. Cultural/social and professional norms
13. Community engagement

Can Peer Comparisons Encourage Reductions in Discharges?

Peer comparisons (a.k.a., social comparisons) reduce household energy and water consumption, as well as encourage other pro-environmental behaviors.

Could they encourage polluters to reduce their emissions?



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From: Dietrich Earnhart, Professor, Center for Environmental Policy, University of Kansas
Paul Ferraro, Professor, Johns Hopkins University

To:

Ronald L. Taylor
c/o City Clerk
Toronto Wastewater Treatment Facility
PO Box 235
Toronto, KS 66777-0235

Why am I getting this letter?

Your municipal wastewater treatment facility, Toronto Wastewater Treatment Facility, is regulated under the Clean Water Act by the Kansas Department of Environment and Health (KDHE), in concert with the Environmental Protection Agency (EPA). The KDHE lists you as the facility's contact person for the National Pollutant Discharge Elimination System (NPDES).

Peer Comparisons of Compliance among Kansas Municipal Dischargers

Based on our conversations with wastewater treatment experts in Kansas, we believe municipal wastewater facilities are not sure how their compliance performance differs from their Kansas peers. We have initiated a project that aims to provide this information.

We hope you find it useful!

What is a compliance ratio and why should I care?

To give you some sense of **how your compliance with your NPDES discharge limits compares to your Kansas peers' compliance**, we have extracted publicly available data from the EPA Integrated Compliance Information System (ICIS) database and assembled these data in a more easily understood format. We focus on the extent of compliance, which we measure as the *discharge-to-limit ratio*: the ratio of your wastewater discharges to the permitted discharge limit. **A lower discharge-to-limit ratio indicates *better* compliance with a facility's discharge limit.**

See the example in box →

Discharge-to-Limit Ratio

Wastewater discharges are recorded as a concentration, in milligrams of pollutant per liter of water discharged (mg/L). Say Facility A's discharge limit for a pollutant is 30 mg/L and it discharges 15 mg/L. Its *discharge-to-limit ratio* then equals 0.50. If the facility's discharge limit changes from 30 mg/L in the winter to 12 mg/L in the summer, yet the discharge level stays the same, then the facility's discharge-to-limit ratio would also change: from 0.50 in winter to 1.25 in summer. Say Facility B faces the same winter discharge limit, but discharges 45 mg/L in the winter. Its discharge-to-limit ratio equals 1.50. Comparing the two facility ratios, we conclude that Facility A has better compliance in the winter.

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The discharge-to-limit ratio allows one to measure the **extent of compliance** for any discharge limit, even when a facility's discharge limit varies over time. More importantly, this compliance ratio allows one to compare the extent of compliance across multiple facilities, even when each facility faces a different discharge limit. By comparing the two facilities' compliance ratios, one can assess which facility complies to a greater extent with its discharge limit and which complies less. **Facilities with lower compliance ratios comply to a greater extent.**

Kansas municipal facilities discharge a variety of pollutants. In order to facilitate comparison across facilities, **our calculations of the compliance ratio focus on the most prominent pollutant among Kansas municipal facilities: Biological Oxygen Demand (BOD).** For each facility, we use the facility's BOD discharge limits and its actual BOD discharges to calculate its 2016 compliance ratio, which is the average ratio over the 12-month period between January and December 2016.

So how does my facility compare with other facilities in Kansas?

Based on these facility averages, we are able to generate a distribution of all facilities' average compliance ratios. We graphically present this distribution in the enclosed figure. Each facility is represented once in this distribution. At the bottom of the distribution is the facility with the smallest compliance ratio – it is found at the extreme left of the graph where the curve begins (minimum ratio = 0.04). At the top of the distribution is the facility with the largest compliance ratio – it is found at the extreme right of the graph where the curve ends (maximum ratio = 1.92). In the middle of the distribution is the median compliance ratio (0.44) – half of the facilities have compliance ratios above this value and half have compliance ratios below this value.

Have questions or want to provide us with feedback?

You are most welcome to call Professor Earnhart at 785-864-9119 or email him at earnhart@ku.edu.

If you are not the NPDES contact person for your municipal facility, we request that you deliver our letter to the correct NPDES contact person.

Your Facility's 2016 Compliance Ratio (lower is better): **0.13**
Your facility's percentile: **13th percentile** (see star on the graph)

In other words, **13%** of Kansas municipal facilities comply with their discharge limits to a greater extent than your facility complies with your limits.

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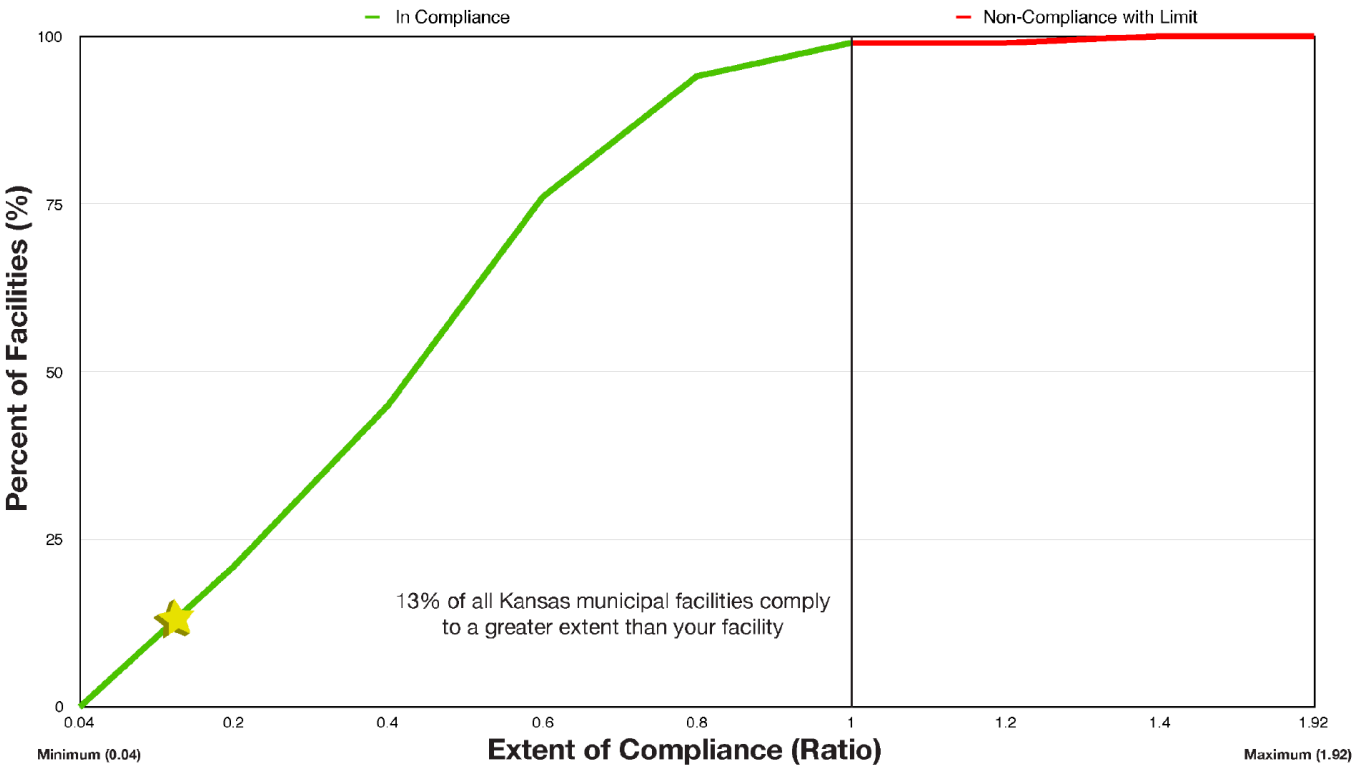
Extent of Compliance with Discharge Limits
Distribution of Kansas Municipal Facilities



A pilot study suggests peer comparisons can help

- 328 municipal wastewater facilities in Kansas in 2017.
- Half randomized to receive a peer comparison.
- Some evidence that recipients of letter reduced their discharge compared to the control group, but sample size needs to be increased (more states needed).

- University of Kansas, Johns Hopkins University and OECA are interested in expanding this pilot study to more states and perhaps with government sending the letters.

Path to Evidence Based Compliance Programs

Review existing data on our programs to try to understand effectiveness

- Identify the limits and constraints in existing data.
- Collect more data on our programs.

Read the literature on theories and empirical evidence that exists on what works in compliance.

- Professor Jay Shimshack will make this easy for you shortly.

Test new approaches based on a "theory of change" and build evaluation measurement in from the beginning.

Testing and learning are not that hard

NPDES is unique among environmental programs with rich electronic data set on compliance.

- There are gaps and limits in our NPDES data, but compared to other programs we have far more self-monitoring and accessible electronic data.

Test new approaches with evaluation design built in from the beginning.

- The gold standard for testing – randomized control test –could be done by phasing.
- Academic researchers can help with design and evaluation as many approaches might be possible.
- We have 5 MOUs with universities that are interested in collaborating with us.

Acknowledgements

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For More Information

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