COMPLIANCE DEMONSTRATION FOR THE SOLVENT EXTRACTION FOR VEGETABLE OIL PRODUCTION NESHAP

Compliance Demonstration for the Solvent Extraction for Vegetable Oil Production NESHAP

Prepared for:
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1.0 INTRODUCTION

The purpose of this document is to demonstrate compliance with the solvent extraction for vegetable oil production NESHAP (40 CFR 63, Subpart GGGG). To comply with these NESHAP, ZFS Ithaca, LLC (ZFS Ithaca) monitor and records three types of information, as listed below:

1. The HAP loss (gallons) from the vegetable oil production process. An example HAP loss inventory log is shown as Table 1 and is described further in Section 2.0.

2. The quantity (tons) of each oilseed type processed at the vegetable oil production process. Example oilseed processed inventory logs are shown as Tables 2A and 2B and are described in Section 3.0.

3. The determination and status of compliance. An example compliance determination and status log is shown in Table 3 and is described in Section 4.0.

2.0 HAP LOSS INVENTORY LOG

Table 1 is a log that shows how ZFS Ithaca records monitoring information on HAP loss from the process. The HAP Loss Inventory Log includes entries to record the following information:

1. The beginning and ending dates for each operating status period and the process operating status (columns 1 and 2 of Table 1).

2. Beginning and ending solvent inventory in gallons (columns 3 and 4 of Table 1).

3. Total quantity of solvent received in gallons (column 5 of Table 1).

4. Justified adjustments made to the solvent inventory (column 6 of Table 1).

5. The monthly actual solvent loss in gallons (column 7 of Table 1).

6. The monthly weighted average HAP content of all solvent received represented as a volume fraction of the solvent (column 8 of Table 1).

7. The actual solvent loss for the previous 12 operating months in gallons (column 9 of Table 1).

8. The weighted average HAP content in solvent received for the previous 12 operating months represented as a fraction of the volume of solvent (column 10 of Table 1)

Each of these listed entries is discussed in more detail in Sections 2.1 through 2.8.

2.1 Beginning and Ending Dates for Each Operating Status Period and the Process Operating Status

Columns 1 and 2 of Table 1 indicate the process operating status, and beginning and ending dates for each change in operating status. In §63.2853(a)(2) of the solvent extraction for vegetable oil production NESHAP, five types of process operating status that a vegetable oil production process may experience are listed and described:

1. normal operating period,

2. non-operating period,

3. initial startup period,

4. malfunction period, and

5. exempt period.

The dates that define each operating status period include the beginning date of each calendar month and the date of any change in the source operating status. If the process maintains the same operating status during an entire calendar month, the beginning and ending dates of the calendar month define the operating period.

2.2 Beginning and Ending Solvent Inventory

Columns 3 and 4 of Table 1 indicate the beginning and ending solvent inventory for each normal operating period. ZFS Ithaca staff record the solvent inventory by summing the hexane volume in gallons from the three (3) storage tanks and the work tank on a daily basis. The volume of the storage tanks and work tank is determined by a pressure plate inside of each tank and is available on the computers in the Soy Plant Control Room.

2.3 Total Quantity of Extraction Solvent Received

Column 5 of Table 1 indicates the quantity of solvent received. The quantity of the solvent received is determined using the truck scale at ZFS Ithaca. The total amount is calculated by subtracting the weight of the tanker before and after unloading the solvent. The density of the solvent is used to convert the weight received into gallons.

2.4   Solvent Inventory Adjustments

Column 6 of Table 1 allows ZFS Ithaca to document periodic adjustments to improve the recorded accuracy of the solvent inventory. Section 63.2853(a)(5) of the solvent extraction for vegetable oil production NESHAP allows solvent inventory adjustments to be made as long as an adequate justification for the adjustment is provided. Adjustments to the solvent inventory are expected to be infrequent.

2.5   Monthly Actual Solvent Loss

Based on information already recorded in the log, ZFS Ithaca staff determine the actual solvent loss for each operating month and enter the value under Column 7 of Table 1. The monthly actual solvent loss is the total solvent loss during all normal operating periods of an operating month. The monthly actual solvent loss may be determined using Equation 1 of §63.2853:

$$\text{Monthly Actual Solvent (gal)} = \sum_{i=1}^{n} \left(SOLV_B - SOLV_E + SOLV_R \pm SOLV_A \right)_i \quad \text{(Eq. 1)}$$

where:

$SOLV_B$ = Gallons of solvent in the inventory at the beginning of normal operating period "i" as determined at §63.2853 (a)(3).

$SOLV_E$ = Gallons of solvent in the inventory at the end of normal operating period "i" as determined at §63.2853 (a)(3).

$SOLV_R$ = Gallons of solvent received between the beginning and ending dates of the normal operating period "i" as determined at §63.2853 (a)(4).

$$SOLV_A \quad = \quad \text{Gallons of solvent added or removed from the solvent inventory during operating period "i" as determined at §63.2853 (a)(5).}$$

$$i \quad = \quad \text{An operating period.}$$

$$n \quad = \quad \text{Number of operating periods within a calendar month.}$$

2.6 Monthly Weighted Average HAP Content of Solvent

Column 8 of Table 1 shows the weighted average HAP content of solvent received during a given month. The monthly weighted average volume fraction of HAP in the extraction solvent is based on all shipments of solvent received during the operating month, regardless of the operating status at the time of the delivery. The monthly weighted average volume fraction of HAP is determined using Equation 1 of §63.2854:

$$\begin{array}{l} \text{Monthly Weighted} \\ \text{Average HAP Content} \\ \text{of Extraction Solvent} \\ \text{(volume fraction)} \end{array} = \frac{\displaystyle\sum_{i=1}^{n} \left(\text{Received}_i * \text{Content}_i \right)}{\text{Total Received}} \qquad \text{(Eq. 1)}$$

where:

Received_i = Gallons of extraction solvent received in delivery "i"

Content_i = The volume fraction of HAP in extraction solvent delivery "i" based on the Certificate of Analysis (COA) provided by the vendor.

Total Received = Total gallons of solvent extraction received since the end of the previous operating month. Note: this includes all solvent deliveries such as deliveries during nonoperational and malfunction periods that occur between the end of the previous normal operating period and the beginning of the next normal operating period.

i = The delivery of extraction solvent.

n = The number of extraction solvent deliveries during the operating period.

2.7 Actual Solvent Loss for the Previous 12 Operating Months

After recording solvent loss information for 12 operating months, Column 9 of Table 1 shows the value for the actual solvent loss from the process for the previous 12 operating months. This solvent loss value is determined by summing the actual solvent losses for the last twelve operating months.

2.8 Weighted Average HAP Content of Solvent for the Previous 12 Operating Months

After recording solvent loss and HAP content information for 12 operating months, Column 10 of Table 1 shows the weighted average HAP content expressed as volume fraction of solvent received at the process for the previous 12 operating months. This volume fraction value is determined using Equation 2 of
§63.2854:

$$\begin{array}{l}\text{12-Month Weighted} \\ \text{Average of HAP Content} \\ \text{in Solvent Received} \\ \text{(volume fraction)}\end{array} = \dfrac{\displaystyle\sum_{i=1}^{12}\left(\text{Received}_i * \text{Content}_i\right)}{\text{Total Received}} \qquad \text{(Eq. 2)}$$

Where:

Received_i = Gallons of extraction solvent received in operating month "i" as determined at §63.2853(a)(4).

Content_i = Monthly average volume fraction of HAP in extraction solvent received in operating month "i" as determined in accordance with §63.2854(b)(2).

Total Received = Total gallons of extraction solvent received during the previous 12 operating months.

i = The operating month.

3.0 OILSEED PROCESSED INVENTORY LOG

An Oilseed Processed Inventory Log must be completed for each oilseed type processed. ZFS Ithaca currently only processes soybeans. If a different oilseed were to be processed, the appropriate updates to this plan and inventory log would be made. Table 2 shows how ZFS Ithaca organizes and records monitoring information documenting the quantity of each oilseed type processed. The Oilseed Processed Inventory Log includes entries to record the following information for each operating month:

1. Process operating status and the beginning and ending dates for each change in process operating status,

2. Determination of the monthly quantity of each oilseed type processed, and

3. Determination of the quantity of each oilseed type processed for the previous 12 operating months.

Each of these listed entries is discussed in more detail in Sections 3.1 through 3.5.

3.1 Process Operating Status and Beginning and Ending Dates for Each Change in Process Operating Status

Columns 1 and 2 of Table 2 show the process operating status, and beginning and ending dates for each change in operating status. The dates and process operating status entered on the Oilseed Inventory Log coincide exactly with the dates entered on the HAP Loss Inventory Log.

3.2 Monthly Determination of Quantity of Oilseed Processed

Column 3 of Table 2 shows the quantity of soybeans processed each operating month. ZFS Ithaca uses a scale located at the beginning of the process to measure the weight of soybeans entering the process. The scale operates continuously to calculate the weight of soybeans as they pass through the scale system over time. ZFS Ithaca staff record the weight of soybeans that pass through the scale on a per-day time basis to determine the quantity of soybeans processed per day. The total amount of soybeans processed per month is the sum of the daily amounts for each day of the month.

3.3 Determining the Quantity of Oilseed Processed for the Previous 12 Operating Months

After recording the quantity of all oilseed types processed for 12 operating months, Column 4 of Table 2 shows the quantity of each oilseed type processed for the previous 12 operating months.

This is determined by summing the monthly quantities of oilseed processed for the last twelve operating months.

4.0 COMPLIANCE DETERMINATION AND STATUS LOG

Table 3 shows how ZFS Ithaca organizes and records the input variables for the compliance ratio calculation and the corresponding results. The Compliance Determination and Status Log includes entries to record the following information:

1. Beginning and ending dates defining each operating month if not the entire month,

2. Actual solvent loss for the previous 12 operating months (see Table 1),

3. Weighted average of HAP in solvent for the previous 12 operating months (see Table 1),

4. Quantity of each oilseed type processed for the previous 12 operating months (see Table 2),

5. Determination of the monthly compliance ratio, and

6. Determination of compliance status with the HAP emission limits of these NESHAP.

The 12-month rolling sum of actual solvent loss, weighted average HAP content, and quantity of each oilseed type processed is determined using the example data recorded in Tables 1 and 2. These calculated and recorded values are copied over to Table 3 to support documentation of the compliance ratio calculation.

The compliance ratio is the ratio of the "actual" HAP loss in gallons from the process to the "allowable" HAP loss in gallons as permitted by the NESHAP.

$$\text{Compliance Ratio} = \frac{\text{Actual Hap Loss}}{\text{Allowable Hap Loss}}$$

The prior mentioned compliance ratio equation can be re-arranged to accept solvent loss information instead of HAP loss information, as shown in Equation 2 from §63.2840(a)(2):

$$\text{Compliance Ratio} = \frac{f * \text{Actual Solvent Loss}}{0.64 * \sum_{i=1}^{n}\left((\text{Oilseed})_i * (\text{SLF})_i\right)}$$

Where:

f = The weighted average volume fraction of HAP in solvent received during the previous 12 operating months, as determined in §63.2854, dimensionless. (Refer to Table 3, Column 3)

0.64 = The average volume fraction of HAP in solvent in the baseline performance data, dimensionless.

Actual Solvent Loss = Gallons of actual solvent loss during previous 12 operating months, as determined in §63.2853. (Refer to Table 3, Column 2)

Oilseed = Tons of each oilseed type "j" processed during the previous 12 operating months, as shown in §63.2855. (Refer to Table 3, Column 4)

SLF = The corresponding solvent loss factor (gal/ton) for oilseed "j" listed in Table 1 of §63.2840 of the NESHAP. As a convenience, the list of solvent loss factors has been reprinted in this document as Table 4.

i = Each oilseed type processed.

n = Number of oilseed types processed during the previous 12 operating months.

Tables 1, 2, and 3 show data for ZFS Ithaca from June 2020 through June 2021. An example calculation for the Compliance Ratio for May 2021 is presented below:

$$Compliance\ Ratio = \frac{(0.55)\ x\ (135,767)}{0.64\ x\ (0.2\ x\ 1,192,118)}$$

$$Compliance\ Ratio = \frac{74,672}{152,591}$$

$$Compliance\ Ratio = 0.49$$

When the value of the compliance ratio, as determined above, is less than 1.00, then the facility is in compliance with the allowable HAP emissions under these NESHAP. The word, "Yes," is entered under Column 6 of Table 3. When the compliance ratio is greater than 1.00, then the facility is not in compliance with the allowable HAP emissions under these NESHAP. The word, "No," would then be entered under Column 6 of Table 3.

TABLE 1. HAP LOSS INVENTORY LOG

(1) Operating Dates/Month §63.2853 (a)(1)	(2) Operating Status §63.2853 (a)(2)	Solvent Inventory (gallons) §63.2853 (a)(3)		(5) Total Extraction Solvent Received (gallons) §63.2853 (a)(4)	(6) Solvent Inventory Adjustments [+/-] (gallons) §63.2853 (a)(5)	(7) Monthly Actual Solvent Loss (gallons) §63.2853 (b)	(8) Monthly Weighted Average HAP Content of Solvent (Volume fraction) §63.2854 (b)(2)	For the Previous 12 Operating Months	
		(3) Beginning	(4) Ending					(9) Actual Solvent Loss (gallons) §63.2853 ©	(10) f (Volume fraction) §63.2854 (b)
Jun-2020	Normal	24,444	22,686	7,148	0	8,906	0.46		
Jul-2020	Normal	22,686	16,539	6,700	0	12,847	0.47		
Aug-2020	Normal	16,539	17,096	13,657	0	13,100	0.47		
Sep-2020	Normal	17,096	18,408	14,830	0	13,518	0.47		
Oct-2020	Normal	18,408	21,976	13,748	0	10,180	0.55		
Nov-2020	Normal	21,976	19,110	8,035	0	10,901	0.62		
Dec-2020	Normal	19,110	19,636	13,874	0	13,348	0.58		
Jan-2021	Normal	19,636	20,749	15,520	0	14,407	0.52		
Feb-2021	Normal	20,749	25,148	14,574	0	10,175	0.57		
Mar-2021	Normal	25,148	29,127	16,060	0	12,081	0.57		
Apr-2021	Normal	29,127	22,209	0	0	6,918	0.57		
May-2021	Normal	22,209	27,674	14,851	0	9,386	0.57	74,431	0.55
Jun-2021	Normal	27,674	19,067	0	0	8,607	0.57	71,142	0.53
Jul-2021	Normal	19,067	23,311	13,818	0	9,574	0.58	76,060	0.58
Aug-2021	Normal	23,311	14,668	0	0	8,643	0.58	69,588	0.54
Sep-2021	Normal	14,668	12,038	7,730	0	10,360	0.49	66,385	0.53
Oct-2021	Normal	12,038	15,039	13,524	0	10,522	0.54	66,099	0.53
Nov-2021	Normal	15,039	16,628	14,207	0	12,618	0.49	68,032	0.54
Dec-2021	Normal	16,628	16,402	14,403	0	14,629	0.56	68,107	0.53
Jan-2022	Normal	16,402	18,015	14,105	0	12,492	0.48	66,784	0.53
Feb-2022	Normal	18,015	20,243	15,240	0	13,012	0.46	65,470	0.51
Mar-2022	Normal	20,243	15,356	7,863	0	12,750	0.46	59,982	0.46
Apr-2022	Normal	15,356	10,318	6,932	0	11,970	0.46	63,181	0.47
May-2022	Normal	10,318	17,545	19,667	0	12,440	0.47	64,051	0.47
Jun-2022	Normal	17,545	20,174	15,797	0	13,168	0.47	71,520	0.50
Jul-2022	Normal	20,174	22,019	14,088	0	12,242	0.47	70,143	0.48
Aug-2022	Normal	22,019	20,968	7,923	0	8,974	0.48	73,925	0.51
Sep-2022	Normal	20,968	18,885	7,912	0	9,995	0.46	73,799	0.51
Oct-2022	Normal	18,885	17,405	7,930	0	9,410	0.46	70,206	0.49
Nov-2022	Normal	17,405	12,790	7,947	0	12,562	0.47	66,981	0.47
Dec-2022	Normal	12,790	20,217	15,874	0	8,447	0.49	66,637	0.48
Jan-2023	Normal	20,217	14,738	7,919	0	13,399	0.49	63,684	0.46
Feb-2023	Normal	14,738	14,519	7,825	0	8,044	0.49	60,516	0.45
Mar-2023	Normal	14,519	10,611	7,916	0	11,824	0.47	60,591	0.46
Apr-2023	Normal	10,611	14,333	15,867	0	12,145	0.50	65,278	0.49

TABLE 1. HAP LOSS INVENTORY LOG

(1) Operating Dates/Month §63.2853 (a)(1)	(2) Operating Status §63.2853 (a)(2)	Solvent Inventory (gallons) §63.2853 (a)(3)		(5) Total Extraction Solvent Received (gallons) §63.2853 (a)(4)	(6) Solvent Inventory Adjustments [+/-] (gallons) §63.2853 (a)(5)	(7) Monthly Actual Solvent Loss (gallons) §63.2853 (b)	(8) Monthly Weighted Average HAP Content of Solvent (Volume fraction) §63.2854 (b)(2)	For the Previous 12 Operating Months	
		(3) Beginning	(4) Ending					(9) Actual Solvent Loss (gallons) §63.2853 ©	(10) f (Volume fraction) §63.2854 (b)
May-2023	Normal	14,333	12,670	11,513	0	13,176	0.50	61,701	0.46
Jun-2023	Normal	12,670	18,977	15,867	0	9,560	0.47	61,706	0.48
Jul-2023	Normal	18,977	17,107	7,947	0	9,817	0.47	58,735	0.46
Aug-2023	Normal	17,107	15,553	7,912	0	9,466	0.48	58,763	0.46
Sep-2023	Normal	15,553	24,107	17,468	0	8,913	0.49	63,748	0.50
Oct-2023	Normal	24,107	15,178	0	0	8,929	0.00	60,084	0.48
Nov-2023	Normal	15,178	19,878	15,877	0	11,177	0.49	64,159	0.51
Dec-2023	Normal	19,878	19,122	7,916	0	8,673	0.49	60,280	0.48
Jan-2024	Normal	19,122	16,732	7,905	0	10,295	0.49	60,269	0.49
Feb-2024	Normal	16,732	16,445	7,944	0	8,231	0.49	60,323	0.49
Mar-2024	Normal	16,445	15,621	7,748	0	8,571	0.49	60,388	0.51

TABLE 2. OILSEED PROCESSED INVENTORY LOG

Oilseed Type: Soybean

(1) Operating Dates/Month §63.2855 (a)(1)	(2) Operating Status §63.2855 (a)(2)	(3) Quantity of Soybeans Processed (tons) §63.2855 (b)	(4) 12-Month Rolling Sum of Soybeans Processed (tons) §63.2855 (c)
Jun-2020	Normal	103,586	
Jul-2020	Normal	97,263	
Aug-2020	Normal	101,253	
Sep-2020	Normal	80,810	
Oct-2020	Normal	109,289	
Nov-2020	Normal	110,675	
Dec-2020	Normal	106,106	
Jan-2021	Normal	108,193	
Feb-2021	Normal	87,981	
Mar-2021	Normal	93,034	
Apr-2021	Normal	85,220	
May-2021	Normal	108,708	1,192,118
Jun-2021	Normal	91,323	1,179,854
Jul-2021	Normal	92,214	1,174,805
Aug-2021	Normal	107,124	1,180,676
Sep-2021	Normal	91,050	1,190,916
Oct-2021	Normal	115,333	1,196,960
Nov-2021	Normal	108,099	1,194,384
Dec-2021	Normal	107,020	1,195,297
Jan-2022	Normal	111,915	1,199,019
Feb-2022	Normal	104,537	1,215,575
Mar-2022	Normal	102,367	1,224,908
Apr-2022	Normal	89,080	1,228,769
May-2022	Normal	114,500	1,234,561
Jun-2022	Normal	114,690	1,257,928
Jul-2022	Normal	113,946	1,279,661
Aug-2022	Normal	115,017	1,287,553
Sep-2022	Normal	92,493	1,288,996
Oct-2022	Normal	118,086	1,291,749
Nov-2022	Normal	113,782	1,297,433
Dec-2022	Normal	115,812	1,306,225
Jan-2023	Normal	116,555	1,310,866
Feb-2023	Normal	105,978	1,312,306
Mar-2023	Normal	117,415	1,327,354
Apr-2023	Normal	89,764	1,328,038
May-2023	Normal	109,203	1,322,741
Jun-2023	Normal	109,432	1,317,483
Jul-2023	Normal	99,139	1,302,675
Aug-2023	Normal	113,817	1,301,475
Sep-2023	Normal	91,321	1,300,304

TABLE 2. OILSEED PROCESSED INVENTORY LOG

(1) Operating Dates/Month §63.2855 (a)(1)	(2) Operating Status §63.2855 (a)(2)	(3) Quantity of Soybeans Processed (tons) §63.2855 (b)	(4) 12-Month Rolling Sum of Soybeans Processed (tons) §63.2855 (c)
Oct-2023	Normal	117,561	1,299,778
Nov-2023	Normal	114,345	1,300,341
Dec-2023	Normal	117,067	1,301,596
Jan-2024	Normal	117,227	1,302,268
Feb-2024	Normal	117,934	1,314,224
Mar-2024	Normal	123,285	1,320,093

TABLE 3. COMPLIANCE DETERMINATION AND STATUS LOG

(1) Operating Dates/Month §63.2855 (a)(1)	(2) Actual Solvent Loss for Previous 12 Operating Months (gallons) §63.2853 ©	(3) f, Weighted Average HAP Content in Solvent Received for Previous 12 Operating Months (weight %) §63.2854(b)	(4) Quantity of Soybeans Processed for Previous 12 Operating Months (tons) §63.2855©	(5) Compliance Ratio §63.2840(b)	(6) Is Source in Compliance? (Ratio < 1.00) §63.2840©
May-2021	135,767	0.55	1,192,118	0.49	YES
Jun-2021	135,468	0.53	1,179,854	0.47	YES
Jul-2021	132,195	0.58	1,174,805	0.51	YES
Aug-2021	127,738	0.54	1,180,676	0.46	YES
Sep-2021	124,580	0.53	1,190,916	0.44	YES
Oct-2021	124,923	0.53	1,196,960	0.43	YES
Nov-2021	126,639	0.54	1,194,384	0.44	YES
Dec-2021	127,920	0.53	1,195,297	0.45	YES
Jan-2022	126,006	0.53	1,199,019	0.44	YES
Feb-2022	128,843	0.51	1,215,575	0.42	YES
Mar-2022	129,512	0.46	1,224,908	0.38	YES
Apr-2022	134,564	0.47	1,228,769	0.40	YES
May-2022	137,618	0.47	1,234,561	0.41	YES
Jun-2022	142,179	0.50	1,257,928	0.44	YES
Jul-2022	144,847	0.48	1,279,661	0.43	YES
Aug-2022	145,178	0.51	1,287,553	0.45	YES
Sep-2022	144,814	0.51	1,288,996	0.45	YES
Oct-2022	143,701	0.49	1,291,749	0.42	YES
Nov-2022	143,646	0.47	1,297,433	0.40	YES
Dec-2022	137,464	0.48	1,306,225	0.40	YES
Jan-2023	138,370	0.46	1,310,866	0.38	YES
Feb-2023	133,402	0.45	1,312,306	0.36	YES
Mar-2023	132,476	0.46	1,327,354	0.36	YES
Apr-2023	132,651	0.49	1,328,038	0.38	YES
May-2023	133,386	0.46	1,322,741	0.36	YES
Jun-2023	129,779	0.48	1,317,483	0.37	YES
Jul-2023	127,353	0.46	1,302,675	0.35	YES
Aug-2023	127,846	0.46	1,301,475	0.35	YES
Sep-2023	126,764	0.50	1,300,304	0.38	YES

TABLE 3. COMPLIANCE DETERMINATION AND STATUS LOG

(1) Operating Dates/Month §63.2855 (a)(1)	(2) Actual Solvent Loss for Previous 12 Operating Months (gallons) §63.2853 ©	(3) f, Weighted Average HAP Content in Solvent Received for Previous 12 Operating Months (weight %) §63.2854(b)	(4) Quantity of Soybeans Processed for Previous 12 Operating Months (tons) §63.2855©	(5) Compliance Ratio §63.2840(b)	(6) Is Source in Compliance? (Ratio < 1.00) §63.2840©
Oct-2023	126,283	0.48	1,299,778	0.36	YES
Nov-2023	124,898	0.51	1,300,341	0.39	YES
Dec-2023	125,123	0.48	1,301,596	0.36	YES
Jan-2024	122,020	0.49	1,302,268	0.36	YES
Feb-2024	122,207	0.49	1,314,224	0.36	YES
Mar-2024	118,954	0.51	1,320,093	0.36	YES