

Letter Health Consultation

Confirmatory Soil-Gas Sampling Report

VELSICOL CHEMICAL LLC SITE

CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

**Prepared by
Tennessee Department of Health**

JULY 15, 2014

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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RE: Letter Health Consultation
Velsicol Chemical LLC, Confirmatory Soil-Gas Sampling Report,
4902 Central Avenue, Chattanooga, Hamilton County, Tennessee

Summary

The Tennessee Department of Health's (TDH), Environmental Epidemiology Program (EEP), was asked by the Tennessee Department of Environment and Conservation's (TDEC), Division of Solid and Hazardous Waste Management (DSWM), to review results of an off-site soil-gas confirmatory sampling investigation for the former Velsicol Chemical LLC Site (the Velsicol Site). TDEC wanted to know if potential vapors from soil-gas posed a possible health risk and if the results were representative of all conditions.

Only a total of 3 of 7 sampling points were able to be analyzed for this investigation. Of the 4 samples that could not be tested, 1 was not collected because of encountering bedrock at the location and because the other 3 samples were influenced by a rain event that occurred during soil-gas sampling. The results of the 3 samples that were tested appear representative of those locations. However, basing health conclusions on 3 samples from the entire 52nd Street investigation area would not likely be representative.

Pesticides, beta-BHC and heptachlor, were included as part of the testing because they were manufactured at the site. Both beta-BHC and heptachlor were not found in the 3 samples tested. The detection limits for these two chemicals were elevated. Health comparison values for both beta-BHC and heptachlor were lower than the reported detection limits. Therefore, it was not possible to evaluate health effects from these chemicals. Amounts of these chemicals may have been present at levels that were lower than their respective detection limits.

TDH EEP is unable to conclude if vapor intrusion was likely occurring in the area where samples were collected along East 52nd Street based on the results of this sampling event. EEP could not determine if off-site soil-gas contained any of the chemicals tested based on the limited number of samples collected and the elevated detection limits for the pesticides.

In general, ATSDR and EEP recommend concurrently collecting additional indoor air, ambient air, and sub-slab soil-gas or crawlspace air at homes within a reasonable distance (100 feet) of the groundwater contamination. Sampling events are recommended during multiple seasons to confirm that vapors are not intruding into indoor air at levels of concern across different climate conditions. Based on the precipitation event that occurred as the soil-gas samples were being collected, and recent EPA vapor intrusion guidance, EEP recommended another sampling event be conducted in the neighborhood to confirm the absence of chemicals in soil-gas and/or indoor air of the homes.

The following sections of this letter present how TDH EEP arrived at our conclusions and recommendations based on the results for the off-site soil-gas investigation.

Background

The Velsicol Chemical LLC Site is located at 4902 Central Avenue near the Piney Woods area of south Chattanooga, Hamilton County, Tennessee. The Velsicol Site is located near other environmental sites managed by TDEC that include Residue Hill and Tennessee Products. Velsicol manufactured many different chemicals at the site from 1948 to 2007. Since 2007, all site buildings have been demolished. Concrete building floor slabs and one wastewater containment structure remain at the site. An earthen cap is intended to be placed over the site by the owner of the Velsicol property in 2014.

In the past, onsite soil was contaminated with chemicals from spills and leaks from chemical manufacturing, chemical disposal practices, chemical transfer activities, and other activities. Over time, chemicals migrated through the soil and reached shallow groundwater. Groundwater moves away from the site to both the northeast and the southeast.

A Phase 2 RCRA Facility Investigation (RFI) was conducted in 1998. A neighborhood located south and southeast of the site was evaluated using passive soil-gas sampling techniques to test for vapor migration. The neighborhood is comprised of single family homes built around the 1940's and 1950's. It is part of the Piney Woods community. The potentially exposed people are the residents living close to the Velsicol Site. Although detected in 5 of 33 soil-gas samples collected near the residential area in 1998. Levels were below ATSDR comparison values (Law 1998).

In 2011, ATSDR was petitioned to evaluate proposed remedial actions for the site. The petition was accepted and EEP, as part of its Cooperative Agreement Program with ATSDR, evaluated the groundwater and remediation concerns for the site. As part of the evaluation, EEP recommended that TDEC retest soil vapor migration in the residential area. Reasons for this

recommendation included advancements in soil-gas sampling techniques, analysis of air samples, reporting of results in more useable and accepted units than the previous investigation, and unknown plume migration over the past 15 years.

TDEC subsequently requested Velsicol to perform additional testing. An off-site soil-gas investigation was performed by Geosyntec Consultants, during the week of January 28, 2013, under the direction of the Memphis Environmental Center Inc.

Soil-Gas Sampling and Results

Details of this investigation were summarized from the soil-gas sampling work plan (Geosyntec 2012) and Geosyntec's Confirmatory Sampling Report (2013), both of which were submitted to and approved by TDEC DWSM.

The sampling area was in a neighborhood southeast of the Velsicol Chemical Site, along East 52nd Street and Fagan Avenue (Figure 1). This latest soil-gas investigation was done in a portion of the area investigated in 1998. This latest investigation area was selected because it was part of the 1998 investigation area and near the Velsicol Site (Law 1998). The investigation area was also selected because the East 52nd Street and Fagan Street neighborhoods are located between the site and the known impacted groundwater location of Piney Woods Spring. Groundwater migrates from the southern portion of the site beneath the neighborhoods to Piney Woods Spring. Piney Woods Spring is used as an off-site groundwater monitoring point and groundwater collection point. Groundwater from Piney Woods Spring is diverted to Chattanooga's Moccasin Bend Water Treatment facility and is not accessible to the public.

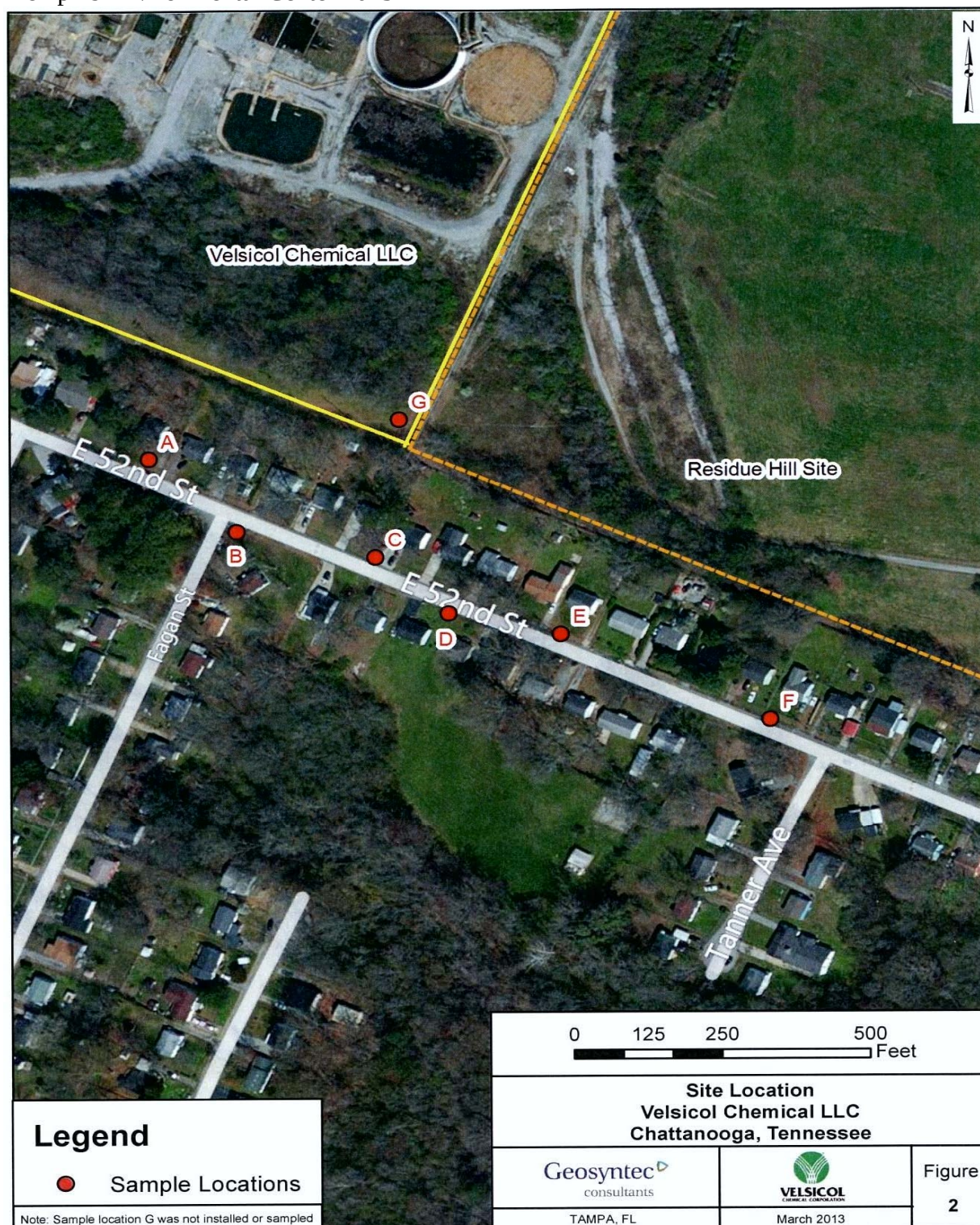
Velsicol obtained permission for access and sampling from the resident or land owner for each location. A total of 6 sampling points were ultimately installed off-site (Figure 2, Locations A through F). Clayey silt was encountered in all 6 off-site soil-gas borings in the top 6 inches with low moisture, low permeability, plastic, dense clay encountered from 6 to 60 inches. The one proposed sampling point not installed was in the extreme southeastern corner of the Velsicol Site (Figure 2, Location G). This sampling point could not be installed because of rock occurring at a shallow depth. Due to bedrock being encountered at relatively shallow depths in the area, multiple depth soil-gas samples could not be obtained. Sampling locations were placed in accessible areas and not close to the homes. It was suspected that if the groundwater plume was extensive, the soil-gas sampling locations would identify the plume.

During the time the soil-gas probes were being installed, a significant rain event saturated local soils. Three of the 6 sampling locations contained water (Figure 2 – C, E, and F). Water was removed from the 3 borings until only residual water was left. The following day, an attempt was made to draw soil-gas from the 3 saturated borings. No soil-gas could be drawn from these borings. In the end, soil-gas samples were only collected from 3 of the 7 borings. These borings were allowed to equilibrate a minimum of 40 hours before sample collection. No traces of water were noted in these 3 borings when samples were collected, though the residual soil moisture content of the clay layer was unknown.

Figure 1. Location of Velsicol Chemical LLC, nearby Tennessee Products and Residue Hill environmental sites, and soil-gas study area. Source: Memphis Environmental Center 2013.



Figure 2. Location of Velsicol Chemical LLC onsite and off-site soil-gas boring locations. Location G could not be installed. Locations C, E, and F could not be sampled. Locations A, B, and D were successfully sampled during the week of January 28, 2013 and analyzed. Source: Memphis Environmental Center 2013



For each of the 3 samples collected, the entire sample train was tested for sample vacuum and leaks using an isopropanol (70% rubbing alcohol) tracer prior to collection of the actual soil-gas samples. No traces of isopropanol were found, confirming the integrity of the sampling train and results. The 3 samples collected (Figure 2 – locations A, B, and D) were analyzed for the following site-related chemicals: volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene, xylene, chlorobenzene, 1,4-dichlorobenzene; and pesticides including beta-BHC, and heptachlor. Samples from each location were tested for VOCs using EPA method TO-15. Samples from each location were tested for pesticides using EPA method TO-10. All samples were tested by Test America Laboratories in Knoxville, Tennessee.

None of the mentioned chemicals were found. VOC detection limits ranged from 6.4 to 40.9 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). For the pesticides, the detection limit for beta-BHC was 10 $\mu\text{g}/\text{m}^3$ and the detection limit for heptachlor was 2.5 $\mu\text{g}/\text{m}^3$. The soil-gas sample results are shown in Table 1.

Evaluation of Results

As stated above, all results of the VOC and pesticide soil-gas sampling were non-detect. Even though there were only 3 of the 7 possible site samples to evaluate, the 3 locations were located inside the residential area on East 52nd Street close to the Velsicol Site. If chemicals migrated in soil-gas from the site to the East 52nd neighborhood, then these sampling locations should have identified them due to the fact that groundwater migrates from the southern portion of the Velsicol Site beneath the neighborhood to Piney Woods Spring.

Because there were no detections of the analyzed chemicals, the detection limit value was used as the result for each sample. An evaluation using the detection limit is a very conservative evaluation and was done even though there was no indication that the chemicals were present.

To evaluate the soil-gas results, an attenuation factor was applied to the soil-gas results to understand how much of the soil gas may be able to migrate into the indoor air of a building. The detection limits for all VOC compounds tested for except benzene, and ethylbenzene at one location, were below EPA and ATSDR indoor air screening levels for an excess cancer risk of 1 extra cancer in 1,000,000 people when a very conservative soil-gas to indoor air attenuation factor of 0.1 (EPA 2002) was used (Table 1).

Using the soil-gas to indoor air attenuation factor of 0.1, benzene detection limits were above the 3.1 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) soil-gas to indoor air screening level for a 1 in 1 million excess cancer risk. However, the detection limits for all 3 samples were below the 31 $\mu\text{g}/\text{m}^3$ soil-gas to indoor air screening level for an excess cancer risk of 1 in 100,000. This risk level is within EPA's target range of cancer risk. Additionally, background benzene levels in homes range from approximately 10 to 29 $\mu\text{g}/\text{m}^3$ (EPA 2011). Detection limits of the analyses were within or below this background level range.

Table 1. Analytical results of the 3 soil-gas samples collected in the East 52nd Street/Fagan Street/Tanner Avenue neighborhood. The soil-gas sampling was conducted by Geosyntec Consultants for the Memphis Environmental Center near the Velsicol Chemical Company LLC Site, 4902 Central Avenue, Chattanooga, Hamilton County, Tennessee. All soil-gas results are presented in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Results are compared to an EPA soil-gas to indoor air attenuation factor of 0.1 at a 1 in 1 million additional cancer risk (1×10^{-6} risk) screening value.

Sample Location/Chemical	Location A	Location B	Location D	Soil-Gas Screening Criteria (EPA 2002) (0.1 Attenuation Factor at 1×10^{-6} risk)	ATSDR Indoor Air Screening Criteria with 0.1 EPA Attenuation Factor Applied
Benzene	<21.7	<6.4	<6.4	3.1	96 for non-cancer health effects (chronic EMEG/MRL x 0.1) 1.3 for cancer health effects (CREG x 0.1)
Toluene	<22.6	<7.5	<7.5	4,000	3,000 -
Ethylbenzene	<29.5	<8.7	<8.7	22	2,600 -
o-xylene	<29.5	<8.7	<8.7	70,000	2,200 -
m&p-xylene	<29.5	<8.7	<8.7	70,000	
Chlorobenzene	<31.3	<9.2	<9.2	600	ngv
1,4-dichlorobenzene	<40.9	<12	<12	8,000	600 -
beta-BHC	<10	<9.4	<10	0.014	0.019 -
Heptachlor	<2.5	<2.4	<2.5	0.019	0.0077 -

Notes and Modifiers:

Screening values from EPA OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (EPA 2002).

The EPA soil-gas screening level of alpha-BHC was used as a surrogate for beta-BHC.

ATSDR soil-gas screening criteria are derived by using the compound-specific Environmental Media Evaluation Guide (EMEG) or Cancer Risk Evaluation Guide (CREG) and dividing by an attenuation factor of 0.1.

<21.7 = Not detected in the soil-gas sample. Numerical values represent the analytical detection limit.

ngv = No guidance value for the specific chemical.

The ethylbenzene level at Location A was also above its 22 $\mu\text{g}/\text{m}^3$ soil-gas to indoor air screening level for a 1 in 1 million excess cancer risk. However, the detection limits for Location A was below the 220 $\mu\text{g}/\text{m}^3$ soil-gas to indoor air screening level for an excess cancer risk of 1 in 100,000. This risk level is within EPA's target range of cancer risk. Additionally, background ethylbenzene levels in homes range from approximately 12 to 17 $\mu\text{g}/\text{m}^3$ (EPA 2011) at a 1 in 1 million excess risk. Detection limits of the analyses were slightly above this background level range but within the 1 in 100,000 excess cancer risk range.

For the pesticides beta-BHC and heptachlor, detection limits were higher than the screening values for a 1×10^{-4} excess cancer risk, or 1 additional cancer in 10,000 people. This additional cancer risk is the low end of EPA's target range of cancer risk (EPA 1991). The normal background cancer risk in the United States is a little less than 1 in 2 for men and a little more than 1 in 3 for women in the general population (NTP 2011). Keep in mind that even though the detection limits are higher than the lower endpoint of EPA's target cancer risk range, the screening values used are very conservative and equate to an exposure that is 24 hours per day, 7 days per week, 365 days per year, for a 70-year lifetime. Additionally, EPA lists both of these chemicals as not sufficiently volatile or toxic to cause a vapor intrusion concern. Given these facts, it is still unknown if either beta-BHC or heptachlor could be present in the soil-gas at levels that could be harmful.

The influence of soil type is another consideration. The type of soil in an area influences the ability for vapors to migrate in the subsurface soil. The local subsurface geology and soil characteristics very much influence the ability of vapor to migrate through the unsaturated soil interval above groundwater in the East 52nd Street area. A low moisture, low permeability, dense clay was found at depths of 6 to 60 inches in each soil-gas boring drilled. The presence of this type of dense clay soil is known to be beneficial in reducing the process of soil vapor migration (EPA 2012).

The Residue Hill Site is located east from the Velsicol Site. As part of a soil-gas investigation for the adjacent Residue Hill Site, 2 soil-gas sampling points were sampled along the eastern property boundary. This soil-gas sampling was performed to determine if the Residue Hill Site had soil-gas migration and potential vapor intrusion concerns. The soil-gas samples were analyzed for benzene, toluene, ethylbenzene, m,p-xylene, o-xylene, and naphthalene. None of these chemicals were detected in either of the two samples above target shallow soil-gas levels corresponding to target indoor air levels with a soil-gas to indoor air attenuation factor of 0.1 and a 1 in 1 million excess cancer risk (ENVIRON 2011). ENVIRON (2009) also performed a passive soil-gas investigation immediately east of the area of the Geosyntec investigation along East 52nd Street. No detections of chemicals were found in the 6 locations where passive soil-gas samples were collected.

While exterior soil gas samples are commonly used to characterize general areas with subsurface contamination, they often do not portray the soil-gas profile that occurs beneath homes due to low interior pressures (depressurization) that actively draw vapors up from the source (EPA 2012). Additional uncertainty exists when soil-gas samples are collected farther away from the homes' foundation and when samples are collected following a recent rain event.

ATSDR recently released a memorandum advising health assessors to use caution in making health decisions based on the prediction of indoor air impacts from subsurface contamination measurements (ATSDR 2013). ATSDR and EEP prefer concurrently collected indoor air, ambient air, and sub-slab soil-gas or crawlspace air from multiple seasons to make health conclusions.

Conclusions:

Based on the January 2013 soil-gas sampling results, it is not possible to accurately conclude if vapor intrusion is occurring in the area where samples were collected along East 52nd Street. Not enough representative samples were collected during this soil-gas investigation. Only 3 of 7 samples could be used to evaluate soil-gas conditions. Reasons for this include:

- shallow bedrock at 1 sample location preventing a sample from being taken, and
- 3 of the 6 other soil-gas sample locations were unable to have a sample collected, making them unusable.

EEP also could not determine if soil-gas contains site-related pesticides at levels that would harm residents due to the detection limits of the analysis. No pesticides were found as a result of the soil-gas testing. However, the detection limits for the chemicals tested were higher than their respective health screening values.

Recommendations:

In general, ATSDR and EEP recommend concurrently collecting additional indoor air, ambient air, and sub-slab soil-gas or crawlspace air at homes within a reasonable distance (100 feet) of the groundwater contamination. Sampling events are recommended during multiple seasons to confirm that vapors are not intruding into indoor air at levels of concern across different climate conditions. Based on the precipitation event that occurred as the soil-gas samples were being collected and recent EPA vapor intrusion guidance, EEP recommends another sampling event be conducted in the neighborhood to confirm the absence of chemicals in soil-gas and/or indoor air of the homes.

TDH EEP appreciates TDEC's willingness to respond promptly to our initial vapor intrusion investigation recommendation as outlined in the draft Public Health Assessment for the Velsicol Chemical Site. Even though they did not see the draft of the Public Health Assessment, EEP also appreciates the Memphis Environmental Center's cooperation and sampling of soil-gas in the East 52nd Street neighborhood.

The initial draft of the petitioned Public Health Assessment has been accepted for publication. It was released as a public comment draft document on May 13, 2013. The final release was published February 27, 2014 and is available at health.tn.gov/environmental.

Should you have any questions or concerns please contact me at 615-741-7247 or via email at joseph.george@tn.gov.

Respectfully,

A handwritten signature in cursive script that reads "Joseph P. George". The signature is written in black ink and is positioned below the word "Respectfully,".

Joseph P. George
Environmental Health Assessor
Tennessee Department of Health
Environmental Epidemiology Program

References

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