Public Involvement in Technology Integration: Understanding San Diego's Successes and Failures with Potable Reuse

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By

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Water: Both the issue and the problem

Drinking water is an essential human need. While a human only needs to drink about 2.7-3.7 liters a day to stay healthy, potable water is also used for other purposes such as cooking, sanitation, and hygiene activities (Mayo Clinic, 2020). The average American uses about 88 gallons of water a day, according to the U.S. Environmental Protection Agency (US EPA, 2017). Oftentimes, drinking water comes from freshwater sources like lakes, rivers, or groundwater aquifers. However, in some parts of the United States, these freshwater sources are becoming increasingly hard to depend on. U.S. Forest Service scientists determined that by 2071, just 50 years from today, nearly half of the 271 freshwater sources in the United States may not be able to provide for our water consumption (Brown et al., 2019). This concerning statistic highlights the importance of more effectively managing community water consumption. A potential solution to address some of the water shortages expected in the coming decades, especially for urban communities, is reclaimed drinking wastewater. Reclaimed drinking water (often called potable reuse) is drinkable water which has been partially or fully derived from wastewater (WateReuse, 2019).

This idea of reusing wastewater as drinking water, while scientifically sound, may be controversial or outright rejected by some communities. Rejection of potable reclaimed water has been shown by some as primarily driven by a distrust in public water authorities (Ormerod and Scott, 2013). Nowhere is the issue surrounding trust and drinking water quality more relevant and devastating in the United States, than in Flint, Michigan where in 2014, the city government decided to switch their source of drinking water to the Flint River which had extremely high levels of lead (Denchak, 2018). The city didn't provide for adequate testing and monitoring and were found to have lied about lead levels even when Flint residents began complaining about adverse health effects (Denchak, 2018). It took three years before the lead levels of the drinking water met EPA action levels (below 15 ppb) and another two years for lead pipes to be replaced in every Flint residence (Denchak, 2018).

As of today, Flint water meets some of the most stringent drinking water standards in the state and country making their water as safe to drink as any other Michigan city (Winowiecki, 2019). However, many Flint residents remain distrustful of their city's water and still drink from bottled water (Winowiecki, 2019). In fact, the Flint water crisis has shaken public trust in the safety of drinking water around the nation. In 2016, a national poll found that about 18% of the public didn't have confidence in the quality of their tap water (Swanson, 2016). This poll and the case of Flint, Michigan indicate that public trust is a complex and dynamic idea, but one that is central to the successful integration of technology providing the most essential municipal service. This research will explore how water resource engineers build trust with the public as a means to integrate reclaimed drinking water facilities in those communities.

Social Contract of Engineering: Public involvement in engineering practice

While scientists, engineers, and technologists tend to agree that building public trust is important, there are disagreements about how trust is best established. Many scientists believe that public trust in technology can be achieved by simply communicating the science in ways that are accessible to people, thereby increasing public scientific literacy, and then demonstrating through facts and figures that the technology at hand is safe and/or effective. While increasing scientific literacy and consistently informing the public about the latest science are important, these strategies come from the idea that there exists a knowledge gap or deficit that scientific authorities must try to fill. Once this knowledge is communicated to the public in a way that they understand, their doubts about settled science will decrease as well (Brown, 2009). This is known as the *deficit model* and there are a few troublesome assumptions this model makes. The first and most obvious assumption is that the public is ignorant of science, the second is that the public shares negative attitudes towards certain technologies, and the third is that said ignorance about technologies is the root cause of these negative attitudes (Ahteensuu, 2012). This last assumption is directly countered by Brown who posits that the public "[…] make[s] decisions based on a host of factors as well as the scientific 'facts' [which] include ethical and religious beliefs, in addition to culture, history and personal experience" (Brown, 2009, p. 609). In fact, Brown goes further and suggests that there is a *new deficit model* that assumes that the difficulties in integrating new technologies can be ameliorated by collecting more data and scientific facts (Brown, 2009). All of these assumptions raise questions about whether Deficit Model thinking is effective and whether or not "what is needed instead is a public that is more familiar, comfortable with, and trusting of scientists" (Mooney, 2010, p. 3).

This notion of trust, rather than the psychological disgust known as the "yuck factor", is pivotal when it comes to whether or not reclaimed drinking water is actually desired. Ormerod and Scott (2013) surveyed residents of Tucson, Arizona about a proposed reclaimed drinking water project and they found that residents who trusted the local water and government authorities involved in planning and development, viewed potable reuse more favorably (Ormerod and Scott, 2013). They conclude that "Rather than trying to move public opinion in line with expert thinking, we argue water planners and local government must […] confront public concerns regarding continued development and growth […] and expand participation to include those normally considered outside of the usual boundaries of system design and development" (Ormerod and Scott, 2013, pg. 367).

Both Brown (2009) and Ormerod and Scott (2013) suggest that trust is at the heart of the discussion around acceptance and support of controversial technologies. They also both suggest that public trust is gained when laypeople are brought closer to the work of scientists, engineers, and local government. This suggestion represents the framework of a Social Contract of Engineering (SCE). SCE offers a new "socially robust" engineering that allows for the public to actively participate in decisions that ultimately affect them (Gibbons, 1999). This is opposed to the prevailing idea that there is "reliable" engineering that gains the immediate trust of the public (Gibbons, 1999). Gibbons (1999) points to the controversy over genetically modified organisms (GMOs) as an example. He argues that the "knowledge of the health implications of GMOs may be 'reliable' in the conventional scientific sense; but it is not socially robust […] until the peer group is broadened to take into account the perspectives and concerns of a much wider section of the community" (Gibbons, 1999). Instead of a top-down approach to engineering where engineers develop technology and dispense that technology onto the public, SCE "[…] fully incorporate[s] principles of accessibility, transparency, and accountability" into engineering practice, thereby democratizing it (Guston, 2004). SCE is a powerful framework for understanding the social integration of controversial technologies because it asks the question of who is considered part of the engineering process that ultimately affects society. This is especially relevant when the technology or product that is being implemented has the potential to cause, or protect against, bodily harm.

Combining wastewater treatment and drinking water production

Currently, in most communities, wastewater treatment and drinking water treatment plants are two separate processes. Reclaimed drinking water (a.k.a. potable reuse) goes through a series of treatment processes that involve both wastewater treatment and advanced drinking water treatment, see Figure 1 and 2 that illustrate the first and second stages of the wastewater treatment process.

Generally, the wastewater that leaves one's house gets pumped through a sewer system to a wastewater treatment plant (WWTP), along with runoff from roads and industrial/agricultural wastewater (U.S. EPA, 2004). At the plant, the water is sent through a mesh-like screen to remove the largest solid matter in the wastewater influent that might clog or damage the treatment equipment (U.S. EPA, 2004). The solid matter, which contains everything from rocks and wood to plastics, usually gets sent to a landfill while the screened wastewater goes to a grit chamber where smaller solid particulates like sand and grit are allowed to settle to the bottom of the chamber ("Treatment Steps", n.d.). From here, wastewater, removed of equipment-damaging solids enters a primary sedimentation tank (a.k.a. a primary clarifier) where even finer, suspended solids will be allowed to settle at the bottom of the tank while oil and grease are skimmed off the top (U.S. EPA, 2004). The settled solids are called primary sludge and removed from the bottom of the tank periodically (U.S. EPA, 2004). After removing the primary sludge, the wastewater enters an aeration tank that vigorously mixes the wastewater to allow for oxygen to enter the aqueous system (U.S. EPA, 2004). Usually, aerobic bacteria are added to the aeration tank to help break down organic matter (U.S. EPA, 2004). The combination of aerobic bacteria and chemically-decomposed organic matter forms activated sludge (U.S. EPA, 2004). The activated sludge and wastewater are allowed to separate in a secondary sedimentation tank (or secondary clarifier) ("Treatment Steps", n.d.).

Normally, at this point, the treated wastewater is sent to lakes, rivers, or oceans, not to be used for human consumption. However, with reclaimed drinking water, the partially treated wastewater goes through a series of advanced water treatment stages (Gerling, 2016). This typically first involves coagulation, or the chemically-driven formation of large aggregate solids, and microfiltration/ultrafiltration (MF/UF) to remove any remaining suspended solids (U.S. EPA, 2004). This is then followed by the reduction of the concentrations of dissolved chemicals through Reverse Osmosis (RO) or ion-exchange processes (U.S. EPA, 2004). The water is then disinfected by chemicals like hydrogen peroxide, ozone, and/or chlorine and/or with ultraviolet light (U.S. EPA, 2004). After going through advanced treatment, the water can be added to a drinking water reservoir, or other environmental buffer, before it enters a regular drinking water treatment facility (DWTF), as shown in Figure 1 (Gerling, 2016). This is known as indirect potable reuse (IPR) and is the most common way to dispense reclaimed drinking water (Gerling, 2016). The less common method, direct potable reuse (DPR), sends the water directly to the DWTF (Gerling, 2016). In either case, after arriving at the DWTF, both fresh and reused water go through very similar processes as described above to remove suspended solids from the reservoir as well as aesthetic treatments to improve color, odor, and taste (U.S. EPA, 2004).

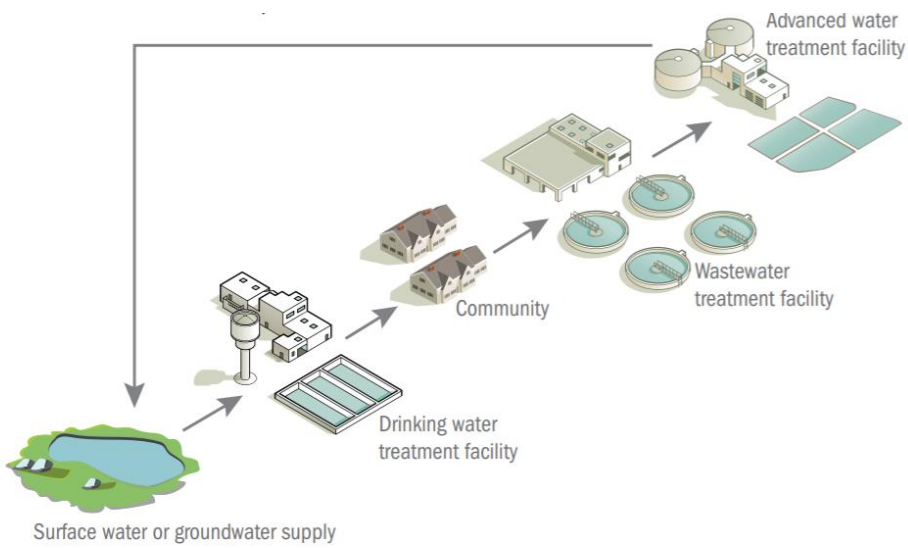

Figure 1. Flow Schematic of Indirect Potable Reuse (Image Source: Gerling, 2016)

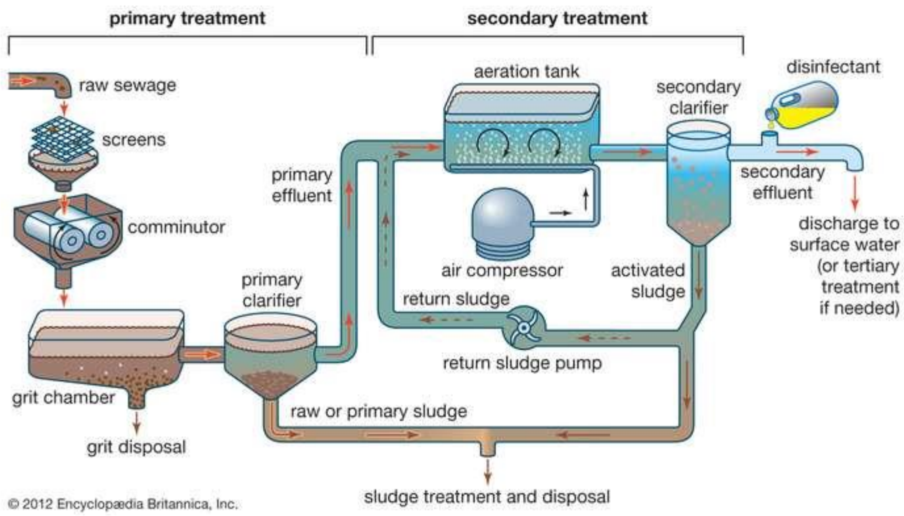

Figure 2. Generic wastewater treatment process (Image Source: Wastewater Treatment - Primary Treatment, n.d.)

As demonstrated above, drinking water derived from wastewater goes through numerous treatment stages and processes before it enters the drinking water supply. However, just because it is possible to produce safe, clean drinking water from waste, doesn't mean that the public won't be hesitant to consume water they know comes from their waste. More than likely, the public must be convinced that the water is safe and acceptable to drink. This barrier of implementation and how engineers and public water authorities can overcome it is an interesting topic that goes beyond the technical and into the social element of the project.

Research Question and Methods

The research question that I will pursue is: How can engineers and local water authorities build trust with community members to successfully integrate recycled drinking water in said communities? This research question builds off the aforementioned work of Scott and Ormerod which concluded that trust was the determinative factor when it came to the willingness of the public to accept and consume reclaimed potable water. As technology becomes more interwoven into the everyday activities of our lives, trusting technology and those that build it is extremely important. This research provides new insights in how to develop and integrate more trusted and therefore more effective technologies.

This question was investigated through a case study analysis of the City of San Diego's 20-year effort to integrate potable reuse facilities into the city's drinking water supply. To gain the perspective of potable reuse professionals on what goes into making potable reuse projects successful and how they see their role in engaging the public adequately, two interviews were conducted. The first interview was with Mr. Doug Owen, a program manager for PureWater San Diego, the current potable reuse project. The second interview was with Mrs. Patricia (Patsy) Tennyson who is an Executive Vice President for Katz & Associates (K&A). K&A was the public relations firm that San Diego hired to promote both PureWater San Diego and the Water Repurification Project (WRP) which was initiated by City Council in 1993 and scrapped six years later in 1999. Contemporaneous notes from the interviews with Mrs. Tennyson and Mr. Owen can be found in Appendices A and B, respectively.

In addition to these interviews, an extensive media and literature review was conducted to determine the level of public outreach and engagement at the time of each of the projects' development. Public opinion of recycled drinking water and public trust of local water agencies were surmised from surveys released by San Diego County Water Authority (SDCWA) in 2004, 2012, and 2019. These data helped inform a qualitative assessment of how public trust is related to public engagement and outreach. The analytical framework used to investigate the complex dynamics of public trust in this case study is the Social Contract of Engineering (SCE) which looks at sociotechnical systems through the lens of how engineers encourage and initiate public involvement in the process of technology development and integration.

Case Study Results

Public trust in potable reuse is closely associated with the amount of trust in local water agencies who develop and run potable reuse facilities. Given this, the most effective way for local water agencies to generate and sustain the public's trust with potable reuse and themselves is to directly engage the broader community as a whole that is being served by this resource instead of just a select number of community leaders or representatives. In the case of San Diego's efforts, the single most effective public engagement activity in regards to increasing public trust and approval in potable reuse was PureWater's Water Purification Demonstration Project (WPDP) publicly accessible tours that allowed participants to directly see the processes of potable reuse and even drink the final product. These tours were shown to markedly increase public understanding and approval of potable reuse and therefore build trust with local water agencies and recycled drinking water integration.

Recent History of Potable Reuse in San Diego

In their interviews, both Mr. Owen and Mrs. Tennyson extensively detailed the history of potable reuse in San Diego. Both of the interviewees stated that the City of San Diego has struggled to provide enough drinking water to its citizens due to frequent droughts and the city's growing population. This sentiment is widely held and indicated by numerous reports on the city's water supplies (Kenney, 2019; Rodrigo et al., 2021; Steirer et al., 2004). Thus, San Diego imports 85% of their water, according to Mrs. Tennyson and further corroborated by the city's 2020 Urban Water Management Plan (Rodrigo et al., 2021). Interestingly, Mrs. Tennyson stated that the city has been using recycled water even before WRP was initiated in 1993 for irrigation purposes. This use of recycled water is mentioned in the 2005 city report on Water Reuse (Steirer et al., 2004). It wasn't until WRP, however, that the city entertained the idea of further treating recycled water to drinking water standards.

During the planning process for WRP, a few key developments occurred that altered public perception. Both interviewees along with a 2018 report co-authored by the U.S. Environmental Protection Agency (EPA) stated that the term "toilet-to-tap", which led to misperceptions and distrust by the public about the technology, was widely used in the media and by opponents of the project (U.S. Environmental Protection Agency, 2018). The interviewees also pointed out that the project's design was misconstrued, during a City Council election campaign year, as taking the wastewater from the affluent areas of the city and treating it for use as drinking water in the poorer and historically Black communities in the southern portions of the city. These statements about the false claims of environmental injustice were in line with what was found in other reports on the failure of WRP (Kenney, 2019; Pratesi, 2017; U.S. Environmental Protection Agency, 2018).

Mrs. Tennyson said that 5 years after the failure of WRP, the city began studying the issue of public perception of water reuse. She also said that the city began meeting with community groups before any official plans were drawn. About these actions by the city in the early 2000's, Mr. Owen added that the city knew that they needed to supplement drinking water somehow and that they still saw potable reuse as an option worth exploring. All of these anecdotal statements about the city's efforts and intentions after WRP failed can be corroborated by the 2005 Water Reuse Study (Steirer et al., 2004). After the report was completed, the city moved to design and construct a pilot scale processing plant that would later become the WPDP in 2011 and which is currently being expanded today.

Public Opinion and Public Trust

Figure 3 below shows public opinion data from three separate opinion polls conducted by SDCWA in the years 2004, 2012, and 2019. This figure demonstrates a dramatic increase in the amount of San Diego residents who support adding recycled water to help supplement drinking water supply. Likewise, the amount of people who oppose recycled drinking water dramatically decreases over these three polls. Figure 4 shows survey data about whether or not respondents trust their local water agency from the same three public opinion polls. Almost the same fold increase seen in those who strongly favor potable reuse can be seen in those who trust their local water agency. These data suggest a clear association between public trust in the engineers themselves and public trust in recycled drinking water which closely aligns with the previous primary research (Ormerod and Scott, 2013). These data and research illustrate that trust in potable reuse technology is closely associated with trust in the authorities that dispense that technology.

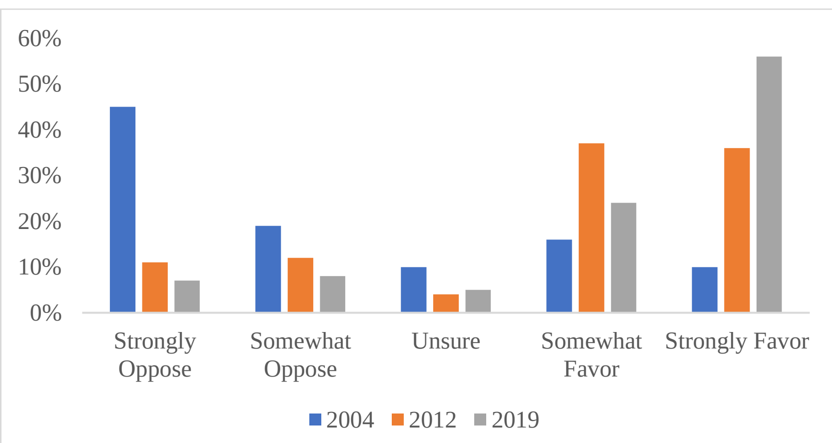

Figure 3. Public Opinion on Adding Recycled Water to Drinking Water Supply (Sources: San Diego County Water Authority, 2004; San Diego County Water Authority, 2012; San Diego County Water Authority, 2019)

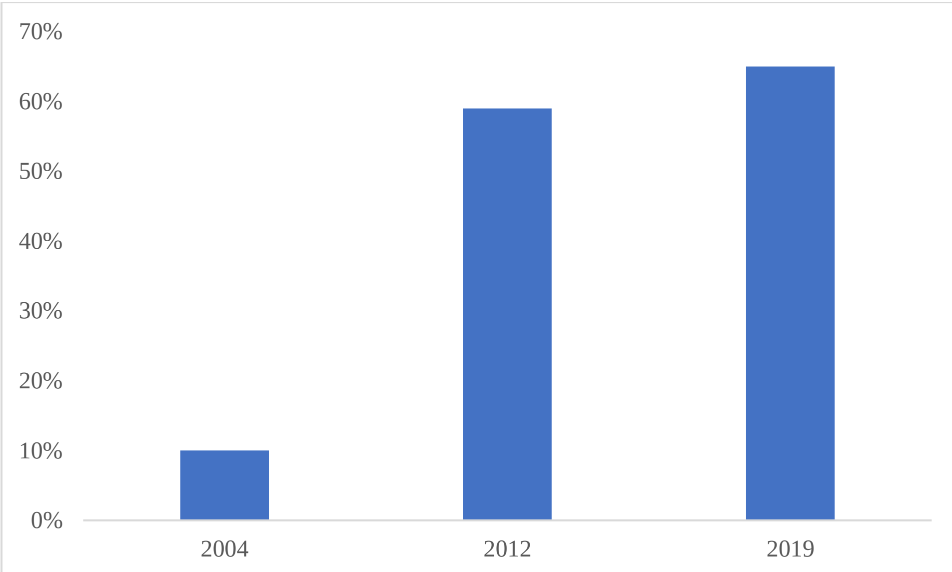

Figure 4. Public Trust in San Diego Water Agencies (Sources: San Diego County Water Authority, 2004; San Diego County Water Authority, 2012; San Diego County Water Authority, 2019)

Public Outreach and Public Engagement: Seeing is Believing

As public trust increased throughout the 15-year period for which data are shown, a significant amount of public engagement and outreach around potable reuse was being undertaken. Here, public engagement is distinguished from public outreach. Public engagement includes interacting directly with the community via events, presentations, and publicly accessible meetings, whereas public outreach includes passive, unidirectional communication which might include marketing or informational materials distributed to the public, video presentations, factsheets, newsletters, advertisements, etc. Table 1 shows the types of public outreach done for each project. Both projects used typical, passive strategies to communicate with the broader public. In Table 2, however, the public engagement done for each project differs significantly. For WRP, most of the engagement was focused on a small number of community individuals and never focused on the community at large. In the 2018 EPA report that discussed WRP, it was concluded that "… [local water agency staff] had little regular interaction with the broader community…" which led to the project stalling due to a "lack of visibility" and a "lack of reputation" with the San Diego water authorities (U.S. Environmental Protection Agency, 2018). This is opposed to the widely-supported PureWater project that had broad public engagement, including speaker's bureau presentations and community events that were hosted by SDCWA to inform the broader public (Steirer et al., 2004). These public engagement activities began in 2004, several years before any design was considered, when the City of San Diego conducted a year-long study to investigate public perception of water reuse opportunities. The rise in public opinion and trust in local water authorities which coincided with the beginning of active public engagement suggests that consistent and long-term public engagement that is not just aimed at specific stakeholders or focus groups, but the broader community is what helps increase public trust in water authorities, generally, and potable reuse technologies, specifically. In the words of Mr. Owen in the interview conducted for this research, "you need to bring people along on this".

Water Repurification Project	**PureWater**
Brochures	Brochures
Video Presentations	Video Presentations
Newspaper Stories	Newspaper Stories
Fact Sheets	Fact Sheets
Telephone Hotline	Website
	Newsletters

Table 1. Public Outreach Activities for Each Project (Sources: Pratesi, 2017; Owen, 2018)

Water Repurification Project	PureWater
Stakeholder Interviews	Stakeholder Interviews
Focus Group Research	WPDP Public Tours
Public Opinion Research	Community Events
	Speakers' Bureau Presentations
	Public Opinion Research

Table 2. Public Engagement Activities for Each Project (Sources: Pratesi, 2017; Owen, 2018)

More than all of the aforementioned public engagement activities, though, the WPDP tours have shown to be the most influential. Since it began operation in June 2011, PureWater's WPDP has been visited by over 17,000 people and, at the end of their tour, people are encouraged to drink the water that went through the treatment process (U.S. Environmental Protection Agency, 2018). Both interviewees, Mr. Owen and Mrs. Tennyson, stated that these tours help the public understand the complex and thorough water treatment process and demonstrate the level of water quality the plant produces. Mr. Owen stated that around 2/3 of people entering the tour believed the water was unsafe while coming out of the tour, 75% believed it was safe. In regards to the WPDP, Mrs. Tennyson remarked that "seeing is believing" and that when people believe the process produces water of high quality, they are more likely to support potable reuse. These anecdotal statements are bolstered by research that showed demonstration tours combined with informational handouts had the largest positive effect on the public's opinion of recycled water (Lohman, 1987).

Discussion

SCE Analysis

In this case study analysis of San Diego, public engagement with potable reuse led to massive positive changes in public trust with the technology. These results can be understood through the SCE framework and its themes of accessibility and transparency that are paramount to fully democratizing engineering practice. To start, the failure of WRP has been partially attributed to the spreading of misinformation about the technology (Kenney, 2019; U.S. Environmental Protection Agency, 2018). The misinformation was ultimately brought about by a lack of transparency with the public about what this technology does and how it does it. A key step taken by San Diego after WRP's failure was to increase transparency and democratize the process of integrating potable reuse in the future with the 2004 city-wide study done to better understand residents' concerns, knowledge, and preferences around recycled water. Accessibility to the technology was also achieved by the City of San Diego by directing broad community engagement that allowed the process to be better understood. This increase in transparency and accessibility fulfilled the desire by the public to feel included in the rollout of PureWater which drastically increased trust in and approval of potable reuse and the people making it a reality.

Research Limitations

It must be stated that all case study analyses are limited in the conclusions they can draw. In this particular research, only the potable reuse perceptions of San Diegans and the public outreach and engagement efforts of the City and County of San Diego were examined. Thus, completely generalizable results cannot be ascertained. Additionally, because WRP occurred in the mid to late 90s, there was a dearth of digitally-accessible data available in regards to public perception about potable reuse and public engagement/outreach activities done by the City. As a result, public opinion data from 2004 was used as a proxy for public opinion at the time of WRP by making the assumption that there were no significant shifts in public opinion in the five- to six-year period between the failure of WRP and the 2004 study done by the City.

Future Work

Given the dearth of data about WRP described above, I would've liked to have tried more avenues of data collection than public opinion surveys. For example, to gain more insight into WRP, I would've liked to have conducted an interview with an engineer at SDCWA who was directly involved with WRP. I would've also liked to have found more documents relating to the public engagement/outreach efforts for the WRP from K&A which would help in drawing more accurate comparisons with the efforts for PureWater. Lastly, I would've liked to have survey data taken of tour visitors about their opinions on recycled drinking water to gain direct data on how this public engagement activity affected the public's support of potable reuse technologies.

Advancing My Own Engineering

The research I completed demonstrates the importance of public trust in engineering practice. Without public trust, projects that are technologically sound and highly needed, fail. The research also illustrates the importance of how engineers gain the trust of the public. It isn't enough to simply inform and lecture the public with pamphlets, fact sheets or graphs; the public must be fully engaged and invited into the process of integrating technologies that will affect them. I plan on fore fronting these key principles that I have identified in my research within my own engineering practice. Actively inviting the public's concerns and inputs into my own engineering practice is the only way I see myself being able to contribute to socially-robust and trustworthy technology that truly benefits the community I'm serving.

Conclusion: Towards a More Community-Inclusive and Responsive Engineering

This research illustrates that a specific technology is successfully integrated into a community when those who are affected by it are allowed to engage with it and with the engineers who operate it directly. Allowing the public to voice concerns, interact with, and learn about the technology is how trust is formed between the public, the technology, and those who work to make that technology. This trust building is even more important for technologies that are essential public services, but are not often visible to the public. However, because the work of any engineer is eventually employed by and for other people, every engineer should learn how to engage the public about their work. Additionally, public engagement as it relates to transparency and accessibility are becoming increasingly important, as technology becomes more complex and engrained in individuals' lives and how people interact with the world around them. Put simply, if one assumes the ethos of engineering is to help create a better world for everyone, then inviting those they are trying to help into the practice should be integral to the engineering process. While not easy, it is essential for all engineers to take seriously the ideas represented by this research. Most importantly, the engineers of tomorrow must take the lessons of this research and apply it to our engineering practice. Our engineering practice cannot be a passive one if we are to successfully address the technological and sociotechnical problems that will define our field in the decades to come. This means that rather than just educating the general public about our projects and technologies, engineers of tomorrow must invite them in and consider their concerns and perspectives at every stage: from design and development to integration and operation. In doing this, engineering becomes a more equitable and open practice that leverages the strength and diverse perspectives of a community to create a better and brighter world for everyone.

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Appendix A: Contemporaneous Notes from Tennyson Interview

WateReuse Symposium

Water Repurification Project – 1993
San Diego had recycled water before '93

- Run treated sewage through water hyacinths in Mission Valley
- North and South Bay – recycled water for irrigation (purple pipe water)
- Purple pipes needed to be put in → construction, expensive
- Water facilities department head – Dave Schlesinger
    - Use irrigation water for drinking water (clean water enough)
    - Microfiltration, RO, UV
- San Diego County Water Authority
    - 1.2 million people – need to import 85 % water
    - Formed to manage the importation of water coming from Metropolitan Water District of Southern California
    - "Whiskey's for drinking, water's for fighting over" – Mark Twain

She worked with Sarah Katz on WRP
Water Authority worked with City on project

1. Who gets the water?
2. "toilet-to-tap" -
3. How pure is the water going to be? Science and tech involved

WRP became a political football – city, county, state, federal
Rhodes Trussell – National Research Council (NRC) paper on potable reuse (2011)
1998 NRC paper "last resort" quote got out into media
Former city council member -Bruce Henderson wants to run again – campaign against WRP

- Wastewater from La Hoya to Drinking water in District 4
- Black ministers came out as against the project

Less acceptance in Latinx communities and Vietnamese than white people
Concern over endocrine disruptors and other CECs near wastewater effluent in 1998
Cancelled in the spring 1999
"It's safe but can we afford it" – San Diego Union-Tribune

- Concern over expense, not safety

2004-2007

- Water Reuse study
- Community group met
- Reservoir Augmentation – IPR basically
- Water Purification Demonstration project
- Temporary rate increase by 3.08 % for water rates (money for demo)

2010

- February 28 – community outreach initiative

June 2011 - Water demo project started!
1 million gpd for one year
Ozone, BAC, MF, RO, UV, Advanced Oxidation Process (AOP)
Dr. Dan Oaken – UNC professor – didn't like potable reuse

“purified water” is a good term to use
Water Reuse research foundation – WRRF (now WRF)

- California survey
- Tell them about IPR before DPR
- Public support went up by 16 % when told about safety and quality of the water

Public outreach has to be at the forefront
“seeing is believing” – demo project

- People can taste it

Dr. Forrest Tennet – coined the term “toilet-to-tap” (or Miller Brewing)
“Sewage Queen of San Diego”

Reasons people don’t support

- Advanced tech, RO – not understood
- “yuck factor”
- Trust in government

Training engineers
Internal Audience – most important people to reach out to and get on your side, those who are working for the water authorities
Public input in decision making

Appendix B: Contemporaneous Notes from Owen Interview

Dynamics in the 90s

- Orange County Water District
  - Already doing
  - Salt water barrier to prevent seawater of groundwater
  - Difference between groundwater vs. surface water in terms of public perception
- "toilet-to-tap" – coined in LA
  - Miller brewing didn't want recycled water in beer
- "you need to bring people along on this"
- Droughts and climate change not as aware to public
- 1996 – city election
  - Candidate framed it as environmental injustice issue
    - Going to Southern SD, less affluent
- No significant public outreach

Mid 2000s

- City knew they needed this
- Environmental groups got on board
  - To reduce ocean discharge
- A lot of public outreach
- Built a demonstration project
  - Brought to public
  - 2/3 of people going in said "no"
  - Almost 75 % said it was safe coming out of the project tour
- Drought is becoming more and more of an issue
- It became a sustainability issue
- Need to stop importing water
- Engage the public and help them understand the technology
- Stone brewing – used repurified water to make
  - "Full circle IPA"
  - Local coffee shop did the same
- "water shouldn't be judged by its origin, but by its quality"

2019

- Panel on PureWater
- Sarah Katz (Katz and Associates), San Diego Water Reuse Annual Symposium, September

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