



City of Greensboro 1,4-Dioxane Investigation

EMC Water Quality Committee Meeting

March 9, 2022

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Winston Salem Regional Office



City of Greensboro 1,4-Dioxane Investigation

1. Review of SOC and 1,4 Dioxane Monitoring Plan
2. Review of sampling data to date
3. Findings for June and November 2021 Exceedances
4. Next steps - Ongoing monitoring and data review



Review of SOC & 1,4 Dioxane Monitoring Plan



Special Order by Consent (SOC) – City of Greensboro

- Original SOC for 1,4-dioxane approved by EMC in March 2021, with effective date of May 1, 2021
 - Two Year SOC with Compliance Values: Year One: 45 ug/l, Year Two: 33 ug/l
- Fayetteville Public Works Commission and Haw River Assembly filed legal petition against SOC in April 2021
- Due to settlement negotiations, an amended SOC approved by EMC in November 2021, with effective date of December 1, 2021
 - Three Year SOC with lower Compliance Values:
 - Year One: 35 ug/l, Year Two: 31.5 ug/l, Year Three: 23 ug/l
- Original SOC monitoring plan in May 2021 included 24 sampling sites
 - Amended monitoring plan now has 58 sampling sites (includes addition of all SIU discharges as well as Pittsboro raw water intake)



SIGNIFICANT INDUSTRIAL USERS		Permit No	Categorical	Industry	Permitted	Flow
T.Z. OSBORNE NC0047384				Type	Flow	Average
1	Aramark	P051	25K	Laundry	150,000	86,000
	Brenntag MidSouth Inc.	W1006	IU, Non Categorical	Spec. Chem Supp	20,000	12,700
2	Chemol	P049	414.110	Chem Mfg	60,000	37,000
3	Ecolab	P078	25K	Soaps & Detergen	100,000	?
4	Elastic Fabrics of America	P003	25K	Dye Textile	400,000	335,000
5	Evonik Pipe 01	P021-01	25K	Spec. Chem Mfg	130,000	13,800
	Evonik Pipe 02	P021-02	25K	Spec. Chem Mfg	⁻⁰¹⁰⁻⁰² combined	60,750
6	Express Container Services	P069	442.15	Tanker & Tote Cleaner	35,000	23,000
7	Gilbarco Pipe 01	P033-01	433.17	fuel dispense Mfg	30,000	12,700
8	Greensboro Industrial Platers 01	P020	413.14	Electroplater	9,995	2,975
9	Greensboro Industrial Platers 02	P020	413.14/413.7	Electroplater	combined	4,760
10	HAECO Air Frame Svcs LLC (TIMCO)	P048-01	433.17	Aircraft Maint Ctr	7,500	428
11	IQE	P077	469.18/469.2	Semi Conductor M	10,000	1,190
12	ITG Brands (Lorillard)	P004	25K	Tobacco Product	250,000	169,000
13	Lanxess	P025	414.110	Chem Mfg	80,000	64,000
14	Machine Specialties	P070	433.17	Metal Finisher	20,000	5,600
15	Parker Metal	P028	413.14 b,f	Electroplater	9,995	5,550

16	Piedmont Plating	P075	433.17	Metal Finisher	60,000	21,000
17	Precision Fabrics	P011	25K	Dye Textile	300,000	135,000
18	Precor	P076	433.17	Metal Finisher	35,000	9,400
19	Procter & Gamble (Swing Road)	P005	439.36/439.	Pharmaceutical M	100,000	77,000
20	Procter & Gamble (Brown Summit)	P031-01	439.36/439.	Pharmaceutical M	550,000	356,500
	Procter & Gamble (Brown Summit)	P031-02	439.36/439.	Pharmaceutical M	100,000	54,000
21	Qorvo 1-1-2015 (formerly R.F. Micro)	P073	469.18A	Semi Conductor M	250,000	121,500
22	Qualicaps	P055	25K	Gel Capsule Mfg	100,000	46,500
	Shamrock Environmental P065 -01	P065-01	437.46 c	Centralized Waste Treatment Ctr	125,000	90,000
	Shamrock Environmental P065 -02	P065-02	437.35	Centralized Waste Treatment Ctr	150,000	107,000
23	Shamrock Environmental P068 -01	P068-01	442.15 CWT	Transportation Equip. Cleaning	35,000	43,000
24	Solenis (formerly As)	P074	25K	Spec. Chem Mfg	65,000	38,000
25	Triad Anodizing P029-01	P029-01	413.14/ 44 b,	No Flow		
	Triad Anodizing P029-02	P029-02	413(D)	Electroplater	9,995	2,850
26	United Metal	P040	433.17	Metal Finisher	15,000	5,600
27	Vertellus	P002	414.110	Chem Mfg	120,000	108,000
28	Zink Holdings (Zink Imaging)	P043	25K	Spec Ink Paper Mfg	150,000	101,000

City of Greensboro 1,4-dioxane SOC Sampling/Monitoring Plan

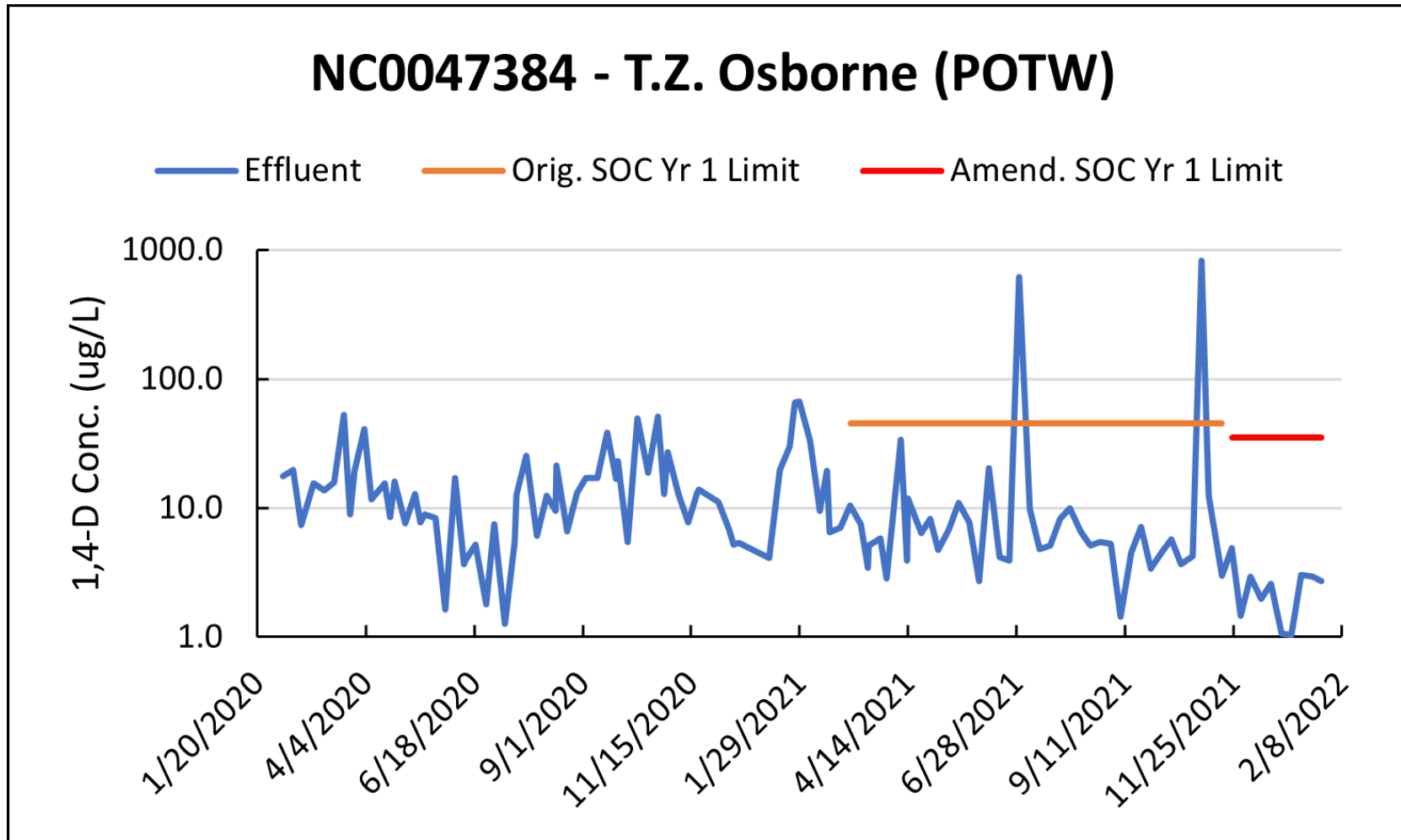
- TZO WWTP
 - Influent, effluent, aeration tank, dewatered sludge cake, incinerator discharge
- 29 Significant Industrial Users (SIUs) with 32 discharges
- 7 Industrial Trunklines (4 are continuous)
- 5 Domestic/Commercial Sites
 - Includes universities, commercial areas, hospitals, residential
- 5 Drinking Water Sources
 - Townsend WTP, Mitchell WTP, PTRWA, Burlington, Reidsville
- City Landfill, Domestic Hauler Septage
- Pittsboro Haw River Water Intake
- Haw River Arm of Jordan Lake (below Pittsboro)



Review of sampling data to date



Effluent 1,4-Dioxane concentrations with SOC limits (Jan 2020 – Jan 2021)



SOC Sampling Plan Data: WWTP Sampling Sites

Site and Sample Type		Results in ug/l 5/1/2021 to 2/16/2022	Sampling Plan #
TZO POTW Influent	C	40 sample results: 2.8-580 Avg. = 29.8	1
NB Influent	C	21 samples: all <2.0	2
TZO POTW Effluent (eDMR samples)	G	84 samples: 1.12 – 879 Avg. = 40.0	3G
TZO POTW Effluent	C	6 results: 5.1 – 547	3C
TZO Aeration Tank	G	3 samples: <2.0, 5.5, 3.6	4
TZO Dewatered Sludge Cake	C	3 samples: <8.3 mg/kg, <35.9 ug/kg, <38.2 ug/kg	5
Incinerator Scubber/Centrates	G	<2.0, 5.7, 3.2	6



SOC Sampling Plan Data: 7 Industrial Trunklines



Site	Number of SIUs	Results in ug/l 5/1/2021 to 2/16/2022	Sampling Plan #
Patton Trunk	6	28 results: <2 – 369 [^] Avg. = 22.2	7
Arlington Trunk	6	23 results: <2 – 32 Avg. 8.6	8
Reedy Fork	4	3 results: 102, 125, 109	9
[Bryan Park] (Shamrock)	1	15 results: 10.3 – 560 Avg: 301	Surveillance
Airport Trunk	6	5 results: 1.34 – 4.48 Avg. 2.3	10
Whitsett Trunk	4	3 samples: 2.49, 1.24, <2.0	11
North Buffalo	4	3 results: all <2	12
Radar Road	1	<50	12A

[^]November 3 event



SOC Sampling Plan Data: 5 Domestic/Commercial Sites



Site	Results in ug/l 5/1/2021 to 2/16/2022	Sampling Plan #
Wesley Long	3 samples: <1.0, 1.26, 1.48	13
A & T University	3 samples: 1.3, <2.0, <2.0	14
Bessemer	2 samples: <1.0, <1.0	15
Willoughby	3 samples: 1.05, 1.32, <2.0	16
Shelby Drive	6 samples: 1.7, 1.7, 2.4, 2.6, 2.1, 1.3	17



SOC Sampling Plan Data: 5 Drinking Water Sites



Site	Results in ug/l 5/1/2021 to 2/16/2022	Sampling Plan #
GSO Townsend Plant	3 samples: All < 1.0	18
GSO Mitchell Plant	3 samples: All < 1.0	19
PTRWA Interconnect (Randleman Lake)	9 samples: 1.3, 2.0, 1.8, 1.2, 2.8, 1.6, 1.1, 2.0, <2.0	20
Burlington Interconnect	3 samples: All < 1.0	21
Reidsville Interconnect	3 samples: All < 1.0	22



SOC Sampling Plan Data: Other Sites

Site	Results in ug/l 5/1/2021 to 2/16/2022	Sampling Plan #
City Landfill	6 samples: 71, 62, 60, 50, 61, 55	23
Domestic Septage	3 samples: All <2.0	24
Haw River Arm of Jordan Lake	16 samples: <1 – 8.76* Avg 1.79	25
Pittsboro Haw River Drinking Water Intake/Plant	Total of 138 samples: Raw: 49 samples: <1 – 80.7^ Finished/Tanks: 89 samples: <1 – 50^	26

**June 30 event*

^November 3 event



Direct Sampling of SIUs

- During settlement, City agreed to sample each of the SIU discharges in 2 consecutive quarters during all 3 years of SOC
 - Year One sampling: Sep-Nov 2021 & Dec 2021-Feb 2022
- Any SIU with value >100 ug/l must complete Source Investigation, Evaluation, and Survey for their facility
 - SIU must investigate internal waste streams and prepare response for City
 - Year Two Trigger is 31.5 ug/l (starts May 1, 2022)
 - Year Three Trigger is 23 ug/l (starts May 1, 2023)
- SIU Sites 27 through 58 were added in September 2021



SOC Sampling Plan Data: Year One Initial SIU Sampling

SIU	# Samples - Results in ug/l 5/1/2021 to 2/16/2022		Trunkline	Sampling Plan #
Aramark	3	All <5	Arlington	27
Chemol	2	789, <100	Arlington	28
Ecolab	2	108, 73	Airport	29
Elastic Fabrics	2	19, <20	Patton	30
Evonik 01	1	<2.0, <2.0	Arlington	31
Evonik 02	3	126, 27, 22	Arlington	32
Express Container	2	5.2, <20	Airport	33
GILBARCO	2	Both <2.0	Radar Road	34



SOC Sampling Plan Data: Year One Initial SIU Sampling

SIU	# Samples - Results in ug/l 5/1/2021 to 2/16/2022		Trunkline	Sampling Plan #
GSO Platers 01	2	1.74, <2.0	North Buffalo	35
GSO Platers 02	2	1.26, <2.0	Patton	36
HAECO	2	Both <2.0	Radar Road	37
IQE	2	Both <2.0	Airport	38
ITG (Lorillard)	2	Both <2.0	North Buffalo	39
Lanxess	2	15, <2	Patton	40
Machine Specialties	2	Both <2.0	Whitsett	41
P&G BS 01	7	All < 10.0	Reedy Fork	42



SOC Sampling Plan Data: Year One Initial SIU Sampling

SIU	# Samples - Results in ug/l 5/1/2021 to 2/16/2022		Trunkline	Sampling Plan #
P&G BS 02	7	14.4, (6 < 10.0)	Reedy Fork	43
P&G Swing	3	5.8, 2.1, <2	Airport	44
Parker Metal	2	Both <2.0	Arlington	45
Piedmont Plating	2	<1.0, <100	Direct to TZO	46
Precision Fabrics	2	52, 56	Patton	47
PRECOR	2	Both <2.0	Whitsett	48
QORVO	2	Both <2.0	Airport	49
Qualicaps	2	Both <10.0	Whitsett	50



SOC Sampling Plan Data: Year One Initial SIU Sampling

SIU	# Samples - Results in ug/l 5/1/2021 to 2/16/2022		Trunkline	Sampling Plan #
Shamrock BS 01 (PT system)	3	956, 286, 5.3	Reedy Fork	51
Shamrock BS 02	4	159, 322, 1040, 92	Reedy Fork	52
Shamrock Patton	2	32, 7	Patton	53
Solenis	2	6.9, <100	Arlington	54
Triad Anodizing 02	2	Both < 2.0	North Buffalo	55
United Metal	2	3.24, <100	Arlington	56
Vertellus	2	220, 819	Patton	57
ZINK	2	Both <10.0	Whitsett	58



SOC Requirements For SIUs > 100 ug/l

- Year One SIU Sampling Identified 6 SIUs >100 ug/l
- Those 6 SIUs required to complete a Source Investigation, Evaluation, and Survey, which includes:
 - Conduct Safety Data Sheet survey of raw materials
 - Review chemistry of any product waste streams
 - Investigate production records/internal waste streams
 - Identify potential significant sources of 1,4 dioxane
 - Prepare response for City to use in evaluating next steps



SIUs Completing Source Investigation, Evaluation, and Survey



SIU	# Samples - Results in ug/l 5/1/2021 to 2/16/2022		Response Submitted
Chemol	5	5 <100 – Also Internal sampling	Yes**
Evonik 02	Internal raw material sampling		Yes**
Ecolab	34	748, 161 & (24 <100, 5 <1000, 3 <2000)	Yes**
Vertellus	15	582/1240 & (13 <100)	Yes**
Shamrock BS 01	44	Daily Composite Samples Retained Weekly Composite Analyzed: Avg. 376	Yes**
Shamrock BS 02	13	Daily Composite Samples Retained Weekly Composite Analyzed: Avg. 165	Yes**

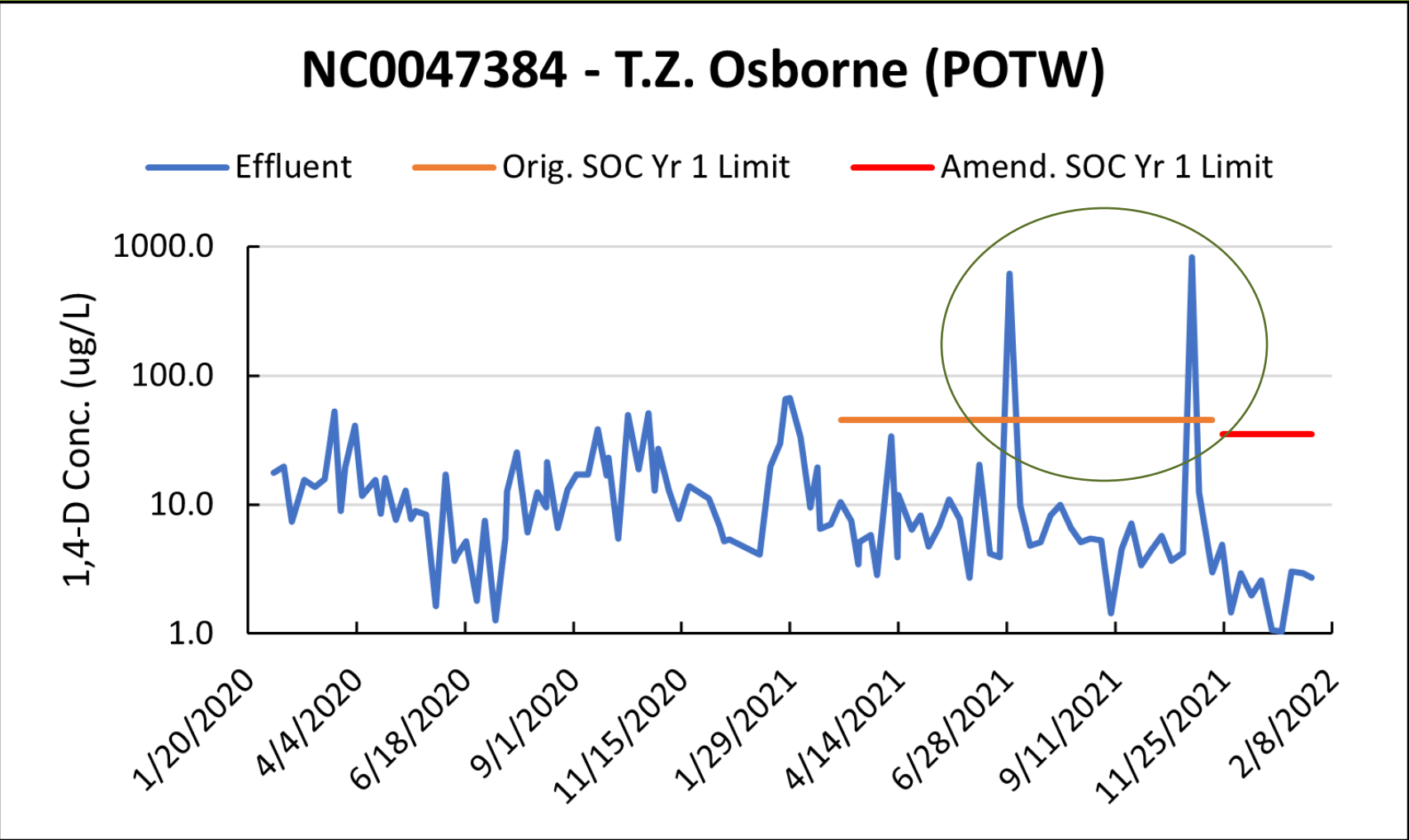
**On-going: Nothing Conclusive So Far



Findings for June & November 2021 Exceedances



June & November 2021 Exceedances



First Incident on June 30, 2021

- June 30, 2021: City collected weekly TZO effluent grab sample
- July 1, 2021:
 - City received 6/30/2021 grab sample result of 615 $\mu\text{g}/\text{L}$ (average of results from two labs)
 - City contacted DWR WSRO and three downstream drinking water treatment plants: Pittsboro, Fayetteville PWC, and Cape Fear Public Utility Authority
 - Pittsboro is the main utility impacted as Jordan Lake dilutes anything further downstream
 - DWR WSRO contacted DWR Public Water Supply Section (PWSS) regional offices to alert downstream WTPs of the exceedance
 - City arranged to sample all of Pittsboro's raw water and finished water with rush lab analysis for the month of July



What did City investigate and rule out?

- City notified Shamrock Environmental immediately and instructed them to have their last 5 daily composite samples (from June 25-30, 2021) sent for rush lab analysis
 - Shamrock collects and holds daily composite samples according to an agreement with the City
 - **Shamrock's retained samples did not indicate Shamrock as source for this incident**
- City sent for rush lab analysis:
 - All daily effluent composites for that week and the following week
 - TZO influent & North Buffalo pump station influent composites
 - Samples from manholes at Bryan Park, Reedy Fork, and Summit Avenue trunklines
- **No clear source was determined**



How DEQ Responded

- DWR WSRO staff communicated daily with City staff in the weeks following the incident for updates, information, and data
- DWR held weekly meetings with Assistant Secretary Masemore. Discussions included review of data received, systematic elimination of potential causes, and areas of additional monitoring required to diagnose future incidents.
- Notice of Violation and Intent to Assess Penalties (NOV/NOI) sent to City on September 1
- DWR and City staff performed site visit of Shamrock Environmental Corporation Browns Summit location on September 27, 2021
- SOC penalty demand letter sent November 4, 2021
 - City paid SOC penalty on November 15, 2021



What DEQ investigated

- Observations from Shamrock Browns Summit site inspection performed by DWR and City on September 27, 2021:
 - Testing for 1,4-dioxane is conducted for all wastewaters during the waste receiving approval process, regardless of the waste subcategory
 - Resampling occurs on an approximate 6-month schedule after initial sampling
 - Shamrock collects process control flow-proportional composite samples from the discharge point on each day of operation
 - Treated wastewaters are not co-mingled until after they are fully processed, measured, and sampled through their respective treatment system
 - DWR inspectors observed the discharge point, where Pipe 01 and Pipe 02 join with 2 samplers set-up before the flume
 - Shamrock stated that during the two-week period prior to the exceedance:
 - Only routine wastewater receipts were handled
 - There was only 1 new client
 - There were no service declinations



City's pretreatment program improvements after June 30 incident and investigation

- City set up 24/7 surveillance samplers at the following locations:
 - Downstream of Shamrock Browns Summit (Bryan Park Trunkline)
 - Patton Trunkline
 - Arlington Trunkline
- Pittsboro Haw River Raw Water intake added to the GSO 1,4-dioxane sampling plan
- City agreed to provide TZO effluent data to downstream drinking water utilities
- Composite sampling by City was collected from all 29 Significant Industrial Users (SIUs), accounting for 32 indirect discharges
 - That sampling showed 5 SIUs with results $> 100 \mu\text{g/L}$
- City developed a source reduction memo for all facilities showing results $> 100 \mu\text{g/L}$



Second Incident on November 3, 2021

- November 3, 2021: City collected weekly TZO effluent grab sample
- November 8, 2021:
 - City received 11/3 grab sample result from first testing lab of 767 $\mu\text{g/L}$
 - City received 11/3 grab sample result on November 9, 2021 from second testing lab: 879 $\mu\text{g/L}$
 - Average of the results from the two separate labs: 823 $\mu\text{g/L}$
 - City contacted DWR WSRO and downstream drinking water utilities
 - City sampled 4 receiving stream locations downstream of TZO and sent samples for rush lab analysis
 - City arranged to sample Pittsboro's raw water and finished water with rush lab analysis



City Response to November 3 Incident

- City notified Shamrock immediately and instructed them to have their last 5 daily composite samples of Pipe 01 and Pipe 02 (from 10/28/2021 to 11/5/2021) sent for rush lab analysis
 - Shamrock collects and holds these daily composite samples
 - **Shamrock's retained samples did not indicate Shamrock as source for this incident**
- All collection system surveillance samples sent for rush lab analysis
 - Results indicate the Patton Trunkline (with 6 SIUs) was the likely source of the high discharge
 - Another surveillance sampler was placed at the Airport Trunkline (with 5 SIUs), which ultimately drains to the Patton Trunkline
 - There are now 4 continuous surveillance samplers at the following trunklines:
Bryan Park, Airport, Patton, Arlington



City Response to November 3 Incident

- During November 3 event, Patton Trunkline results were highest ever recorded at site (369 ug/l)
 - There was no sampler at Patton during June 30 event.
- No clear source has been determined, but the focus is Patton Trunkline
- November 12, 2021: City held mandatory meeting with the 5 SIUs with results $\geq 15 \mu\text{g/L}$ located on the Patton trunkline
 - Begin daily composite sample collection/retention
 - Daily composites analyzed in Week One
 - Weekly composites analyzed in Week 2 forward
 - Submit analyses to City



5 Patton Trunkline SIUs Conducting Self-Monitoring After Nov 3 Event



SIU	# Samples - Results in ug/l 5/1/2021 to 2/16/2022		Source, Investigation & Evaluation Required?
Vertellus (in both groups)	15	582, 1240 & (13 <100)	Yes - Submitted
Elastic Fabrics	7	135, 18, 10 & (4 <10)	Yes - Due 3/11/22
Lanxess	14	287 & (10 <100, 3 <10)	Yes - Due 3/11/22
Precision Fabrics	19	128 & (17 <100, 1 <200)	Yes - Due 3/11/22
Shamrock Patton	18	All values <100 (1 <200)	No – All results < 100 ug/l



Receiving Stream Sampling Data

- Weekly Old 70 and Highway 61 grab sampling/ analysis was voluntarily added after November 3 to provide additional data on downstream concentrations
 - Highway 61 location only includes TZO discharge

Location	# Samples - Results in ug/l		Description
Old 70 Highway Bridge	7	2.1 (6 < 2.0)	South Buffalo Creek Above TZO Effluent
Highway 61 Bridge	11	406*, 5.7, 25^, 2.7, 4.2 (6 < 2)	Reedy Fork Creek Below TZO Effluent and before Haw River confluence

**June 30 event*

^November 3 event



Next steps – Ongoing monitoring & data review



Next steps for Greensboro

- TZO effluent/trunkline data and monitoring plan is posted on City website
- In Year One, any SIU with value >100 ug/l must complete Source Investigation, Evaluation, and Survey
 - Year Two Trigger is 31.5 ug/l – starts May 1, 2022
 - Year Three Trigger is 23 ug/l – starts May 1, 2023
- Year Two of SOC requires calculation of an effluent 1,4-dioxane mass balance using all data (including industrial, domestic, commercial, drinking water, and collection system data)
- TZO NPDES permit reissuance and review in process
 - Will include a 1,4-dioxane limit



Next steps for Greensboro

- New City policy on Contaminants of Emerging Concern (CEC) effective 2-1-2022
 - Outlines City's approach to emerging compounds, not specific to 1,4-dioxane
 - City consulted with environmental attorney to create a Purpose, Legal Authority, and Definitions
 - Provided to SIUs/IUs and posted on website
- Enforcement Response Plan for SIUs and IUs currently being updated to reflect new policy
- Sewer Use Ordinance modifications are also forthcoming in order to completely implement the Policy





July 2022:

Next update to EMC on Greensboro SOC

Questions?

