Oil water separator design guidelines 2019 2020 philippines

alled ottepsir led enoizatulav al e erotarapes led inoizatserp elled acidoirep enoizatulav al rep acincet esab al erilibats rep eseap nu id ovitamron etneulffe oilo id etimil led e oilortep led enoizarapes id azneiciffe'lled otnoc odnenet ;auqca-oilo id ilanoiznevnoc irotarapes i rep)IPA(etutitsnI muelorteP naciremA'lled enoizattegorp id iretirc ia imrofnoc ehc auqca-oilo id ilanoiznevnoc irotarapes erattegorp rep icitametam illedom ivoun e otnemanoisnemid id itad ivoun ,enoizattegorp id emulov id ottecnoc li onacilppa enoizattegorp id idotem ivoun I .acitametam enoizalledom al osrevartta ovitanretla ngised id oiccorppa e ovitavonni ngised id oiccorppa ,ovitavonni ngised id oiccorppa :olotit lad auqca-oilo id ilanoiznevnoc irotarapes i rep enoizattegorp id idotem ivoun otatnevni ah oroval otseuq ,oiggadnos led otise'lla leuqeS .airegiN ,regiN led atleD len auqca-oilo'lled ilanoiznevnoc irotarapes ilanoiznuf inucla id eulfer euqca elled itneulffe ilged oilo id otunetnoc lus enigadni'nu ottodnoc ah acrecir id oroval otseuQ .ilairtsudni eulfer euqca el rep ovitamron etneulffe oilo id etimil la ottepsir edneiza ellus elatneibma enoizatnemaloger id eiznega ad enoisserp ¨Ã iv am ,ilanoiznevnoc auqca-oilo id irotarapes i rep dradnats enoizattegorp id idotem ilautta ilged enoizattegorp id irtemarap onos non oilortep led enoizarapes id azneiciffe'l e eratnemaloger etneulffe oilo id etimiL .oppulivs id aiv ni iseap ien itnanimoderp eulfer euqca elled otnemattart id arutturts al ¨Ã oilortep led auqca'lled elanoiznevnoc erotarapes li ehc ottaf li etnatsonon ittodorp itneulffe ilged Ãtilauq al onatnorffa non ilautta enoizattegorp id idotem i ©Ähcrep auqca-oilo'lled ilanoiznevnoc irotarapes ied enoizattegorp id idotem i eraroilgim id Ãtissecen al otireggus onnah irotua isreviD .ortla'lla eseap nu ad airav ivitsepmet e ilairtsudni itneulffe ilgen irubracordi id elibissimma Ãtitnauq al ¨Ã ehc eratnemaloger etneulffe oilo id etimil lI environmental. Traditional oil separators designed with the new design methods compliant with API design criteria and their size are similar to the size of the separators designed with the Design City of Tacoma approach (a certified certified design design enoizetorp al rep aiznegA(eulfer euqca id ossulf nu ad isepsos idilos e otarapes oilo a acificeps Ãtivarg id eznereffid ellus onasab is ehc Ãtivarg id auqca-oilo id irotarapes onos auqca-oilo'lled ilanoiznevnoc irotarapes I .)6102 ,launaM tnemeganaM retawmrotS amocaT fo ytiC(ociracs id euqca e eulfer euqca ad ilibilibats idilos e auqca ni ilibulosni irubracordi irtla e oilo'l erevoumir auqca-oilo id irotarapes I .)7102 ,.la te atpuG(ehcitsemod e ilapicinum ,ilairtsudni eulfer euqca elled edifs el eratnorffa rep elatnemadnof ¨Ã auqca e oilo art enoizarapes aL .)4102 ,rawdnukmoD(airtsudni ingo id ovitteibo'l eresse ebbervod ilacol ied onretni'lla eulfer euqca elled otnemattart lI .itnevecir icirdi iproc ied enoizacifirup-otua id issecorp i alocatso e acitauqca ativ al rep osolocirep ¨Ã eulfer euqca ellen oilo'L .irubracordi id ihciracs ilg itnadraugir iggel el odnazroffar e odnacane ,etneibma'l ereggetorp rep odnaroval onnats odnom li ottut id inrevog i ehc otaraihcid onnah)0002(artsneeV e rhoM .)5102 ,.la te iganaM(odnom li ottut ni eratnemua da otaunitnoc ah otnemaniuqni'llus evitamron elled Ãtireves al e itazzilairtsudni iseap ied etrap roiggam allen otnemaniuqni'l eraloger rep izrofs iloveton ittaf itats onoS .)3102 ,gnaW(ehcirttele ytilitu ellen ehcna am oilortep led airtsudni'llen olos non itazzilitu etnemaipma itats onos auqca-oilo'lled ilanoiznevnoc irotarapes I .)5102 ,.la te farhsA(ertla e ehcimihc ,erefilortep eirtsudni ellen auqca'llad ittodorp ious i e oilortep li erarapes rep itazzilitu onos auqca-oilo id irotarapes I .ereves ¹Âip odnatnevid onnats eulfer euqca elled otnemitlams olled ilatneibma evitamron eL elatneibma azneics ,elivic airengegni ,acimihc airengegni :evaihc eloraP .eseap ingo ni itacilppa eresse onossoP .elabolg Ãtilibacilppa onnah enoizattegorp id idotem ivoun I .auqca-oilo ilanoiznevnoc irotarapes id enoizattegorp al rep enoizattegorp id idotem ivoun i ¬Ásoc odnadilavnoc 2005). The conventional separators of oily water are rectangular devices in which the waste water flow for a long time with horizontal speed, VH. The API oil separator is a standard example of ad airav oilo auqca id erotarapes led azzehgral al azzehgral al)vi5,0" 3,0 ¨Ã auqca-oilo erotarapes li rep azzehgral- Ãtidnoforp id ollavretni'L)iii)ideip 8(irtem 4834,2 a)ideip 3(irtem 4419,0 ad airav arefilortep auqca id erotarapes led Ãtidnoforp aL)oloccip ¹Âip ¨Ã)isac ied adnoces a ,id adnoces a)TV51(oilortep id ilubolg ied)TV(atilas id Ãticolev al etlov 51 o)otunim la ideip 3(otunim/irtem 4419,0 a elaugu o eroirefni eresse ebbervod auqca-oilo erotarapes li osrevartta eulfer euqca elled elatnozziro ÃticoleV)i :euges emoc otnussaiR enoizattegorp id iretirc ia esab ni etattegorp onos erefilortep euqca elled ilanoiznevnoc irotarapes i ehc otaraihcid ah)0991(IPA.elanoiznevnoc arefilortep auqca id erotarapeS .)0991 ,IPA(erefilortep euqca elled ilanoiznevnoc irotarapes ia ottepsir itneiciffe ¹Âip onos elellarap artsaip a arefilortep auqca id irotarapes i ehc otalanges otats Ã .elellarap etanilcni ertsaip id eires anu ni etsisnoc ehc alellarap arefilortep auqca id erotarapes li ¨Ã Ãtivarg id oilo euqca id erotarapes id opit ortla nU .ellav a otnemattart id ametsis la o angof alla aticsu'l osrevartta onocsiulf e onogloccar is enoizarapes id aremac allad)etneulffe(oilo id evirp etnemavitaler eulfer euqca el iuc ni aremac al ¨Ã yabretla'L .auqca'd annoloc al osrevartta azla is ertnem oilo'l eneittart e eloppart ,oilo'lled enoizarapes al rep itnecseiuq inoizidnoc ecsinrof ehc avitteffe aremac al ¨Ã)oilo'lled atloccar/enoizarapes id allec o elanac/erotarapes id aremac o enoizarapes id aremac ,erotarapes ehcna atamaihc(enoizarapes id enoizes aL .enoizarapes id enoizes alla eulfer euqca el ecsiubirtsid e aznelobrut al ecudir ,itnemides ,ilibattolf eilgoccar ,arutanetna id eloppart eL .)1 .giF idev(yag- tsop e enoizarapes id enoizes ,YABTSERF ;eremac ert ad otiutitsoc ¨Ã erottelfed opit id erotarapes lI .IPA enoizattegorp id iretirc i noc Ãtimrofnoc ni otattegorP ;arefilortep auqca id ilanoiznevnoc irotarapes enoizecir enoizecir alla eulfer euqca el aicsaliR .)5002 ,.¢Ã te ruhtrA(eulfer euqca elled e oilortep led ehcitsirettarac e evitarepo inoizidnoc , oserpmoc ¨Ã auqca-oilo erotarapes li rep aminim azzehgnul-azzehgnul otroppar lI)V)ideip 02(irtem 690,6 a)ideip 6(irtem The authorities are subject to regulation by government bodies responsible (Fair et al., 1981). Several authors have suggested the need to improve the design methods of conventional oil water separators because current design methods do not address the quality of the effluent products. The conventional oil-water separator is a more accessible technology, where limited financial resources play an important role as a common place in developing countries (Lopez-Vazquez and Fall, 2004). There is pressure from environmental regulatory agencies on companies compared to the regulatory limit of oil effluent for industrial waste water. This research conducted an investigation into the oil content of waste water effluents of some functional conventional oil-water separators in the Niger Delta, Nigeria. The results are presented in Table 1. Following the outcome of the survey, this work has invented new methods of design for conventional oil-water separators titled innovative design approach, innovative design approach and alternative design approach for conventional oil-water separators through mathematical modeling taking into account the oil separation efficiency and the regulatory effluent oil limit of a country to establish the technical basis for the periodic assessment of separator performance and the country's compliance. The technical reasoning of this innovation is that when a piece of equipment is not designed to comply with a standard there is no strong technical basis to expect its performance to comply with that standard. Regulatory Effluent Oil Limit and Oil Separation Efficiency are not design parameters of one of the methods of erattegorp erattegorp rep icitametam illedom ivoun e enoizattegorp id emulov id ottecnoc li ,2 allebat allen itatneserp auqca-oilo id ilanoiznevnoc irotarapes i rep otnemanoisnemid id itad ivoun onacilppa oroval otseuq ni ittodortni enoizattegorp id idotem ivoun I .ilanoiznevnoc auqca-oilo id irotarapes i rep ilautta dradnats)48(.auqca-oilo id ilanoiznevnoc irotarapes rep otnemanoisnemid id itaD .gm 5l/gm 5l/gm etneulffe 1 keeW erotarapeS .auqca-oilo id ilanoiznevnoc irotarapes inucla id etneulffe oilo id otunetnoC .elabolg Ãtilibacilppa anu onnaH .eseap ingo ni itacilppa eresse onossop enoizattegorp id idotem ivoun I .IPA enoizattegorp id iretirc ia imrofnoc auqca-oilo id irotarapes ft)1,721.674 (60,800 ft3)The design volume is calculated from the design flow rate or expected peak wastewater flow rate. (API, 1990) stated that the design flow rate for conventional oil-water separators is based on the expected wastewater flow rate and the safety factor required for accommodating flow variations. Unless flow equalization is provided upstream the separator the design flow rate should be based on the maximum flow rate expected from present and future oil-contaminated wastewaters and storm-water runoff.The Niger Delta is the delta of the River Niger situated on the Gulf of Guinea on the Atlantic Ocean in Nigeria. It is located within nine coastal southern states of Nigeria including Delta State, Rivers State, Bayelsa State, Edo State, Akwa Ibom State, Cross River State, Imo State, Abia State and Ondo State. The Niger Delta extends over about 70000 km2 and makes up 7.5% of Nigeria's land mass. It is very densely populated. The area was the British Oil Rivers Protectorate from 1885 until 1893 when it was expanded and became the Niger Coast Protectorate. The Niger Delta is a petroleum-rich region (Wikimedia Inc. 2016).Sampling, laboratory analysis and mathematical modelling were the methods adopted. Materials used include wastewater effluents and sample containers. Wastewater effluents were collected from ten functional conventional oil-water separators in the Niger Delta, Nigeria and analyzed for oil content in the laboratory. Mathematical models titled aspect ratio model, length model, efficiency-time model, volume-aspect ratio model and aspect ratio-length model were developed for conventional oil-water separators. The novel design approach, innovative design approach and alternative design approach for conventional oil-water separators were invented; each based on different mathematical models. Novel sizing data for conventional oil-water separators were generated from API design criteria. The new methods have been demonstrated with an example of design. the same design example was also demonstrated with the tacoma city design approach for conventional oil-water separators to allow comparison. tacoma city design approach is a certified design approach for conventional oil water separators. samples of waste water effluents of ten conventional oil separators were collected and analyzed. Wastewater samples were collected on Wednesdays of each week for a period of four weeks. the results are presented in Table 1. new sizing data for conventional oil-water separators presented in table 2 were generated by the design criteria anterior ii, iv and v for conventional oil-water separators. 4.3.1. the efficiency-time ratio model, length model and appearance for conventional oil-water separators inc. (2015) stated that oil separation (removal) efficiency (e) of oil-water separators can be expressed as in eq. (1:) based on the mass budget equation in which the accumulation term is not zero for conventional oil-water separators, separation efficiency, and can be defined in fractional form, in terms of and eff. (2) and (3) (metcalf and eddy inc, 2004:) practically, the flow of waste water in each conventional separator of the standard oil presence decreases as it flows from the flow of This implies that the flow rate, which is lower than the inflow rate Qi. The separator volume can be calculated from(4) (city of the Tacoma stormy water management manual, 2016): Apply EQ. (4) in EQ. (3) Results in EQ. (5): eq. (5) It is the â € œModel of time of efficiency for the conventional separators of the oilâ €. The volume of the separator can also be calculated by EQ. (6) (city of the separator separator Stormwater management manual, 2016):Using eq. (6) in eq. (4) access to eq. (7):Applicate eq. (7) in eq. (5) results in eq. (8): Eq. (8) is the “length model for conventional oil-water separators”. (9) (agunwamba, 2000):Using eq. (8) in eq. (9) produces eq. (10): Eq. (10) is the “control ratio model for conventional oil-water separators”. where, v = volume of the separator (section section) in the cubic meter (m3)t = time of residence (retention) in the separator in minutes (min)Qi = flow (flow) of discharge water in the separator in m3/minQo = flow (fluent) rate of waste water from the separator in m3/minL = length of the separator in concentration (m)W = depth of the separator volume-specific ratio model for conventional oil-water separators the volume-aspect ratio model has been developed by data in aspect ratio, depth (m) and volume (m3) columns of table 2 applying multiple linear regression analysis to obtain a power equation model as in eq. (11): Transposition of the results of the power equation in eq. (12):logV=a1+a2logR+a3logD(12)Eq. (12) eq. (12) in matrix form produces eq. (13):[nlogRsignlogD ministrilogRasset(logR)2 ministrilogd ministrilogDsignlogRlogD(logD)2]{a1a2a3}=[signlogV ministrilogrlogv ministrilogv ministrilogv ministrilogv ministrylogvDlogV](13)By obtaining the data register in the aspect ratio, depth (m) and table calculation volumeRehto eht dna meht gnittup, 2â €Lbat fo snmulc) m (htped dna) m (htgnel, oitar tcepsa eht ni atad eh gol eht gniniaatbo) 81 (] rgolâ´ã ¢¢^^^^¢rgolâ^^. Â¯ã ¢ [=} 3a2a1a {] 2) dgol (â'ã ¢ dgollâ¯ã ¢ dgolâ¯ã ¢ dgollâ¯ã ¢ 2) lgol (â¯ã ¢ lgolâ ' . 71 (.QE) 71 (dgol3a+lgol2a+1A = rgol:) 71 (.qe ot sdael noitauqe rewop eht gnisopsnart:) 61 (.qe yb detneserp sa noitauqe rewop a niatbo optbo optbo ot Snylna s) Elbat Sa atad eht rof tf tf tnelecxe na sekam ledom eht htw snikiderp gnikam ni tnednoc % 999.99 eb nac ew taht whs stluser eht. % 999.99 taht etacidni stluser ehT%5999.99=599999.0=r,tneiciffeocnoitalerroC%999.99=99999.0=2r,noitanimretedfotneiciffeoC09506.1=tseS,etamitsefororredradnatS766.255=yS,noitaiveddradnatS:stluser gniwollof eht evag sisylana lacitsitatS .seulav lautca eht htiw)ledom ,emulov (seulav detciderp eht gnirapmoc dna soitar tcepsa dna shtped gnidnopserroc eht fo seulav eht gnitupmi yb 2Â ÃelbaT fo nmuloc emulov eht ni)lautca ,emulov(seulav eht tciderp ot ti gnisu yb detadilav saw ledom ehT .)ledom oitar tcepsa-emulov eht Fo noisrev Tinu Lairepmi ET SA Segreme 4419.0d3868.2R1808549.1 = V, Noitauqe ET, 2â € ELBAT NI SA TEEF CIBUC NI V, Emulov DNA TEF NF D, HTPED HIIW, YRTEM NIRLMS (HIP)) 3m (ertem cibuc ni si si) v (emulov; erehw, srotarapes retaw-lio lioitnevnoc rof ledom oitar tcepsa-eemulov eht s) 51 (.QE) 51 (.QE) 51 (3419.0d48.249150361.0 = V) 51 (.QE) 51 (.QE). V, emulov rof gnivlos) 41 (dgol3419.0+RGol4868.2+0787.0` ¢ = vgol:) 41 (.QE ot sdael) 21 (.QE otni 3A, 2A, 1a fo seulav in a relationship of matrix and constant calculation for EQ. (17) Using Matlab: A1 = 0.2035, A2 = 0.5170, GO3 = 0.022222 Values of replacement of A1, A2, A3 in EQ. (17) leads to EQ. 19): Logr = 0.2035+0.5170ogl+0.0222ogd (19). The model was validated using it to predict the values of the appearance ratio (the control ratio, actual R) in the column of the appearance ratio of Table 2 preventing the corresponding values of lengths and depths and comparing the aforementioned values (the report of control, the R model) with the actual values. The statistical analysis gave the following results: Standardeviation, SŸ = 4,47214standerroderrofestimate, SEST = 0.0081725COEFFICIENT OFDERTHERTINATION, R2 = 0.999 = 99.999%CorrelationCoefficient, R = 0.999995 = 99.9995%These results indicate that 99.999%of the original intense is original. was explained by the model. Therefore, the results show that we can be 99.999 % safe in making predictions with the model. the model adapts perfectly to the data as highlighted by Fig. 3. The application of the appearance model and the new sizing data in Table 2 in the design of the conventional separators of oil-water is defined as the new design approach for conventional separators of oil-water. During the design of conventional oil separators, the new design approach takes on the desired depth inside the API range, calculates the design volume before calculating the corresponding width of the separator from table 2 for interpolation. The length of the separator is calculated by the appearance model. The application of the new design approach entails the following Step: 1.) Calculate the rate of increase in the drop of oil, VT using EQ. (21) (API, 1990): where, oil drop rate rate, Visinm / s. 60 multiply to obtain the value in m/min; G = acceleration due to the gravity in m/s2 (9.8 m/s2); Î W = density of waste water at the design temperature in kg/m3; Î o = = density of oil at the design temperature in kg/m3; d = oil drop of oil in the meter (m); Îsis = absolute viscilitate of the drainage water in depth PA.44notor. .3.) Calculate the design volume, V of the separator using EQ. (4): where, V = volume of the separator in M3; Qi = maximum forecast speed flow of drain water in the separator or design flow in M3/min; and t = time of residence (replenishment) in the minutes. 4.) Evaluate the efficiency of separation of the oil requested by the law using EQ. (3): Note takes 5% reduction of the flow rate such as the drain waters flow through the separator to calculate the flow (effluent) rate, qo: where, e = efficiency of separation of the oil in the hamlet. 100 multiply to convert in percentage (if necessary); Qi = foreseen maximum flow of waste water in the separator or in the project flow rate in M3/min; Qo = outflow rate (effluent) in M3/min; Ci = concentration of oil in the wastewater in kg/m3 and co = limit of regulatory effluent oil of a country or concentration of effluent oil desired in kg/m3.5.) Calculate the width, W of the separator: refer to Table 2 with the design volume calculated in phase 3 and calculate the corresponding width from table 2 for interpolation. Note: separator width: 1,8288m â ‰ ¤ W Â Â Â Â ¤ 6,096m (Standard API) Report of depth of the separator: from 0.3 to 0.5 (Standard API). Where, vh = horizontal speed of the waste water through the separator in m/min, d = depth of the separator in metro (m). The calculated horizontal speed, VH should be lower than or equal to horizontal speed maximum bees of 0.9144 m/min (standard bees) .7.) Calculate the appearance ratio, r del del atropmoc ovitavonni elauttegorp oiccorppa'lled enoizacilppa'L .ottepsa id otroppar led oloclac li osrevartta erassap aznes eulfer euqca id ossulf isaislauq a etnednopsirroc erotarapes led elaizini azzehgnul alled enoisiverp al o otterid oloclac li etnesnoc azzehgnul id olledom lI ."ilanoiznevnoc oilo auqca'd irotarapes rep azzehgnul id olledom" li odnazzilitu erotarapes led azzehgnul al eraloclac id amirp 2 allebat allad enoizalopretni rep erotarapes led etnednopsirroc azzehgral al aloclac e enoizattegorp id emulov li aloclac ;IPA ammag alled onretni'lla ataredised Ãtidnoforp al emussa elauttegorp oiccorppa ovitavonni'l ,ilanoiznevnoc oilo auqca'd irotarapes id enoizattegorp al etnaruD .auqca-oiloâlled ilanoiznevnoc irotarapes i rep enoizattegorp id ovitavonni oiccorppaâl emoc atinifed ¨Ã auqca-oiloâlled ilanoiznevnoc irotarapes ied enoizattegorp allen 2 allebat allen otnemanoisnemid id itad ivoun ied e âasoelo auqcaâlled ilanoiznevnoc irotarapes i rep azzehgnul id olledomâ led enoizacilppaâL .)IPA dradnats(5 a eroirepus o elaugu eresse ebbervod)ollortnoc id otroppar li(azzehgral-azzehgnul id otroppar atoN)62(FÃelaizini azzehgnul=erotarapes led enoizattegorp id azzehgnuL:)0991 ,IPA( )62(.qE ad erotarapes led enoizattegorp id azzehgnul al aloclaC 4 .gif ni ocifarg tv/Hv susrev otiucricotroc id erottaf li e iPA aznelobrut allad F ,otiucricotroc id erottaf li e aznelobrut li eraloclac rep tv/Hv otroppar led otaloclac erolav li erazzilitU .1 esaf ni otaloclac tv id erolav li e 6 ossap len otaloclac Hv id erolav lad tv/Hv otroppar led erolav li aloclaC :euges emoc)otiucricotroc e aznelobrut rep odnasnepmoc(erotarapes led enoizattegorp id azzehgnul al aloclaC).9:)52(.qE a atrop azzehgnul rep erevlosiR .)m(ortem ni erotarapes led azzehgnul = L ,evoD :)9(.qE ad erotarapes led elaizini azzehgnul al aloclaC).8.)sselnoisnemid(erotarapes led ottepsa id otroppar = R ,evoD :)01(.qE ,ottepsa id otroppar id olledom lad following design steps:1.) Calculate the oil drop increase rate, vt from Eq. (21): Where vtisinm/s. Multiply from 60 to get the value in m/min.2.)Time of living (retention) calculation, t. Take the desired depth, D of the separator (enter (enter)API range) and calculate the time of residence (replenishment), t from EQ. (22): Note: depth of the separator: 0.9144mâ ‰ ¤Dâ ‰ ¤2.4384m (Standard API) .3.) Calculate the design volume, V of the EQ separator. (4): if, qi = = maximum expected speed of waste water flow in the separator or in the project flow rate in M3/min; and t = time of residence (replenishment) in the minutes. 4.) efficiency of separation of the oil calculated by the law by EQ. (3): Note: take on 5 % of the flow rate such as waste water flow through the separator to calculate the flow flow (effluent) using EQ. (23): 5). Calculate the width, W of the separator: refer to Table 2 with the design volume calculated in step 3 and calculate the corresponding width from table 2 for interpolation. Note: separator width: 1,8288m â ‰ ¤ W Â Â Â Â ¤ 6,096m (Standard API). Depthitate ratio-the separator of the separator: from 0.3 to 0.5 (Standard API) .6.) Horizontal speed of the calculator, VH from EQ. (24): Note: The calculated horizontal speed, VH should be lower than or equal to horizontal speed maximum bees of 0.9144 m/min (Standard API) .7.) Calculate the initial length of the separator using the length model, EQ(8): 8.) Calculate the separator design length (compensating for turbulence and short circuit) as follows: calculates the value of the VH/VT ratio with the VH value calculated in step 6 and the VT value calculated in phase 1. Use the calculated value of the VH/VT ratio to calculate turbulence and the short circuit factor, F from the turbulence bees and short circuit factor VH/VT graphic in Fig. 4. Calculate the design length of the EQ separator. (26): separator design length = initial length— Fnota: ratio of length-longation should be equal to or greater than 5 (standard bees). The application of the model of elanoiznevnoc elanoiznevnoc li rep ovitanretla enoizattegorp id oiccorppa'l emoc atinifed ¨Ã auqca-oilo id ilanoiznevnoc irotarapes ied enoizattegorp allen azzehgnul-ottepsa id otroppar id olledom led e tcepsa-emulov id otroppar id olledom led ,opmet-azneiciffe id separators. During the design of the conventional oil-water separators, the alternative design approach takes on the desired depth inside the API range; Calculate the design volume and calculate the corresponding appearance ratio of the separator from the volume-check ratio model before calculating the length of the separator using the model of ratio-langiance appearance. The alternative design approach can be applied with or without reference to Table 2. The application of the alternative design approach involves the following design steps: 1.) Calculate the rate of increase in the drop of oil, VT from EQ(21): Visinm/s. Multiply from 60 to obtain the value in m/min.2.) Time of residence (replenishment), t. Take the desired depth, D of the separator (within the API range) and calculate the time of residence from EQ. (22): Note: depth of the separator: 0.9144mâ ‰ ¤Dâ ‰ ¤2.4384m (Standard API) .3.) Calculate the design volume, V of the EQ separator. (4): Where? Qi = foreseen maximum flow of waste water in the separator or the project flow rate in M3/min; and t = time of residence (replenishment) in the minutes. 4.) efficiency of separation of the calculator oil, and required by law using the efficiency-time model, EQ. (5): Note: takes on 5 % of the flow rate such as waste water flow through the separator to calculate the flow (effluent), qo: calculates the appearance ratio, r of the separator from the model of volume-check ratio, eq. (15): V = 0.163305194R2.8684d0.9143 solving for appearance ratio, R leads to EQ. (27): R = V0.163305194 -D—D0.91432.8684 (27) 6.) Calculate the initial length of the separator from the model of appearance ratio-lungazza, EQ. (20): R = 1.597717529L0.5170d0.0222 Solve for length lead to EQ. (28): L = R1.597717529ã—D0.02220.5170 (28) 7.) Calculate the width of the separator, W from EQ. (9): solving for W leads to EQ. (29): Note: separator width: 1,8288mâ ‰ ¤Wâ ‰ ¤6,096m (Standard API). Report of separation: from 0.3 to 0.5 (Standard API) .8.) Horizontal speed calculation, VH using EQ. (24): the il Velocity, VH should be lower than or equal to the Horizontal Speed Maximum API of 0.9144 m/min (Standard API) .9.) Calculate the length of designer VH/VT ratio from the VH value calculated in passage 8 and the VT value calculated in the passage 1. Use the calculated value of the VH/VT ratio to calculate turbulence and the short circuit factor, f from the API and short turbulence -Including Factor compared to the VH/VT graphic designer in Fig.ã ¢ 4. Calculate the length of the separator design from the EQ. (26): DesignlengtheftHeseparator = Initiatllength £ -fnota: the length-labor ratio should be the same or greater than 5 (Standard API). The design guide for the conventional separators of the oil waters (separation section) written in the city of Tacoma Storm Manual Manual (2016) is defined as the design of the tacoma city design for the conventional separators of the oil waters. The design of the tacoma city design is a certified design guide for conventional separators of oil waters. The rainwater management manual of the city of Tacoma (2016) declared the following guide for the design of conventional oil separators (separation section): 1.) calculates the rate of increase in oil droplets, VT using L 'Eq. ; 0.5.3.) Calculate the permanence time using the EQ. (22): 4.) Calculate the horizontal speed, VH using the EQ. (24): 5.) Calculate the length of the separator (separation section) using the EQ. ; The tacoma's city design approach was also demonstrated with the same example of design a Comparison and validation of the new design methods.

The design of the tacoma city design is a certified design approach for conventional separators of oil waters. The design example shows the calculation of the size of the fundamental separator (separation section) necessary for the design of detailed units. The specific weight of the diesel varies from 0.81 to 0.96 (Toolbox engineering, 2017). It is the oil referred to in the design example. Design an oil water separator to treat a waste water with 220 mg/l of oil and peak flow of 1.5 m3/min. SG of waste water = 0.992, oil sg = 0.92, wastewater viscilitate = 0.00065 pa.s, diameter of the drop of oil = 150 microns. Application of the designer phases and other parameters of the designed separator are presented in Table 3. Example Design: new design approach, innovative design approach, alternative design approach and comparison of designer approach (M3) wait ratio (length-to- Width Ratio) Horizontal Velocity (m/min) Depth-to-width ratioDesign oil separation efficiencynovel design approach15.291.8550.914425.948.240.88430.49395.68%Innovative Design Approach15.291.8550.91425.94830. 49395.68%APPROVING TO ALTERNATIVE DESIGN151.88610.914425.877.950.869740.48595.68%Design Approach of the Tacoma city. Approach to the design and alternative design approach) satisfied API design criteria. In the same way, the conventional separator of oil water designed with the design of the tacoma city design has satisfied the api design criteria. Table 3 presents the conventional oil separator designed with each of the new design methods and the design design approach to the tacoma for the comparison. It is evident from table 3 that dimensions and other API-parameters of the conventional oil-water separator designed with the novel design approach; innovative design approach, alternative design approach and the City of Tacoma design approach are similar. In TableÃ Â3, the dimensions and the other API-parameters are same for the novel design approach, innovative design approach and the City of Tacoma design approach.However, there is a negligible difference of 0.29 m (1.9%) between the length of separator designed with the alternative design approach and the length of separator designed with the City of Tacoma design approach. There are also negligible differences of 0.008 (1.62%) between the depth-to-width ratios, 0.01456 m3/min (1.65%) between the horizontal velocity values, 0.29 (3.52%) between the aspect ratio (length-to-width ratio) values and 0.0311 m (1.68%) between the values of the widths of the separator designed with the alternative design approach and the separator designed with the City of Tacoma design approach.The novel design approach and the innovative design approach can be applied only when TableÃ Â2 is handy or available because they depend on TableÃ Â2 for interpolation when calculating the width of the separator. Uniquely, the alternative design approach can be applied with or without reference to TableÃ Â2. Thus, the alternative design approach can be applied when TableÃ Â2 is not handy or not available. The aspect ratio model in the novel design approach enables prediction or calculation of the initial aspect ratio of separator corresponding to any wastewater stream prior to calculating the initial length. The volume¢ÂÂÂaspect ratio model in the alternative design approach also enables prediction or calculation of the initial aspect ratio of separator corresponding to any wastewater stream prior to calculating the initial length. Uniquely, the length model in the innovative design approach enables direct prediction or of the initial length of separator corresponding to any wastewater stream. Chapara and Canale (2012) stated that mathematical models describe a natural process or system in mathematical terms, yield reproducible results and they can be used for predictive purposes.Nigeria's regulatory effluent oil limit is 10 mg/l (Federal Environmental Protection Agency, 1991). The oil contents of the wastewater effluents of the conventional oil-water separators presented in TableÃ Â1 are above the regulatory effluent oil limit. Mohr and Veenstra (2000) stated that the regulatory effluent oil limit is the allowable quantity of hydrocarbons in industrial and stormwater effluents and it varies from one country to another; some countries specifying only ¢ÂÂÂno sheen¢ÂÂÂ and others stipulating a specific allowable concentration.The effluent oil contents in TableÃ Â1 will be offensive, if the wastewater effluents are discharged directly into receiving water bodies without further treatment. Domkundwar (2014) stated that oil in wastewater is dangerous to aquatic life. Metcalf & Eddy Inc. (2004) stated that wastewater treatment objectives must go hand in hand with the water quality objectives or standards established by environmental regulatory agencies and effective industrial pretreatment is an essential part of an overall water quality management programme. Fair etÃ Âal. (1981) stated that wastewater discharges to receiving water bodies are subject to regulation by responsible governmental agencies.Therefore, it is imperative to account for oil separation efficiency and regulatory effluent oil limit of a country in the design of conventional oil-water separators. Regulatory effluent oil limit and oil separation efficiency are not design parameters of any of the current standard design methods (traditional design methods) for conventional oil-water separators. LÃ³Âpez-Vazquez and Fall (2004) wrote that current design methods of conventional The separators do not address the quality of the products. Therefore, there is no strong technical basis for assessing the performance of the ten conventional oil water separators against the 10 mg/l regulatory effluent oil limit. The technical reason for this is that when a piece of equipment is not designed to meet a standard, there is no strong technical basis to expect its performance to comply with that standard. Yu et al. (2014) stated that the quality is built in a product in the design phase and that most quality crisis or problems are a design function. The Oregon F Appendix (DOT) Hydraulic Manual (2014) stated that conventional oil-water separators can be designed to achieve the performance goal of 10–15 mg/l in effluent treated. This implies that when future projects of conventional oil-water separators are based on an efficiency of design oil separation corresponding to the regulatory oil limit of a country such separators can be assessed against the limit of regulatory effluent oil. This has pushed the initiative for new design methods. The design of conventional oil-water separators based on the oil separation efficiency corresponding to the limit of a country's regulatory effluent oil as innovative by the new design methods (design approach of the novel, innovative design approach and alternative design approach) establishes the technical basis for the periodic evaluation of the separator performance and compliance with the regulatory effluent oil limit of the same country. Subsequently, the informed decision can be reached on the need or relevance of further treatment and performed appropriately. In Table 1 it is also clear that the ll ll .atadnamoccar ¨Ã etneuqerf enoiznetunam al ,otnatreP .elartsemirt enoiznetunam id ammargorp la esab ni otarepo irotarapes ied etneulffe oilo id oidem otunetnoc la eroirefni ¨Ã elisnem enoiznetunam id ammargorp la esab ni itarepo irotarapes ied etneulffe oilo'lled oidem idotem ied enoizattegorp id ortemarap nu ¨Ã non eseap nu id eratnemaloger etneulffe oilo id etimil ll .otnemaloger led ottepsir led acidoirep enoizatulav al rep acincet esab al ecsinrof ²ÃiC .esseretni id eseap led ovitamron etneulffe oilo id etimil la emrofnoc eresse ebbervod etneulffe oilo id otunetnoc li e enoizattegorp id oilortep led enoizarapes alled azneiciffe'lla erarepo orebbervod irotarapes i ;evitarepo inoizidnoc enutroppo el etad ,ehc acilpmi ²ÃiC .eseap nu id ovitamron etneulffe oilo id etimil la etnednopsirroc oilortep led enoizarapes id azneiciffe'lla esab ni itattegorp onos enoizattegorp id idotem ivoun i noc itattegorp irotarapes I :eseap nu id eratnemaloger etneulffe oilo id etimil li noc ĀtimrofnoC)iI .oilo'lled auqca'lled ilanoiznevnoc irotarapes i rep ilanoizidart enoizattegorp id idotem ied enoizattegorp id ortemarap nu ¨Ã non oilo'lled enoizarapes alled azneiciffe'L .enoizattegorp id oilo'lled enoizarapes id azneiciffe onnah non)elanoizidart enoizattegorp id odotem(ilautta enoizattegorp id idotem i noc itattegorp auqca-oilo'lled ilanoiznevnoc irotarapes I .inoizatserp elled acidoirep enoizatulav al rep otnemirefir emoc evres ehc enoizattegorp id oilo'lled enoizarapes id azneiciffe onnah enoizattegorp id idotem ivoun i noc itattegorp irotarapes I :enoizattegorp id oilo enoizarapes id azneiciffE)i:onodulcni enoizattegorp id idotem ivoun i noc itattegorp ilanoiznevnoc oilo auqca'd irotarapes ied iggatnav I .odnom li ottut ni elatneibma enoizatnemaloger id eiznega e ilanoisseforp imsinagro ,edneiza ,eulfer euqca elled otnemattart led airtsudni ,arefilortep airtsudni ,onrevog ,evitacude inoizutitsi ertla , Ātisrevinu ,icincetilop ,irengegni rep osoizerp eneb nu ĀraS .ocincet e ovitamrofni otlom Ā .elitu enoizattegorp id otnemurts onu ¨Ã 2 allebat aL .ecolev e ecilpmes ¹Āip erotarapes led ongesid li onodner 2 allebat allen itatneserp ilanoiznevnoc oilo auqca'd irotarapes i rep otnemanoisnemid id itad i Traditional design for conventional oil-water separators. Iii) decision relating to further treatment: with design efficiency, the use of separators designed with the new design methods allow a faster and informed decision on a further treatment due to the culture of the periodic evaluation of performance and compliance compliance from new design methods. For example; The consistent performance of the separator below the efficiency of separation of the design oil (or constant non-conformity with the oil limit of the regulatory effluent of a country) would be suggestive of the need for additional treatments that should be confirmed through the complete resolution of the problems. API (1990) stated that the performance of conventional oil water separators varies with changes in the characteristics of oil and waste water and that conventional oil water separators can remove free oil only from waste water but emulsified oil and dissolved oil require further treatment. During this research they met during this research. Table 4 highlights the novelty inherent to new design methods. What was it and what's new? S/N What was that? What's new? 1 Standard design methods 1 currents (traditional design methods) for conventional oil water separators do not consider oil separation efficiency, so existing separators do not have any oil separation efficiency design. The new design methods (new approach to design, innovative design approach and alternative design approach) for conventional oil water separators take into account oil separation efficiency in the design of conventional oil water separators. The design oil separation efficiency serves as a reference for the evaluation of periodic performance.2 traditional design methods for conventional oil water separators do not consider the oil limit of a country's regulatory effluent in the design of conventional oilseed separators. I otnemanoisnemid otnemanoisnemid ivoun i ilanoiznevnoc arefilortep auqca id irotarapes rep enoizattegorp id idoteM .eseap nu id ovitamron etneulffe'lled oilortep id etimil li ortnoc erotarapes led Ātimrofnoc alled enoizatulav al rep ehcincet isab el odnelibats ,erefilortep euqca ni ilanoiznevnoc irotarapes id enoizattegorp allen eseap nu id ovitamron etneulffe'lled oilortep id etimil led otnoc onognet erefilortep euqca elled irotarapes I enoizattegorp id idotem Presented in Table 2, make the design of the separator simpler and faster. Table 2 is a precious design tool. corresponding to any flow of waste water can be calculated directly, thus making the design of the simple and faster separator of the size and other bees parameters of the conventional oil separator designed with the new design methods (new design approach L 'Tacoma's city design approach is similar to what is highlighted by Table 3, thus validating the new design methods for the design of conventional separators of oil waters. Certified design for conventional separators of oil waters. Application of any of the new design methods for future conventional separation projects in oil waters, with frequent maintenance, periodic evaluation of the separator performance together with the assessment of the comparison the oil limit of the regulatory effluent and ulterior and treatment (as required) will promote environmental protection in the Niger delta, Nigeria and other developing countries where the conventional oil separator is used autonomous as a wastewater treatment structure. The new design methods have global applicability. They can be applied in each country, entrusting the petroleum limit of the country's habitative in the relevant equations. William E. today: conceived, designed and performed the experiments; Analyzed and interpreted the data; Reagents, materials, analysis tools and data provided; Conceived the new design methods; He wrote the document. Jonah C. Agunwamba: tools of reagents, materials and analyzes have contributed. This research has not received any specifies by financing agencies in in public, commercial or non-profit sectors. The authors do not declare conflicts of interest. No further information is available for this document. The following are the additional data relating to this article: Design methods_design-calculations file:Agunwamba J.C. Immaculate Publications Ltd; Enugu: 2000. [Google Scholar]Arthur D.J., Langhus B.G., Patel C. ALL Consulting LLC; Tulsa: 2005. Technical summary of water treatment technologies produced by oil and gas. [Google Scholar]American Petroleum Institute . American Petroleum Institute; Washington D.C. 1990. Monographs on the environmental control of refinery: water waste management. [Google Scholar]Ashraf M.A., Shafiq U., Mukhtar A., Saeed M.M. Design of industrial gravity separators for hydrocarbons and heavy separations of oil-water. Res. J. Chem. Sci. 2015;5(9):72–75. [Google Scholar]Chapara S.C., R.P. McGraw-Hill Education (India) Private Ltd; New Delhi: 2012. Numerical methods for engineers. [Google Scholar]City of Tacoma . 2016. Storm Water Management Manual. 20SWMM%20Manual/SWMM%20July%202016%20Masterbook.pdf/ [Google Scholar]Domkundwar V.M. Dhanpat Rai & Co. (P) Ltd; Delhi: 2014. Environmental engineering with global warming introduction. [Google Scholar]Engineering Toolbox . 2017. Fluids Specific Gravities. [Google Scholar]Fair G.D., Geyer J.C., Okun D.A. Topan Printing Company Ltd; Singapore: 1981. Water and waste water engineering. [Google Scholar]Federal Environmental Protection Agency . National guidelines and standards for industrial effluents, gaseous emissions and hazardous waste management in Nigeria. 1991. Treatment and reuse of waste water engineering. Lagos. [Google Scholar]Gupta R.K., Dunkerdale itnecer itnecer ied angessar anu :auqca/oilo'lled enoizarapes id ehcinceT .A imuzoH ,.E.W arretlihgnI and future directions. J.Ā ÂMater. Chem. A. 2017;5:16025¢ÂÂÂ16058. [Google Scholar]LÃ³Âpez-Vazquez C.M., Fall C. Improvement of a gravity oil separator using a designed experiment. Water Air Soil Pollut. 2004;157:33¢ÂÂÂ52. [Google Scholar]Managi S., Opaluch J.J., Jin D., Grigalunas T.A. Environmental regulations and technological changes in the offshore oil and gas industry. Land Econ. 2015;81(2):303¢ÂÂÂ319. [Google Scholar]Metcalf & Eddy Inc . Tata McGraw-Hill Publishing Company Ltd; New Delhi: 2004. Wastewater Engineering Treatment and Reuse. [Google Scholar]Mohr K.S., Veenstra J.N. Proceedings, International Petroleum Environment Conference: An Overview of US and International Regulations Regarding Hydrocarbons in Water Effluents. 2000. Albuquerque, New Mexico. [Google Scholar]Oregon DOT . 2014. Hydraulics Manual. [Google Scholar]Ultraspin Inc . 2015. Oily-water Separator Tutorial. [Google Scholar]US Environmental Protection Agency . US Environmental Protection Agency; Washington D.C: 2005. SPCC Guidance for Regional Inspectors. [Google Scholar]Wang D.D. Proceedings, 3rd International congress on Sustainability Science Engineering: A Few Design Pitfalls of API Oil-Water Separators for Electrical Utilities. Kingsgate Marriott; Cincinnati, OH: 2013. [Google Scholar]Wikimedia Inc . 2016. Niger Delta. [Google Scholar]Yu L.X., Amidon G., Khan M.A., Hoag S.W., Polli J., Raju G.K., Woodcock J. Understanding pharmaceutical quality by design. AAPS J. 2014;16(4):771¢ÂÂÂ783. [PMC free article] [PubMed] [Google Scholar] Scholar]