出國報告（出國類別：考察）

韓國河川流域污染處理與水質改善成效考察

目次

公務出國報告簡表

出國計畫名稱：韓國河川流域污染處理與水質改善成效考察
出國人姓名/職稱/服務單位： 林宏達/科長/行政院環境保護署水質保護處 許智強/薦任技士/行政院環境保護署水質保護處
出國日期：106 年 6 月 25 日至 106 年 7 月 1 日
出國期間概況紀要： 　　韓國總量管理機制係由面源逐步推動到點源，與我國及歐美國家推動不同，惟該方式應建立暢通之溝通協調機制，故韓國以中央單位（環境部）主導協商機制，減少各地方政府間相互對立，確保流域內各地方政府及事業能夠依總量管制計畫執行污染總量減量，避免環境污染惡化，並建立污染削減量交換機制，保留管理制度操作彈性，降低對經濟發展之影響。 　　韓國推動事業或污水處理廠設置自動連續監測相較我國起步較早，在水質監測項目方面與我國相似，其管制之目的係為督促廠商維持正常操作，並作為政府機構監督及研析管制策略之用，故並無將相關數據公開予民眾查詢，另為確保業者正常操作污水處理設施，要求業者設置水樣自動採樣器，水質自動監測管制中心可以遠端遙控方式，即時採取監測數值異常期間之水樣，以利地方主管機關後續查處。 　　韓國水庫水質監測首重總磷，因總磷為藻類之限制生長因子，故於氮源及磷源充足之情況下，極有可能產生藻華，進而影響飲用水水質，因此對庫區之總磷排入管制相對嚴格與重視，其相關水質監測資料亦提供予 4 大流域總量管制管理中心做為總量管制策略之參考。 　　另為創造都市水岸藍帶營造，韓國政府投入龐大資金逐步改造位處市中心的清溪川，運用污水截流、人工濕地、跌水曝氣及生態霸等方式，改善河川水質，打造優質親水環境，使清溪川成為韓國熱門景點，吸引大批遊客造訪。

活動日期	活動內容	活動地點
06 月 25 日	啟程，出發至韓國首爾。	臺北至首爾
06 月 26 日	拜訪首爾大學教授 Dr. Hyunook Kim，諮詢韓國執行流域污染總量管制執行架構與經驗。	首爾大學（University of Seoul）
06 月 27 日	拜會韓國環境公司（Korea Environment Corporation）瞭解韓國水質自動連續監測管理策略及執行成果。	韓國環境公司（Korea Environment Corporation）
06 月 28 日	拜會韓國國家環境研究院（National Institute of Environmental Research，NIER）瞭解韓國河川流域污染管理及總量管制推動執行方式及成果。	國家環境研究院（National Institute of Environmental Research）
06 月 29 日	拜會漢江環境研究中心（Han River Environment Research Center）實地參訪 Paldang 水庫並瞭解水庫水質管理策略。	漢江環境研究中心（Han River Environment Research Center）
06 月 30 日	實地參訪清溪川整治成果，瞭解河川水體水質改善及水岸藍帶營造策略。	清溪川
07 月 01 日	返程，韓國至臺北。	首爾至臺北

行程成果評估及心得建議：

　　韓國政府兼顧環保與經濟發展，對於河川水質管理及污染削減工作不遺餘力，除以水質標準控管污染源外，亦導入污染總量削減及水體涵容能力概念，兼顧人民用水安全及經濟持續發展，使環境保護不成為經濟發展之絆腳石。在水質自動監測方面，我國均將監測數據即時公開於網站，韓國則僅提供政府單位使用，未供非官方單位查詢，其主要理由為監測數據需要專業知識進行判讀，且其

管制之目的係為業者自主管理、政府機構監督及策略研析之用，故無公開之必要，惟該作法必須建立權威性之監督管理機構，以減少民眾對政府監督管理機制之不信任感。另為因應業者可能發生水質異常，並利於後續裁處，韓國政府運用水樣自動採樣方式，降低地方主管機關稽查人力負荷，督促業者正常操作廢水處理設施，惟業者是否能負擔龐大之自動採樣器維運成本，應納入施政考量。

摘要

　　本次出國人員為本署水質保護處林宏達科長、許智強薦任技士，於 106 年 6 月 25 日出發，參訪行程共計 7 日（含交通），參訪地點為韓國首爾，主要拜訪首爾大學（University of Seoul）、韓國環境公司（Korea Environment Corporation）、國家環境研究院（National Institute of Environmental Research）及漢江環境研究中心（Han River Environment Research Center）等單位，就水體總量管制制度、水質監測管理及廢（污）水處理技術進行意見交流與討論，並參訪實際執行案例（Paldang 水庫、清溪川等），了解實際整治成果。考察韓國漢江流域在總量管制的架構下，對於流域內水質監測管理、水污染的處理方式、以及水質改善效益的具體呈現，作為本署水質保護處後續精進水污染管理策略參考。

　　本次拜訪首爾大學 Dr. Hyunook Kim 教授、國家環境研究院及漢江環境研究中心了解韓國執行流域污染總量管制執行架構與經驗，並實地參訪 Paldang 水庫、清溪川等成果案例，與相關執行單位人員討論及交換意見，韓國之總量管制策略係由環保部下轄國家科學研究院主導，成立 4 大流域總量管制管理中心，藉其研究計畫及相關資料文獻蒐集研析，擬定整體總量管制策略推動方向，並由流域管理辦公室負責與地方政府協商及合作工作，建立溝通協調機制減少各地方政府與事業間相互對立，確保流域內各地方政府及事業依總量管制計畫執行污染總量減量，避免環境污染持續惡化，另外為使總量管理制度操作更為彈性，允許各地方政府能夠交換污染削減量，以利省級地方政府能夠調配所轄縣級地方政府排放量，降低對經濟發展之衝擊，追求環境與經濟共榮發展。韓國執行總量管制策略已十分成熟，相關推動經驗、政策法令及執行細節，值得作為本署爾後推動執行工作之參考。

　　為了解韓國水質自動連續監測管理策略及執行方式，拜訪韓國環境公司，韓國推動水質自動連續監測起步較早，目前監測對象已超過 900 家（包含事業及污水處理廠），並依流域劃分成立 4 大水質自動監測管制中心（TMS monitoring center，KECO）即時控管各監測對象之水質排放狀況，當水質異常狀況發生時，

可遠端遙控水樣自動採樣器保留樣品，作為後續處罰之依據；另其即時監測數據資料並均未公開予一般大眾查詢，僅供事業及污水處理廠自我控管、政府單位監督管制及研析相關管制策略之用，此方面與我國全部公開作法不同，未來台韓雙方可就相關法令訂定與政策推動成果相互交流分享。

壹、緣起

　　我國於 2013 年以大漢溪為例逐步推動水體污染總量管制，翌年起逐步擴展至全臺各縣市，請各地方政府提報轄內總量管制河川及管制草案，以逐步落實管理。2015 年擴大將引灌水體水質納入總量管制推動，優先推動農地特定區之灌溉水水質點源重金屬排放總量管制政策，確保灌溉水水質無虞。相關水體經各地方主管機關評估後，可視水體現況決定推動總量加嚴作業或污染量削減作業，管制區域內可依水污染防治法就排放總量或濃度管制項目或方式，加嚴放流水標準，並可依水體涵容能力，控管廢（污）水排放總量，希冀透過總量管制補足排放標準的不足，以避免污染源密集處污染物過度排放導致環境惡化，達成有效改善水體水質及保護環境，促進環境與經濟發展共榮。

　　隨經濟成長發展，事業及污水下水道系統數量持續增加，水污染管制之重要性亦隨之提升，為提供連線預警通報、即時應變管制功能，以提升事業自主管理及主管機關即時掌握水質能力，我國自 2010 年起，逐步規範應設置水量水質自動監測（視）及連線傳輸設施，開啟自動監測（視）連線傳輸管制之序幕

　　韓國政府自 2004 年起分三階段逐步推動總量管制策略，並為強化點源污染管控自 2006 年起規範事業及污水處理廠設置水質自動連續監測設施，相關法令及制度已施行多年，累計豐碩執行成果，值得借鏡。

貳、目的

　　考察韓國漢江流域在總量管制的架構下，對於流域內水質監測管理、水污染的控管方式、以及水質改善效益的具體呈現，並了解自動連續監測管理策略推動及執行方式，作為本署精進水污染管理策略參考。

參、考察行程

　　本次考察自 106 年 6 月 25 日至 106 年 7 月 1 日，共計 7 天，出國行程與內容概要如下表所述：

時間	主要內容
106.06.25(日)	啟程，出發至韓國首爾
106.06.26(一)	拜訪首爾大學教授 Dr. Hyunook Kim，諮詢韓國執行流域污染總量管制執行架構與經驗
106.06.27(二)	拜會韓國環境公司（Korea Environment Corporation）瞭解韓國水質自動連續監測管理策略及執行成果。
106.06.28(三)	拜會韓國國家環境研究院（National Institute of Environmental Research）瞭解韓國河川流域污染管理及總量管制推動執行方式及成果。
106.06.29(四)	拜會漢江環境研究中心（Han River Environment Research Center）實地參訪 Paldang 水庫並瞭解水庫水質管理策略。
106.06.30(五)	實地參訪清溪川整治成果，瞭解河川水體水質改善及水岸藍帶營造策略。
106.07.01(六)	返程，韓國至臺北。

肆、考察工作內容

本次考察行程主要分為韓國流域污染管理及總量管制推動執行、韓國水質自動連續監測管理策略及執行成果兩部分，說明如下：

一、韓國流域污染管理及總量管制推動執行

（一） 韓國流域管理可依水系區分為漢江、洛東江、錦江及榮山江等 4 大流域，水資源來源以地表水、湖泊及水庫等地面水體為主（90％），凸顯流域內水污染源管控及污染排放總量管制之重要性。

（二） 韓國總量管制策略係由環保部下轄國家科學研究院主導，成立 4 大流域總量管制管理中心，藉其研究計畫及相關資料文獻蒐集研析，擬定整體策略推動方向，並建立流域管理辦公室主導與地方政府協商及合作工作，總量管制策略分為 3 階段執行，第 1 階段針對生化需氧量（BOD）（2004年至 2010 年），第 2 階段針對總磷（TP）（2011 年至 2015 年），第 3階段則逐步加嚴目標水質（2016 年至 2020 年），其主要推動方向如下：

1、 污染物排放總量管制。

2、 沿岸地區管理及保育工作。

3、 徵收用水費作為水體水質保育基金。

4、 建立河川流域管理辦公室。

（三） 總量管制推動之資金係由流域內經濟發展蓬勃的地方政府提供資源，即徵收用水費，建立水體水質保育基金，除作為流域管理研究經費外，亦用於補助資源缺乏之地方政府推動河川污染整治及相關污染源管理工作，確保河川水體水質以獲得穩定安全之乾淨用水。以漢江為例，韓國首都首爾市（位於漢江下游）為獲得乾淨穩定之水源維持高度經濟發展與居民生活品質，由其提供資金作為上游水源地（Paldang 水庫）進行流域管理及污染源管理工作。

（四）　總量管制水質目標之擬定，係以長期水質監測資料〔生化需氧量及總磷為主〕模擬推估水體涵容能力，並由韓國環保部主導訂定省級地方政府目標，再由省級地方政府訂定縣級地方政府目標，縣級目標則需提報至環保部核定。如水體水質符合所定目標水質時，可在所定目標水質下進行開發；若水質已嚴重污染超出所定目標水質時，則應禁止開發，惟如推動水質改善策略後，其效益可抵消新增開發所產生之污染時，則可於限值範圍內進行開發。

（五）　國家科學研究院為掌握總量管理制度推展成效，成立各流域總量管制管理中心（TMDL Management Center）及專家學者團，定期監測水體水質狀況（每年至少人工採樣 30 次以上，自動監測為輔），該中心不僅提供長期水質資訊供相關單位參考，亦須就總量管制成效提出評估報告，作為每 3 年檢討修正管制策略之依據（如第 3 年所提評估報告顯示水質已不符目標，則會於第 4 年再次確認，確保評估成果準確性）。如經模式評估後，水體水質符合目標水質，則依原定計畫持續施行；如水質朝向惡化趨勢發展時，除調整原訂計畫外，亦會針對轄內主要污染來源進行輔導改善，提升其污水處理效率減少污染排放量，並逐步加嚴排放水質標準，如該事業持續未改善放流水質，則會依法裁處，最重處以停工或停業。

（六）　承上，於上述總量管理策略下，2004 年至 2010 年間 BOD 改善率達到70%以上，此外生化需氧量及總磷削減量亦均達 25%以上。
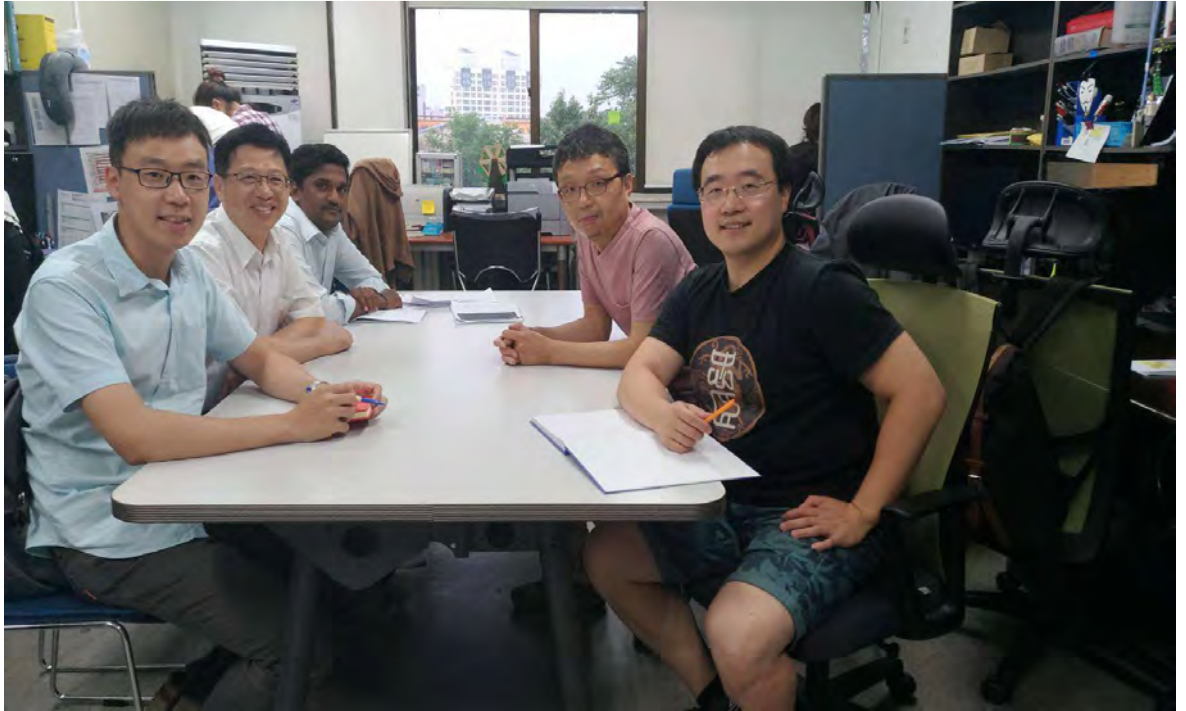
圖 1 拜會首爾大學教授 Dr. Hyunook Kim，諮詢韓國辦理流域污染總量管制方法及水污染相關管制策略

圖 2 參觀首爾大學教授 Dr. Hyunook Kim 實驗室水質試驗模廠

圖 3 參觀首爾大學教授 Dr. Hyunook Kim 實驗室所設計之水質自動監測儀

圖 4 拜會韓國國家環境研究院（National Institute of Environmental Research）由朴辰遠院長親自接待

圖 5 參訪韓國國家環境研究院（National Institute of Environmental Research）諮詢執行污染總量管制執行架構與經驗

二、韓國水質自動連續監測（Tele Monitoring System）管理策略及執行成果

（一）韓國環境部為有效掌握產業廢水排放，自 2006 年起逐步推動水質自動連續監測設施設置，2007 年成立 4 大流域水質自動監測管制中心（TMS monitoring center，KECO），單一管制中心人員編制約 40 人，其管制目的如下：

1、作為事業自主管理及改善污水處理效率之參考。

2、供地方政府即時掌握事業廢水排放，作為早期預警機制，避免環境污染事件發生。

3、提供污染源監測數據，作為推動水體品質管理政策推動之參考。

4、徵收污染防治費。

（二）依現行韓國法令規定，每日排放量達 200 立方公尺之事業、每日排放量達 700 立方公尺之公共污水處理廠及事業廢水處理廠應裝設水質自動連

續監測設施，並與水質自動監測管制中心連線傳輸，其監測項目包含氫離子濃度指數（pH）、化學需氧量（COD）、生化需氧量、懸浮固體物（SS）、總氮（TN）、總磷，數據傳輸頻率為每小時 1 筆，附屬設施包含流量計、電表、水樣自動採樣器、監測值記錄器等，目前管制對象共計 937 家（包含事業 249 家、公共污水處理廠 570 家、事業廢水處理廠 118 家），惟監測數據僅供政府機關使用，並未開放一般民眾查詢。

（三） 韓國自動監測運營體系是由環保部、韓國環境公司（水質自動監測管制中心）、地方政府、事業及污水處理廠等組成，其分工及權責如下：

1、環保部：制定自動連續監測相關法規、規劃推動水污染防治相關工作之參考。

2、韓國環境公司：輔導事業及污水處理廠設置自動連續監測設備、即時控管事業及污水處理廠廢（污）水處理設施運轉及排放狀況、緊急水污染事件通報、判別廢（污）水排放是否符合放流水標準、監督事業及污水處理廠維持自動監測設備正常連線傳輸、提供長期監測資料及成果報告予環保部及地方政府運用等。

3、地方政府：即時控管事業及污水處理廠排放狀況、緊急水污染事件應變、水污染事件稽查及處罰等。

4、事業及污水處理廠：維持自動監測設備正常連線傳輸數據、定期校正維護系統設備等。

（四） 當事業或污水處理廠發生水質監測數據資料連續 3 小時（3 筆監測值）未正常連線傳輸時，水質自動監測管制中心會以簡訊或電子郵件方式通知該廠負責人員，待該廠完成修復後須回報查處結果。如水質監測數據連續 3 小時（3 筆監測值）異常（超標）時，該中心可遠端遙控事業或污水處理廠端之水樣自動採樣器保存該期間之水樣，後續由地方政府派員收集樣本後，以人工檢測分析方式確定該段期間水質是否符合標準，如不符合，則得依相關法令裁處。

（五） 韓國自施行水質自動連續監測以來，污染物排放量下降達 44%（生化需

氧量 61%、化學需氧量 35%、懸浮固體物 69%、總氮 20%、總磷 89%），
即時掌握 937 家事業或污水處理廠，監控水量達 96%。

圖 6 參訪韓國環境公司（Korea Environment Corporation）諮詢韓國水質自動連續監
測管理策略及執行成果

三、水庫水質管理策略

（一） 韓國水庫水質監測首重總磷，因總磷為藻類之限制生長因子，故於氮源及磷源充足之情況下，極有可能產生藻華，進而影響飲用水水質。

（二） Paldang 水庫管理局每週定期針對氫離子濃度指數、化學需氧量、生化需氧量、總有機碳、懸浮固體物、溶氧、總氮、總磷、大腸桿菌群、重金屬等進行監測，其中生化需氧量及總磷數據亦會提供總量管制管理中心做為總量管制策略之參考。

（三） 除上述一般水質監測外，為確保民生用水安全，亦須針對水體藻類數量進行監測，主要監測之藻類包含綠藻、矽藻、藍綠藻等等，若藻類數量大於 1,0000 cell/mL 時水庫管理局將會通知自來水廠應變，如加強淨水效率、改變取水深度等。
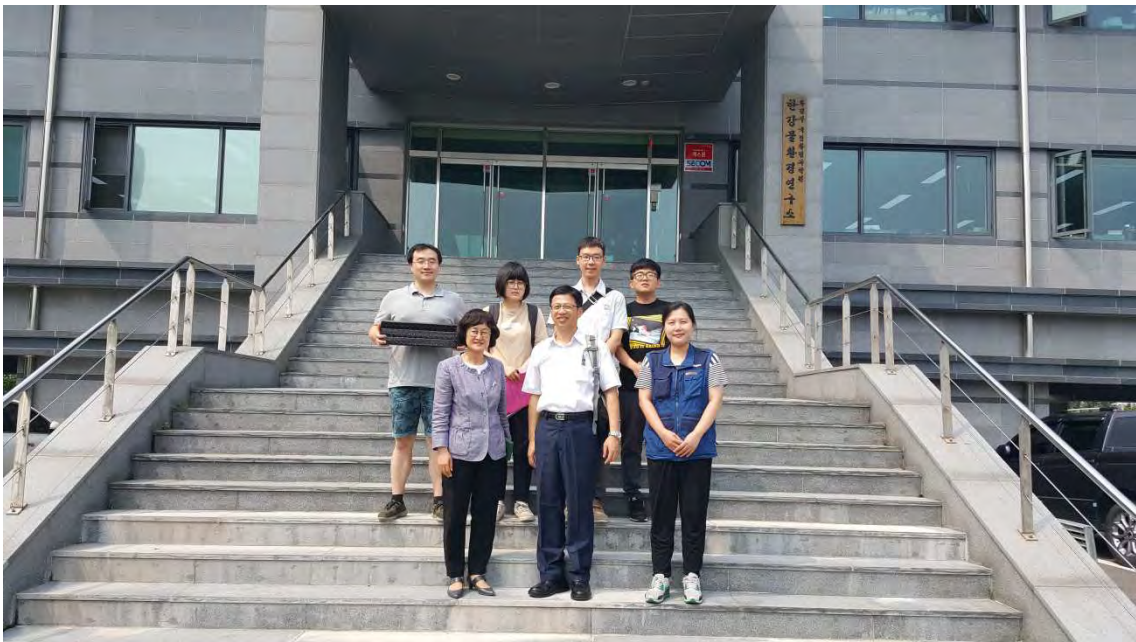

圖 7 參訪漢江環境研究中心（Han River Environment Research Center）瞭解水庫水質管理策略

圖 8 漢江環境研究中心主任說明韓國水庫水質管理策略

圖 9 與漢江環境研究中心主任就水庫水質管理策略及執行方式交換意見

圖 10 參觀漢江環境研究中心進行水體水質採樣工作

圖 11 現場採樣人員介紹超音波水量檢測

四、河川水體水質改善及水岸藍帶營造（清溪川）

（一） 清溪川上游屬加蓋河川，下游屬開放式水域，故為使河川溶氧能夠迅速提升不產生異味，於清溪川景觀河段起點設置觀景瀑布，避免產生厭氧發酵。

（二） 為使河川水體能持續維持高溶氧，於河道內設計許多跌水設施持續補充氧氣，另外為避免泥沙堆積於橋樑下方，故河道寬度於接近橋樑時均會稍微縮減，增加水流速度，帶走泥沙、樹葉等沉積物，減少污泥淤積，該方法亦可見於河道內設置人工濕地之河段。

（三） 為增加水體氨氮去除效果，於河道內設置生態壩，創造好氧及厭氧環境，促進硝化菌及脫硝菌生長，藉以去除氨氮，亦有去除生化需氧量之效用。

圖 12 清溪川加蓋河段終點進入開蓋段，為避免水體溶氧不足產生異味，以噴泉及瀑布方式曝氣

圖 13 為避免河道泥沙淤積於橋底，清溪川河道設計經過橋樑時均會縮減增加水體流速，減少淤泥清理成本

圖 14 運用生態壩創造好氧及厭氧環境，促進生物膜之硝化菌及脫硝菌生長，藉以去除氨氮
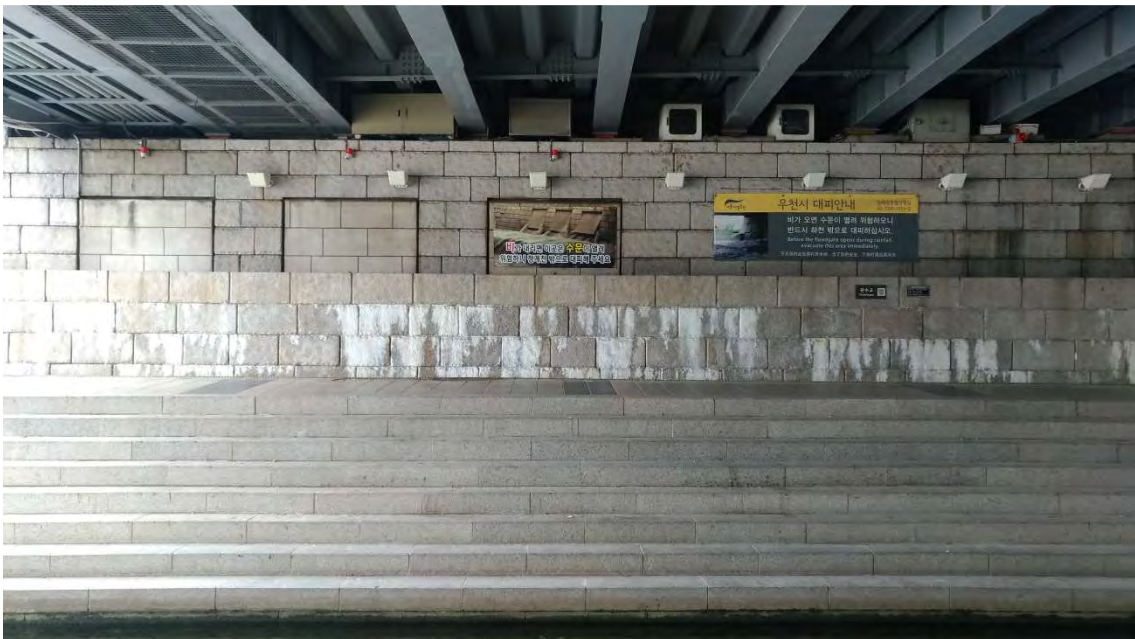
圖 15 河道兩側種植防蚊植物，減少蚊蟲孳生

圖 16 為維持河道排水功能，設置防洪排水設施

伍、結論與心得建議

一、 韓國政府兼顧環保與經濟發展，對於河川水質管理及污染削減工作不遺餘力，除以水質標準控管污染源外，亦導入污染總量削減及水體涵容能力概念，兼顧人民用水安全及經濟持續發展，使環境保護不成為經濟發展之絆腳石。

二、 韓國總量管理機制係由面源逐步推動到點源，此部分與我國及歐美國家不同，惟該推動方式須建立暢通之溝通協調機制，韓國係以環境部主導協商機制，減少各地方政府間相互對立，確保流域內各地方政府及事業能夠依總量管制計畫執行污染總量減量，避免環境污染惡化，另外為使總量管理制度操作更為彈性，允許各地方政府能夠交換污染削減量，以利省級地方政府能夠調配所轄縣級地方政府排放量，降低對經濟發展之影響。

三、 韓國推動事業或污水處理廠設置自動連續監測已達 11 年，相較我國起步較早，在水質監測項目方面與我國相似，不同之處係韓國水域水質監測相當重視總磷，對於氨氮的管制就不如總磷嚴格，其因為磷屬水體優養化之限制因子，且於自然環境之循環不如氮容易轉換，故韓國針對總磷之管制係相當嚴格。

四、 我國水質自動連續監測數據均即時公開於網站，韓國則僅提供政府單位使用，並未提供非官方單位查詢，其主要理由為該類數據需要專業知識進行判斷，其管制之目的係為督促廠商維持正常操作並作為政府機構監督及研析管制策略之用，故無需公開，惟該作法必須建立權威性之監督管理機構，減少民眾對政府監督管理機制之不信任。另外於監測水質超標時，為確保能夠即時採集水樣作為後續裁罰之依據，要求業者設置水樣自動採樣器，後續由政府單位進行人工檢測判定是否處罰，亦可減少自動監測數值作為裁罰依據所產生之爭議，惟業者是否能負擔自動採樣器成本，應納入施政考量。

陸、附件

- 韓國國家環境研究院（National Institute of Environmental Research）2016 年度成果報告

- 韓國國家環境研究院（National Institute of Environmental Research）工作執掌介紹摺頁

- 韓國環境公司（Korea Environment Corporation）工作執掌介紹摺頁

- 韓國水質自動連續監測設施（Tele Monitoring System，TMS）簡介摺頁

Healthier
environment,
healthier
people

National Institute of
Environmental Research
Republic of Korea

CONTENTS

NIER takes the lead to improve the people's quality of life with better 'environmental services.'
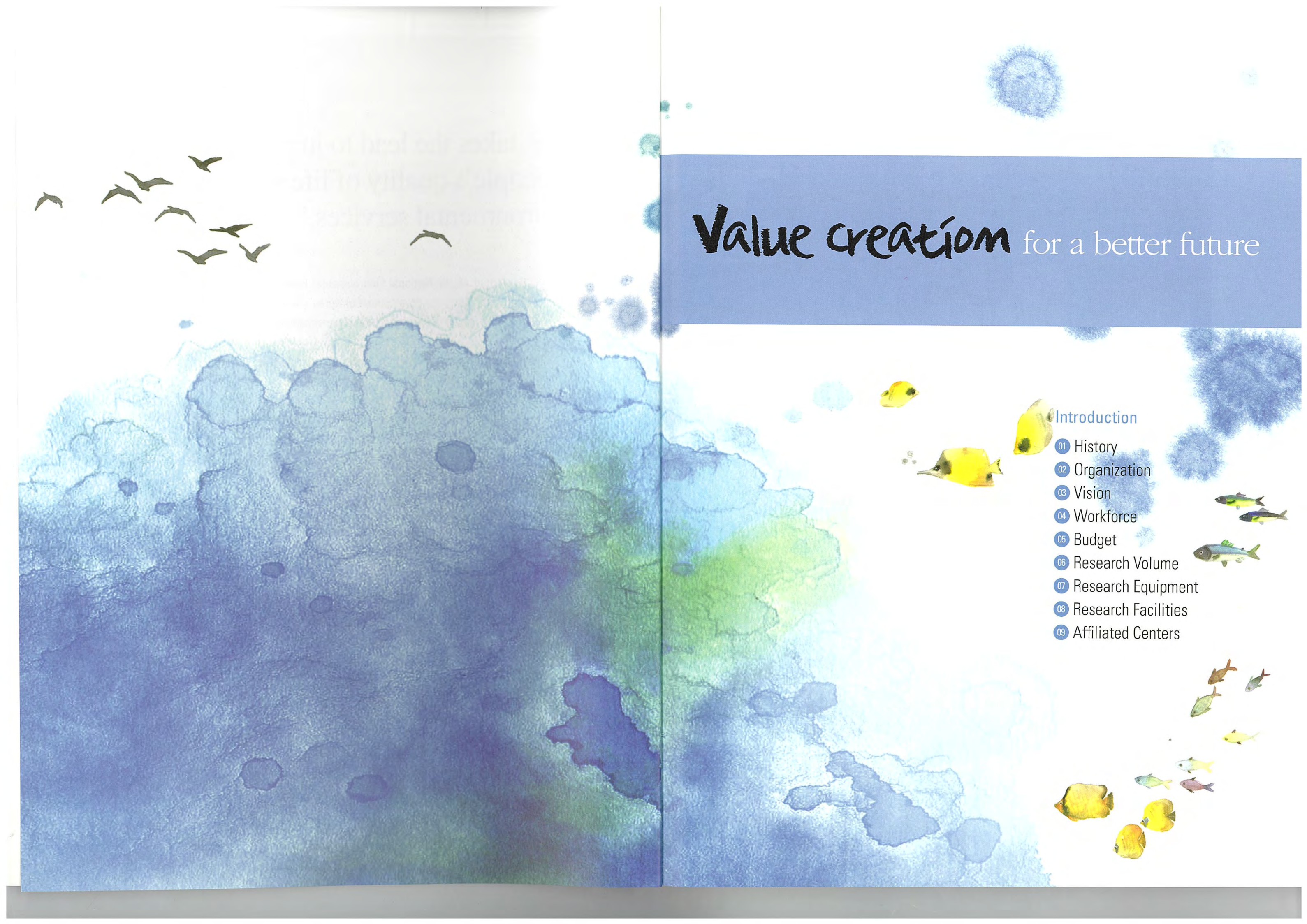
Since its establishment as the National Environmental Protection Institute in 1978, NIER has been committed to supporting the development of Korea's environmental policy and institutions, addressing urgent environmental issues and leading environmental research.

To realize environmental welfare, NIER conducts research in a wide range of fields including environmental health, climate & air, water, resources, energy, indoor environment and soil. Building upon our accumulated scientific knowledge and expertise in the environment, we have contributed to developing Korea's environmental science and technology, improving environmental policy and addressing environmental problems which directly affect people's lives. The effect of recent various environmental issues including particulate matter, algal blooms, noise and light pollution is increasingly becoming a matter of great public concern, threatening people's health. As a result, the public demands for safer and more pleasant environment are greater than ever before. We are in no position to ensure our future without consideration for the environment.

Accordingly, we will further strengthen a range of joint research projects and practical studies in order to address advanced, future-oriented and everyday life environmental issues efficiently. Based on these efforts, we set out the goal of becoming one of the world's best environmental institutions with expertise.

Going forward, we will stay committed to developing and enhancing environmental services and quality to make the people healthier and happier.

President of NIER, **Jin-won Park**

Value creation for a better future

History

Reorganized as a subsidiary body of the National Environment Agency

Relocated to the Environmental Research Complex in Incheon.

July 1978   January 1980   October 1986   July 2000   May 2014

Established as the National Environmental Protection Institute (NEPI) in Seoul

Renamed as the National Institute of Environmental Research (NIER)

Reorganized into 5 Departments, 17 Research Divisions, 5 Research Centers and 3 Centers

Organization

President

- Research Support Division
- Research Strategy and Planning Division
- Transportation Pollution Research Center
- Four Major River Research Centers
- National Wetlands Center

Environmental Health Research Department
- Environmental Health Research Division
- Risk Assessment Division
- Chemicals Research Division

Climate and Air Quality Research Department
- Air Quality Research Division
- Global Environment Research Division
- Air Pollution Engineering Division
- Air Quality Forecasting Center

Water Environment Research Department
- Watershed and Total Load Management Research Division
- Water Environmental Engineering Research Division
- Water Quality Assessment Research Division

Environmental Resources Research Department
- Resource Recirculation Research Division
- Waste to Energy Research Division
- Natural Environment Research Division

Environmental Infrastructure Research Department
- Indoor Environment and Noise Research Division
- Water Supply and Sewerage Research Division
- Environmental Measurement and Analysis Center
- Soil and Groundwater Research Division

Vision

Vision

A leader of high-quality and technology-based environmental welfare policy

(Becoming one of the world's best environmental institutions within 10 years)

Goals

- For the safe and pleasant environment
- For the coexistence of environmental protection and economic development
- For the sustainable future society

Research priorities

- Protecting people's health from hazardous materials
- Creating pleasant daily life environment
- Eliminating dangerous environmental factors in local communities

- Supporting policy for becoming a natural resource-rich country
- Establishing the technological base for integrated environmental management system
- Improving science-based environmental policies

- Developing the virtuous cycle of water resources management
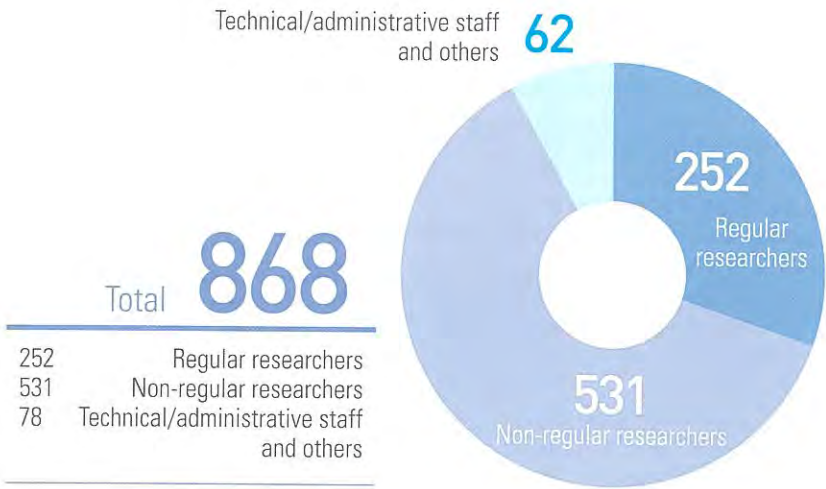- Supporting the sound management of national territory
- Taking pre-emptive actions and reinforcing international cooperation against climate change

Workforce

As of July 2015, 861 people are working for NIER.

Technical/administrative staff and others **62**

Total **868**

252	Regular researchers
531	Non-regular researchers
78	Technical/administrative staff and others

252 Regular researchers

531 Non-regular researchers

Budget

98,516 94,520

75,921 71,930

2015	2016	2015	2016
Budget		Projects	

(Unit: KRW in millions)

	2015	2016
Operating Expenses	1,509	1,512
Personnel Expenses	21,086	21,078
Projects	75,921	71,930

	2015	2016
Research DB Establishment	498	448
Environmental Research	64,135	61,965
Research Infrastructure	11,288	9,517

Research Volume

Projects **282**

NIER's research projects are classified depending on their financial sources: government-funded research projects by NIER and the Ministry of Environment, commissioned projects, and research carried out with watershed management funds. The total number of research projects in 2015, 2014 and 2013 was 282, 282 and 368, respectively.

(Unit: KRW in millions)

Source of finance	NIER		Ministry of Environment		Commissioned Project		Watershed Management Fund		Total	
	Project	Budget	Project	Budget	Project	Budget	Project	Budget	Project	Budget
2015	163	23,136	71	22,491	-	-	-	-	234	45,627
2014	177	22,915	104	25,197	1	109	-	-	282	48,221
2013	193	30,386	142	25,965	3	510	30	8,193	368	65,054

Research Equipment

Unit **1,438**
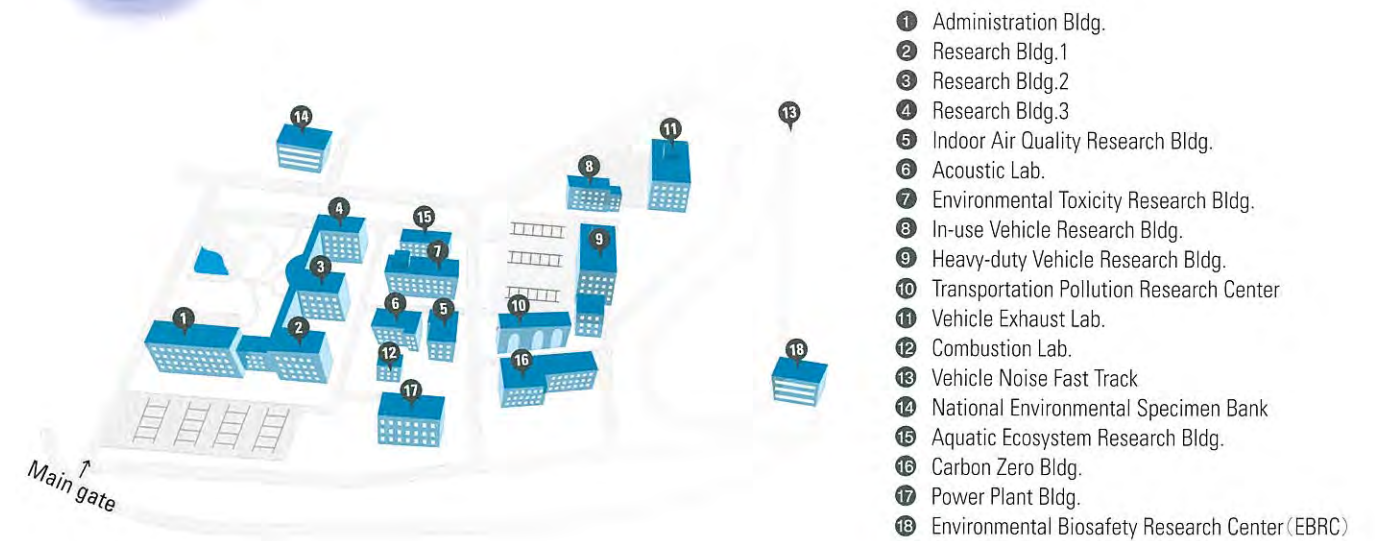
NIER has 1,438 units of major equipment (equivalent to 128 billion KRW).
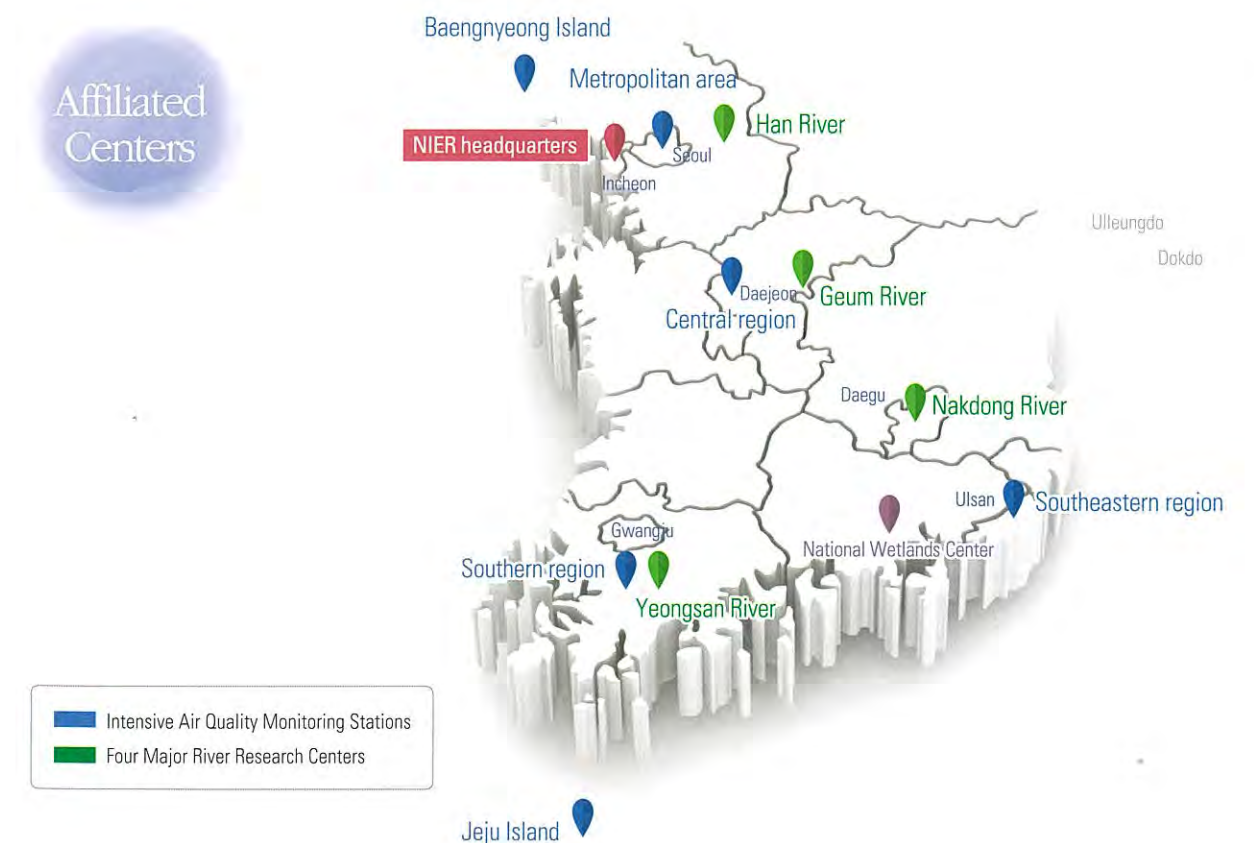
(Unit: KRW in millions)

Division	Equipment	Unit	Amount
Environmental Health Research Department	Inhalation laboratory system, etc.	154	9,988
Climate & Air Quality Research Department	Odor analysis system, etc.	423	24,517
Water Environment Research Department	ICP-MS, etc.	85	4,629
Environmental Resources Research Department	X-Ray diffractometer, etc.	44	4,002
Environmental Infrastructure Research Department	MC-ICP/MS, etc.	273	19,879
Transportation Pollution Research Center	Vehicle emission testing equipment, etc.	169	50,584
National Wetlands Center	Particle size distribution analyzer, etc.	12	623
Four Major River Research Centers	Projection microscopes, etc.	278	14,649
Total		1,438	128,871

※ Equipment whose acquisition value is over 10 million KRW, except for office equipment (As of Jul 13, 2016).
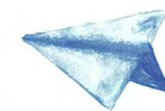
Research Facility

Main gate

1. Administration Bldg.
2. Research Bldg.1
3. Research Bldg.2
4. Research Bldg.3
5. Indoor Air Quality Research Bldg.
6. Acoustic Lab.
7. Environmental Toxicity Research Bldg.
8. In-use Vehicle Research Bldg.
9. Heavy-duty Vehicle Research Bldg.
10. Transportation Pollution Research Center
11. Vehicle Exhaust Lab.
12. Combustion Lab.
13. Vehicle Noise Fast Track
14. National Environmental Specimen Bank
15. Aquatic Ecosystem Research Bldg.
16. Carbon Zero Bldg.
17. Power Plant Bldg.
18. Environmental Biosafety Research Center (EBRC)

Affiliated Centers

Baengnyeong Island
Metropolitan area
NIER headquarters
Seoul
Incheon
Han River
Ulleungdo
Dokdo
Daejeon
Central region
Geum River
Daegu
Nakdong River
Gwangju
Ulsan
Southeastern region
National Wetlands Center
Southern region
Yeongsan River
Jeju Island

Intensive Air Quality Monitoring Stations
Four Major River Research Centers

Innovation to lead future growth

Research Fields

01 Environmental Health Research
02 Climate and Air Quality Research
03 Water Environment Research
04 Environmental Resources Research
05 Environmental Infrastructure Research
06 Transportation Pollution Research
07 Four Major River Research
08 Wetland Environment Research

Environmental Health Research

We have strengthened measures to protect the public health from harmful environmental factors by

- calculating representative values of public exposure to harmful environmental factors and environmental health indices.
- monitoring and evaluating the environment and health for populations vulnerable to environmental pollution.
- conducting constant surveillance of avian influenza and research on wildlife diseases.
- conducting risk assessments on environmental pollutants and chemicals contained in potentially harmful products.
- conducting research on biological test system for ecotoxicity and inhalation toxicity tests.
- conducting safety assessments on materials of global concern including nanomaterials and studying relevant control measures.
- registering, producing and releasing information on chemicals through risk assessments.
- conducting trace-driven research on environmental pollution sources using stable isotopes and multiple search methods.
- conducting research on environmental behavior of materials of global concern: the Stockholm Convention, the Minamata Convention, etc.

Climate & Air Quality Research

We establish the foundation for advanced and efficient air quality management in Korea by

- identifying causes of dense ozone and particulate matter.
- improving air observation network and establishing advanced management system.
- monitoring air pollutants in urban, industrial complexes and forest areas.
- further promoting international joint research on air quality improvement in Northeast Asia.
- developing a geostationary environmental satellite and establishing the application system.
- conducting integrated research on climate and air and strengthening emissions verification at national level.
- preparing countermeasures against air pollution and pollutant emissions.
- providing measures to control discharge of harmful air pollutants and volatile organic compounds from work places.
- providing air quality forecasting service.
- developing air quality forecasting technology and promoting international cooperations.

Water Environment Research

We lead and support water management policies that consider both aquatic quality and ecosystems by

- establishing groundwork and providing technical support for the Total Water Pollution Load Management System and nonpoint source pollution.
- investigating causes of water pollution nationwide and establishing a foundation for integrated pollutant management.
- improving comprehensive management of livestock excretions.
- extending water environmental standards to protect people and aquatic organisms.
- improving industrial wastewater management system and eco-toxicity assessment practices.
- conducting further research on algae to create safer water environment.
- improving aquatic ecosystem health assessment and establishing a foundation for observation network for living organisms.
- conducting remote monitoring of water quality using hyperspectral sensors.
- developing and operating real-time water quality forecasting system to prevent water pollution accidents.
- operating water quality forecasting system for preemptive water quality management.

Environmental Resources Research

We lay the groundwork for Zero-waste Society for healthier ecosystems by

- conducting research on technology-based zero-waste and resource circulation society.
- supporting the policy on safe treatment and advanced regulations of hazardous waste.
- conducting research in response to international agreements on hazardous waste management.
- establishing the foundation for tackling environmental issues regarding resource circulation in the future.
- supporting the policy for advanced energy conversion of combustible waste resources.
- improving efficiency and stability in converting organic waste resources into energy.
- developing measures to handle hazardous waste safely.
- establishing environmental plans based on spatial materials including urban biotope maps.
- supporting creation of eco-cities by developing an urban ecological soundness index, etc.
- predicting impacts of climate change and natural disasters and developing the countermeasures.
- operating National Environmental Specimen Bank to analyze and predict the impacts of environmental pollution on ecosystems.

Environmental Infrastructure Research

We reinforce the groundwork for harmful factor management and create clean everyday environment by

- conducting research on indoor air quality in homes and public space including multi-functional transportation system facilities.
- studying everyday exposure to harmful factors including noise, light pollution and electromagnetic waves.
- evaluating characteristics of risk factors in everyday life such as radon, asbestos and bacteria, and establishing the management platform.
- expanding monitoring items for drinking-water management.
- improving standards of harmful substances in public sewerage system.
- establishing a management system for pathogenic microorganisms in drinking-water.
- building up the quality control system for environmental test and inspection organizations to meet international standards.
- integrating KS and the official test standards of environmental pollution in response to ISO.
- exploring environmental pollutants and establishing a foundation for trace-driven research with strategic environmental research equipment.
- expanding standard items for soil and underground water quality and developing measures to activate the risk assessment system.
- introducing technology to reduce natural radioactive materials in soil and underground water and technique to identify pollution causes.
- strengthening underground water management systems in vulnerable areas such as livestock burial sites and agricultural and stockbreeding areas.

Transportation Pollution Research

We study air pollution mobile sources from various angles and provide science-based support for national environmental policies by

- improving air quality through vehicle emissions management under real-driving conditions.
- meeting global technical regulations of vehicle tests for certification and post-management of production vehicles.
- conducting regular and frequent inspections for production vehicles and in-use vehicles.
- developing national transport emission factors and improving measures to estimate vehicles emissions.
- conducting research on emissions characteristics of and proper countermeasures for trace hazardous air pollutants in the transport sector.
- studying particle emission distributions and gaseous emissions of gasoline vehicles.
- evaluating emissions reduction devices for decrepit diesel vehicles and distributing eco-friendly vehicles.
- improving quality management system for fuels, additives and catalysts; and test methods and regulations.
- improving greenhouse gas management for vehicles and controlling the system performance.

Four Major River Research

We support water policies for conservation of water quality and aquatic ecosystem in four major river watersheds by

- operating observation networks for water quality and sediment at national level to support climate change policies.
- conducting preventive water quality management through algal bloom alarm system and water quality forecasting system.
- measuring mainstream and tributary flows for Total Maximum Daily Load (TMDL).
- conducting comprehensive monitoring and studies on control measures for nonpoint source pollution (e.g. characteristics of rainfall runoff by land use).
- conducting monitoring of hazardous pollutant pathways in tributaries of the river basins.
- operating observation networks for radioactive substances in public waters.
- conducting monitoring of the aquatic ecosystem at weirs on the four major rivers.
- investigating the aquatic environment and ecosystem in the four major rivers.
- promoting Basic Environmental Survey Project to improve water quality and aquatic ecosystem health in the four major rivers.
- promoting investigation and research projects on pressing environmental issues by watershed.
- responding to contamination accidents and environmental problems through immediate monitoring system.

Wetland Environment Research

We conserve and manage inland wetlands by

- conducting general and intensive surveys to identify the distribution status of Korean inland wetlands and ecological conservation values.
- monitoring changes in ecological wetland environment.
- conducting intensive surveys on Wetland Protection areas for the ecosystem changes and biotas.
- undertaking intensive surveys on estuary ecosystems with high biodiversity.

Passiom for the new era

Major Research Outputs in 2015

01 Environmental Health Research Department
02 Climate and Air Quality Research Department
03 Water Environment Research Department
04 Environmental Resources Research Department
05 Environmental Infrastructure Research Department
06 Transportation Pollution Research Center
07 Four Major River Research Centers
08 National Wetlands Center

Environmental Health Research Department

Nationwide monitoring of environmental health

To identify the environmental health status across the nation (at the national and local level), we have conducted a 3 year-survey since 2015 targeting 5,500 Koreans age over 3 and analyzed the exposure to 26 environmental hazards including lead, mercury and bisphenol A. In addition, based on the results of the survey from 2012 to 2014, we calculated the representative exposure values of environmental hazards to the Korean people and announced it as national statistics. In addition, with data released from the Statistics Korea, WHO, the OECD and the EU, we developed 23 environmental health indicators in 5 areas (Air, Indoor Air, Climate Change, Chemicals and Water quality) to compare and assess environmental health levels among nations and regions.

※ A representative value is a geometric mean and reference range percentile of environmental hazard exposure levels in Koreans.

Launching ceremony of the Korean Environmental Health Survey - 3rd stage

Korean Statistical Information Service (KOSIS)

Environmental health monitoring and assessment in areas vulnerable to environmental pollution

We investigated exposure levels and health impacts of environmental pollutants for residents living near 8 major national industrial complexes including Sihwa-Banwol Complex, and conducted environmental health assessment in areas adjacent to 6 small and medium industrial complexes in Pyeongtaek and Hwaseong, Gyeonggi Province. In addition, we performed health impact assessment to identify health damages caused by environmental pollution, in response to a petition from residents living near Donghae Port. Environmental health assessment was also conducted to analyze heavy metal exposure levels in residents of 22 abandoned mining areas across the nation, and its follow-up management to reduce the levels in some residents exceeding the

standard. Furthermore, we conducted a survey on heavy metal exposure factors and health impacts on residents living near Indae mine areas (Jinan, North Jeolla Province) and requested a related authority to conduct mine reclamation projects based on the survey results.

Community meeting on health impact assessment in residents of Donghae Port

Community meeting on a survey on arsenic exposure of residents in Indae mining areas

Korean Children's Environmental Health Study (Ko-CHENS) and international cooperation

As a core center for 'Children's Environmental Health Birth Cohort Study (Ko-CHENS),' we have tracked exposure to and health impacts of environmental hazards on from fetus to adolescents since 2015 (2015-2036, for 22 years). In the study 2015, 6,000 pregnant women were recruited for questionnaire surveys and bio-sampling. We also developed database on environmental hazard exposure levels and environment measurement, performed quality control of questionnaires and analysis and established a system for bio-sample transport and storage. Designated as the WHO Collaborating Centre for Vulnerable Population and Environmental Health, we developed measures to actively cooperate with other WHO collaborating centers at home and abroad and helped developing countries improve capacity to manage environmental health knowledge and data by hosting the WHO Collaborating Centre Network Meeting in Korea (July 21), Korea-Mongolia Mini Symposium for Environmental Health (March 13), the 4th Environmental Health Forum between NIER and CRAES (July 23-24) and the 1st Regional Training Workshop on Health, Environment and Development (November 30-December 5).

Ko-CHENS Workshop

The 1st Regional Training Workshop on Health, Environment and Development

Research on wild animal-borne zoonoses and the countermeasures

We established a surveillance system and countermeasures for the management and prevention of wild animal-borne zoonoses. To this end, we have analyzed AI viruses of wild birds in 30 major wintering sites across the nation since 2012, and identified seasonal and regional outbreak frequency of the highly pathogenic viruses in the environment. We also determined characteristics of intra and inter-country migration routes of the birds using satellite tracking devices. In addition, we monitored infection of 4 major diseases - tuberculosis, brucella, rabies and thrombocytopenia syndrome - in wild mammals such as elks, wild boars, racoons and rats and other new zoonoses outbreaks. In the NIER campus, Animal Bio-safety Level 3 (ABL3) - nation's first wild animal disease research center - was newly completed, laying the groundwork for high risk zoonoses research.

※ A zoonotic disease is a disease that can be spread between animals and humans.
※ Animal Biosafety Level 3 (ABL 3) facility is a safe and sealed laboratory that protects humans and the environment where high-risk pathogens such as avian influenza viruses are dealt with.

Monitoring of wild animal-borne zoonoses

Hazard and risk assessment of harmful substances contained in household chemical products

Household chemical products are made up of various chemicals and can have adverse effects on human health through respiration and physical contact. With the aim to efficiently manage those products such as adhesives and sanitizers, we revised the Regulations on Products of Concern and a Methodology of Risk Assessment by developing exposure factors such as hours and amounts of use through risk assessment. We also developed a screening exposure assessment model to prevent exposure risk of chemicals contained in those products and encouraged industries to adopt it to their products prior to release. In addition, we conducted research on inhalation toxicity screening, mixing preservatives and solvents contained in air fresheners and deodorizers. The study revealed that a mixture of hazardous chemicals triggered more oxidative damage in cells than a single chemical, and interactive reactions between two chemicals increased toxicity effects in animal testing for intratracheal instillation and inhalation exposure.

※ Intratracheal instillation is inserting a tube the airway to artificially expose the lungs.

Risk assessment system (MiRiAm)
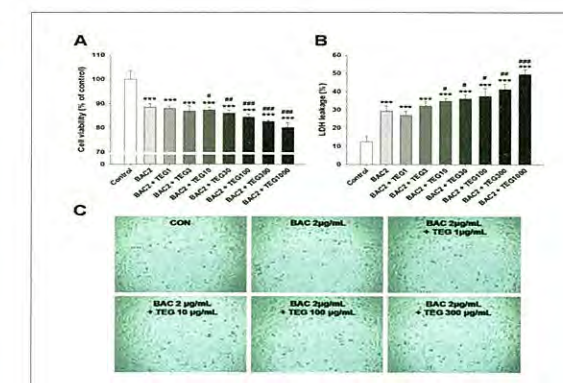
Study on lung cell toxicity of chemical mixtures

Toxicity assessment of harmful substances including nanomaterials

Frequent occurrence of large-scale environmental pollution incidents has increased the need to develop measures for protecting human health and the environment. Accordingly, we developed a list of bio-species and toxicity test methodologies suitable for ecological risk assessment. To develop the species and methodologies appropriate for local environments, we standardized acute toxicity test methodologies for a freshwater organism, neocaridina denticulate, and identified the applicability to various substances. In addition, with the increased use of nanomaterial-containing products and rising concerns over the exposure into the environment, a study on bioaccumulation and toxicity effects of nanomaterials was conducted using fish, marsh snails and wild celeries.

Standardization of acute toxicity tests for
eocaridina denticulata


Nanomaterial toxicity study using micro-ecosystems

Research on pollutant source tracing using stable isotopes

We conducted a study to analyze lead, nitrate, sulphate, carbon, nitrogen and sulfur isotopes in $PM_{2.5}$ in Baengnyeongdo Island and Seoul to evaluate applicability of stable isotopes as tracers of $PM_{2.5}$ sources. The study found that nitrogen isotopes of nitrate had different characteristic values depending on emission sources including coal-fired power plants and transboudary pollutants. $PM_{2.5}$ levels during the winter and summer seasons in Baengnyeong Island showed isotope values attributable to coal-fired power plants and natural phenomena, respectively; in Seoul, the values were derived from transboudasry pollutants. In addition, we identified isotope characteristic values of gaseous NO_2, and established a lead isotope library based on the analysis of lead isotopes in inflow and outflow samples collected from 24 major lead emitters (in 9 industry fields, 450 samples) across the nation.

※ Stable isotopes are isotopes of the same elements whose nuclei contain the same number of protons but different numbers of neutrons.
※ $PM_{2.5}$ (Particle Matter less than 2.5μm) : fine particles less than 2.5 micrometers in diameter.
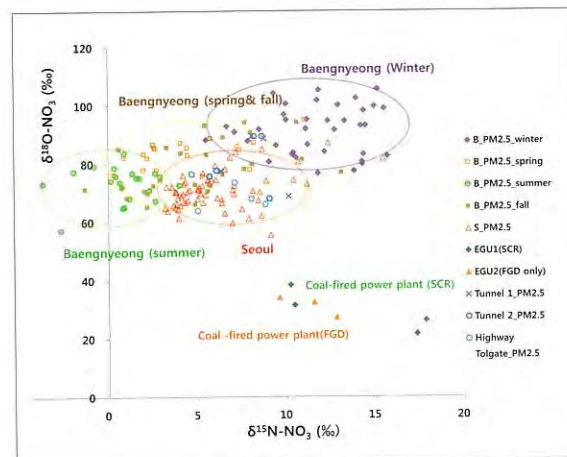
Distribution characteristics of ^{15}N-NO_3 and ^{18}O-NO_3 in $PM_{2.5}$ in Seoul and Baengnyeongdo Island
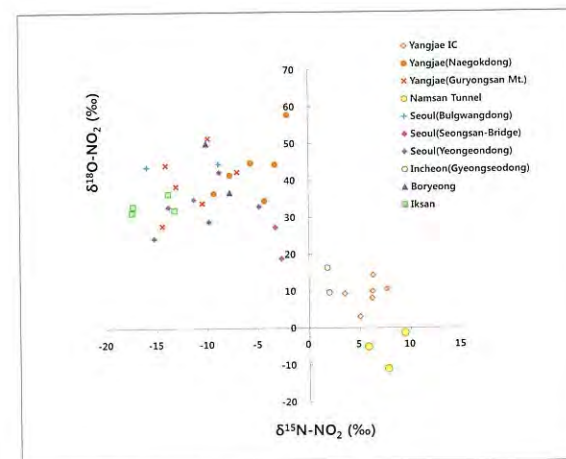

Distribution characteristics of ^{15}N-NO_2 and ^{18}O-NO_2 in $PM_{2.5}$ in Seoul and Baengnyeongdo Island

Establishment of risk management targets for food contaminants

There have been difficulties in managing food contaminants derived from heavy metals, POPs and other environmental factors only with safety management of food itself. Therefore, as a cooperative research project at inter-ministerial level (Ministry of Science, ICT and Future Planning and Ministry of Food and Drug Safety involved), we conducted risk assessment and identified food production-environmental pollution (e.g. soil) and contaminant sources so as to secure food safety and establish integrated management networks. To assess characteristics of contamination routes, we adopted a calculation method of critical load, the maximum exposure amount that does not pose risks to specific ecosystems, using a receptor-centered risk management approach rather than a simple method assessing concentrations. In addition, we studied risk management-setting methods and multimedia integrated monitoring by stage in order to develop measures to reduce exposure to food contaminants from environmental pollution.

※ Critical Load is a quantitative estimate of an pollution level in food production environments that does not exceed environmental standards, i.e., critical concentrations.
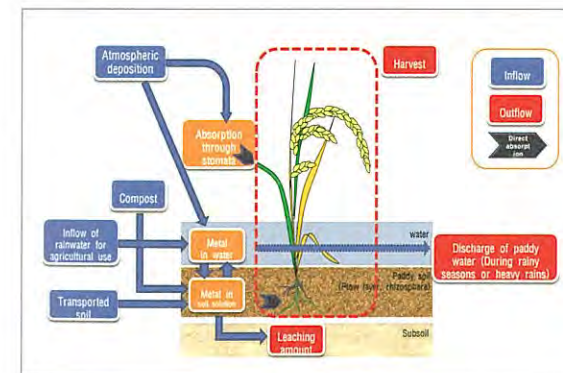
Heavy metal balance in a rice production environment
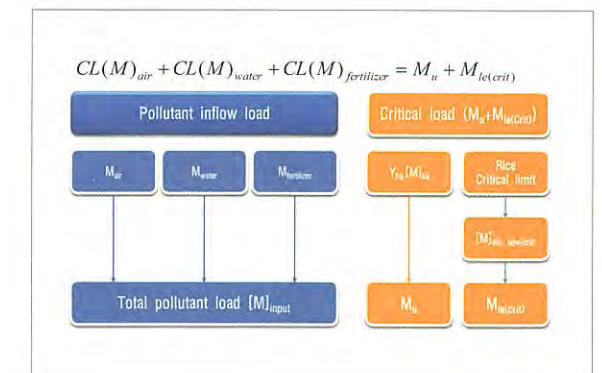

Calculation of critical loads

Climate and Air Quality Research Department

Cooperative air quality field study in Korea between the Republic of Korea and the U.S. (KORUS-AQ)

KORUS-AQ has been developed as a cooperative air quality field study between the Republic of Korea and the U.S. The purpose of the study is to effectively resolve air quality problems in the Korean Peninsula in a short period of time partnering with the National Aeronautic and Space Administration (NASA), a world leading agency for satellite and aerial observation research. Its pre-campaign took place for 4 weeks from May 18, 2015 and the main campaign for 6 weeks from May 2 to June 12, 2016. The findings of the study will help identify causes of PM (Particulate Matter) and O_3 in the metropolitan area, improve accuracy of air quality forecasting and develop technologies for early utilization of environmental satellites. To this end, both organizations are planning a wide range of studies including ground, air and sea-borne observation, air quality modeling and satellite data analysis.

※ KORUS-AQ (KORea-US Air Quality Study) : Cooperative air quality field study between the Republic of Korea and the U.S.
※ Air quality modeling is estimating amounts of air pollutants such as PM and ozone in the air based on observation values and scientific knowledge.
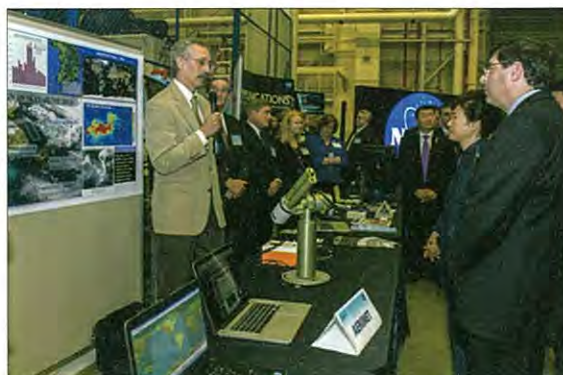
Visit by President Park Guen-hye to NASA for KORUS-AQ

The MOU between NIER-NASA

Public release of real-time data on lead (Pb) and Calcium (Ca) levels in particulate matter (PM)

To address public concerns over the recent rapid increase in high levels of particulate matter and the health damage, real-time data on atmospheric levels of lead (Pb) and Calcium (Ca), major heavy metals in particulate matter (PM), have been released on the website of Air Korea (www.airkorea.or.kr) since March 26, 2015. Its monitoring stations are currently located in two regions : Baengnyeongdo Island where air pollutants flowing into the country are detected first and the central region (Daejeon). The list will be added when more data are released from Jeju and the Honam area (Gwangju) in 2016 and the metropolitan area (Seoul) and Yeongnam area (Ulsan) in 2017. The average concentrations of particulate matter in 2 hours, 24 hours and 1 year are provided so that the public can identify its temporal variations in the long and short term.

※ Lead (Pb) has been reported as one of the most risky heavy metals in blood that causes nerve disorders.
※ Calcium (Ca), with no harmfulness, is the most representative indicator to identify impacts of yellow dust.

Release of real-time data on air quality by Air Korea

Data on heavy metal components in PM

Greenhouse gas monitoring using the Greenhouse gases Observing SATellite (GOSAT)

For the successful development and utilization of the Geostationary Environment Monitoring Spectrometer (GEMS) to be launched in 2019, we conducted a study on the global carbon cycle using the Greenhouse-gases Observing Satellite (GOSAT); we established a variational method-based model to improve quality of input-data on atmospheric chemistry models, and analyzed and verified improved data on CO_2 absorption and emission sources by comparing with other data from the bottom-up approach. Furthermore, more ground and air-borne observation data were used to improve the accuracy, and ultimately, the carbon cycle structures in every corner of the world including East Asia were estimated through carbon flux analysis by factor.

※ GOSAT (Greenhouse-gases Observing Satellite) is the world's first low-orbit satellite for observing greenhouse gases such as carbon dioxide and methane in Japan; it was launched in Jan 2009.
※ Flux is the flow rate of specific physical mass per unit time through unit areas vertical to the given direction.

DIFF = -0.82
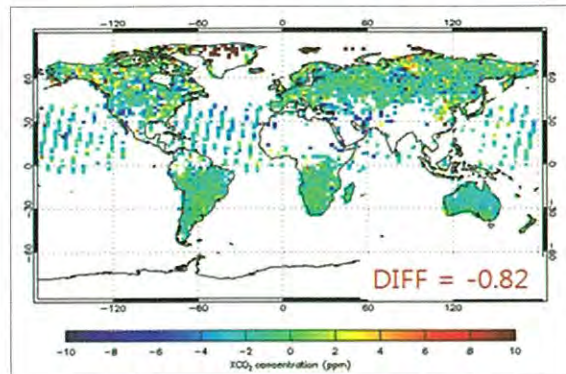
Improved data on CO_2 absorption and emission sources
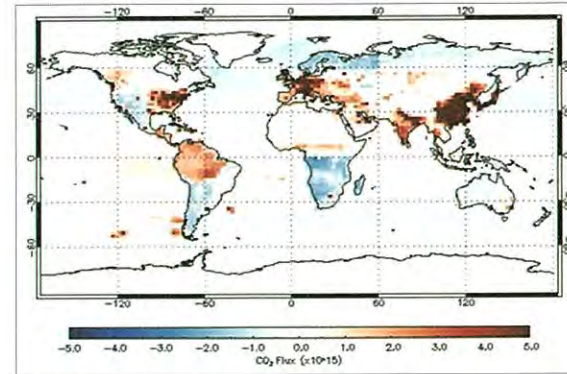
Carbon fluxes in the world

Long-range Transboundary Pollutants (LTP) Project in Northeast Asia

We identified characteristics of long-range transboundrary pollutants in Northeast Asia through background concentration monitoring, trend analysis and comparison analysis of source-receptor relation modeling. In particular, over the campaign periods of KORUS-AQ during the summer (June) and fall (November) seasons, we assessed vertical distribution characteristics using aircrafts and radiosondes and observed particle number concentrations and gaseous air pollutants such as CO and SO_2. In addition, we calculated regional contribution of emission sources at home and abroad according to seasons - spring (April), summer (July), fall (October) and winter (January) - based on the results of source-receptor relationship (SRR) analysis in 8 modeling areas including China.

※ SRR (Source-Receptor Relationship) modeling studies the amounts and contributions of transboudary air pollutants in a quantitative approach.
※ Radiosonde measures meteorological factors including temperature, air pressure and humidity at high altitudes and sends the information via radio waves.


Airborne observation equipment and the measurement results
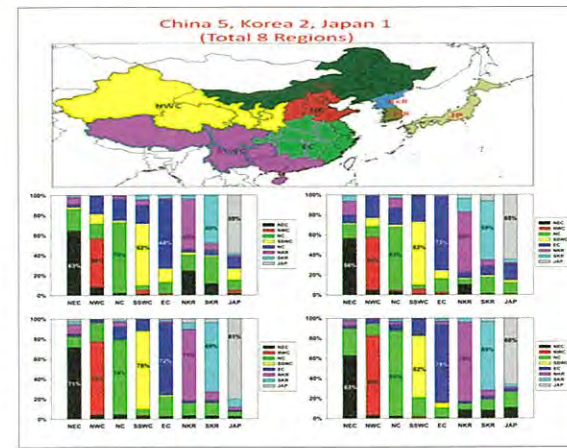
Source-receptor relationships among regions

Development of a PM_{10} & $PM_{2.5}$ cyclone combination device suitable for Korea

To analyze PM_{10} and $PM_{2.5}$ using a stack sampling method, we studied the development of its measurement approaches suitable for local circumstances. The study mainly focused on improving PM_{10} and $PM_{2.5}$ cyclones appropriate for sampling ports with diameter of 100 mm and Computational Fluid Dynamics (CFD)- adopted designing. For this, we developed a size-adjusted cyclone that can be applicable to existing stack sampling ports in Korea and similar functions to an existing cyclone using a 3D printer. The economic effect by using the existing sampling ports without remodeling at sites is estimated at about 62.2 - 311 billion KRW.
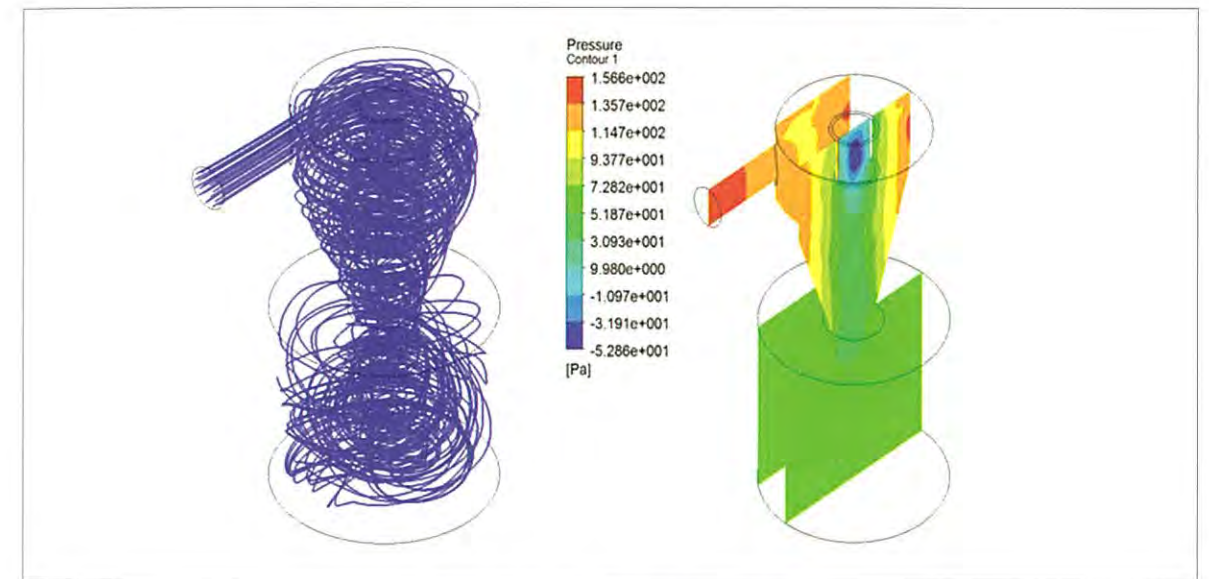
Example of an improved $PM_{2.5}$ cyclone

Air pollution source monitoring at class I - V emission facilities

In order to effectively support air pollution policies by managing industrial air pollutant emitters and providing emission estimation data, we surveyed 39,953 emitters from class I to V and analyzed energy consumption of their emitting and control facilities. Currently, there are a total of 414,761 air pollutant emitting facilities, among which mixed-type facilities are most accounted for 7.8% (32,460). In 132,653 control facilities, bag filter dust collectors were most installed and operated. In addition, specific air pollutant (such as benzene) emitters accounted for 10.4% (4,138 facilities) and class I - III and IV - V facilities mostly belonged to the manufacturing sector and service sector, respectively.
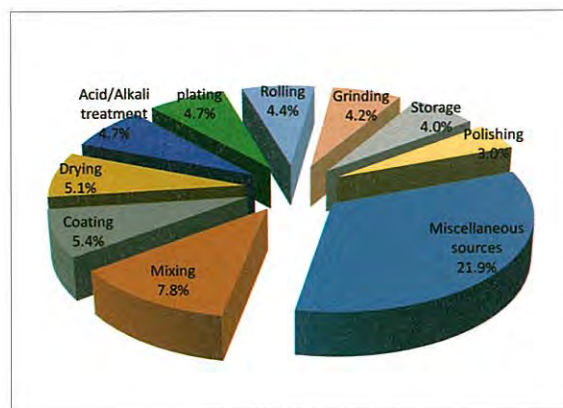
Air pollutant emitting facilities
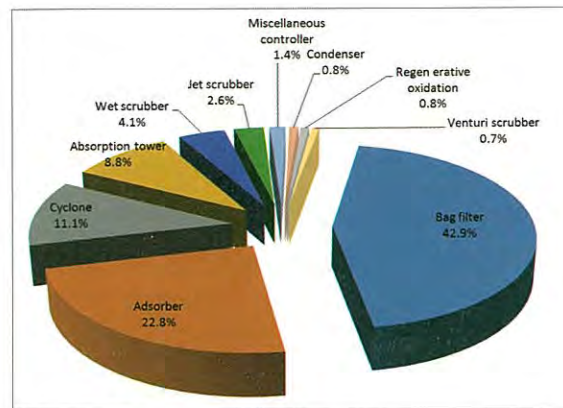
Major air pollutant control facilities

Nationwide air quality forecasting

The national air quality forecasting system is in operation for the public to assess concentrations of major air pollutants such as PM_{10}, $PM_{2.5}$ and O_3 and get forecasts. For the reliable forecasting, we expanded its coverage in 2015: monitored pollutants (PM_{10} in 2014 → $PM_{2.5}$ in Jan 2015 → O_3 in Apr 2015), forecasting zones (10 → 18 zones in Nov 2015), forecasting periods (a day → two days in Nov 2015) and forecasting cycles (two → four times a day). In addition, the Meteorological Administration Call Center (dial 131) is continuously operated for the people's convenience. As a result, the forecasting accuracy was improved by 15% to 88% compared to the pilot forecasting in 2013 (73%).

※ 18 forecasting zones: the metropolitan area (Seoul, Incheon, northern and southern region of Gyeonggi-do), Gangwon area (Yeongseo and Yeongdong), Chungcheong area (Daejeon, Chungbuk and Chungnam), Honam area (Gwangju, Jeonbuk and Jeonnam), Yeongnam area (Busan, Daegu, Ulsan, Gyeongbuk and Gyeongnam) and Jeju areas (Jeju).
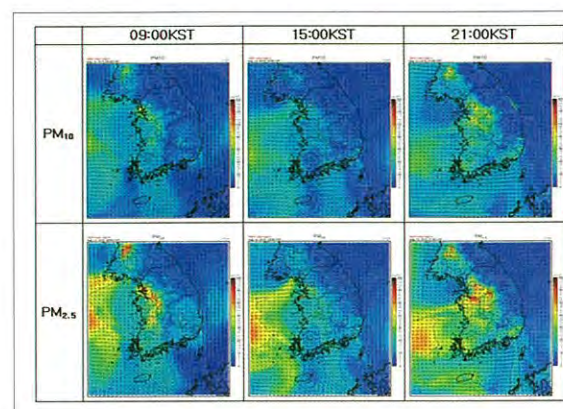

Air quality forecasting model (PM_{10}, $PM_{2.5}$)
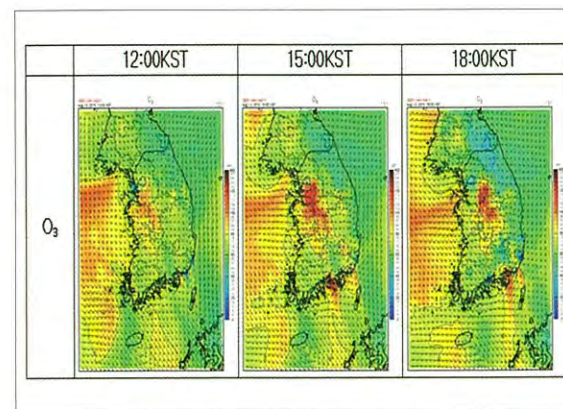
Air quality forecasting model (ozone)

Establishment of the Korea-China Joint Atmospheric Working Group

Under the Korea-China Environmental Cooperation MOU concluded at the Korea-China Summit in July 2014, the two countries launched the Korea-China Joint Atmospheric Working Group to improve air quality models and identify air pollution sources. The working group is composed of 10 members, 5 each from NIER and Chinese Research Academy of Environmental Sciences (CRAES). They first will study on advanced estimation of emissions, improved forecasting and alarm systems, and characteristics of $PM_{2.5}$ generation and changes, gradually expanding the research scope. Furthermore, a FTP (File Transfer Protocol)- based data sharing system was established in Nov 2015 for real-time exchange of air quality data between the two countries.

※ Data on 6 air pollutants including PM from 35 Chinese cities and 3 Korean cities will be shared.

Korea-China Joint Atmospheric Working Group MOU (June 2015)

Launching ceremony of the Korea-China Joint Atmospheric Working Group

Water Environment Research Department

## Selecting vulnerable areas to non-point source pollution and setting and evaluating the management target(Ⅲ)

The Ministry of Environment is pushing forward the legislation under which areas necessary for focused management of non-point pollutants will be designated as non-point pollution management regions in accordance with Article 54 of 'Water Quality and Ecosystem Conservation Act.' In this study, a Load Duration Curve (LDC) and scientific decision-making methods were used to identify priority areas for nation-wide management. Specifically, after drawing up the LDC, we identified basins with excess pollutants in high flow zones and those ranked on the top through experts' decision-making system, and then finally selected overlapping areas among the basins above. For Cheongmi river basin, the top priority for management, we suggested a detailed management scope and optimal countermeasures; this region showed the most effects when the upper streams of the region including Yulgok river were managed in priority.

※ Load Duration Curve (LDC) : a load curve of water quality and data illustrated in descending order of loading rates, providing information to determine selective management of pollutants periodically.
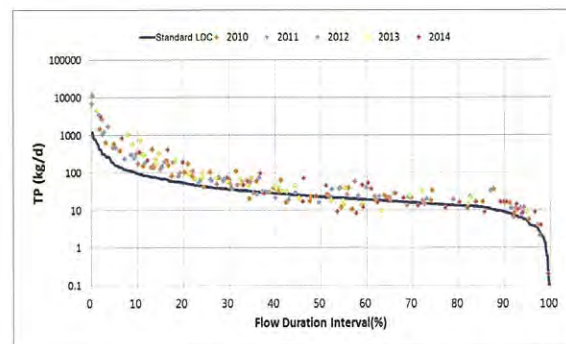
LDC of Chengmi river basin
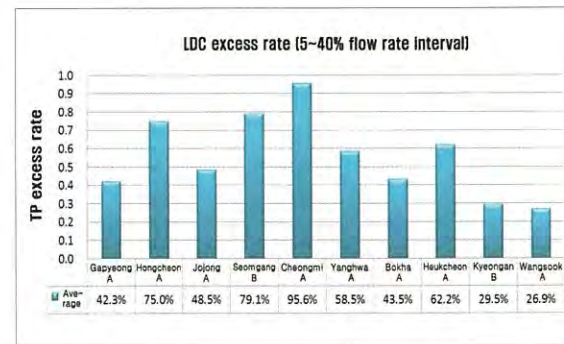
Analysis results of non-point excess rates in candidate areas

Trial research for effective survey on livestock excreta pollution

According to 'Act on the Management and Use of Livestock Excreta' revised in March 2014, surveys on livestock excreta pollution should be conducted for effective establishment and implementation of policies related to the management and use of livestock excreta. Accordingly, in 2015, 'the status of livestock farming and nutrition' and 'the status of environmental pollution' were investigated in the upper stream of Chengmi river, a protected area for the source water in the downstream of Namhan river where livestock farming is concentrated, and appropriate survey methodologies were presented.

※ Survey on livestock excreta pollution investigates environmental pollution caused by fertilizer contents, feed rates and livestock excreta in farmlands.
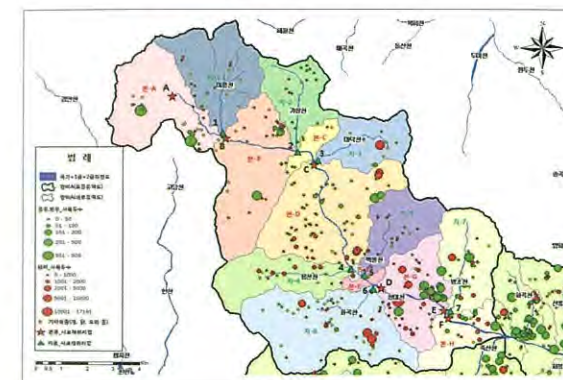
feedlots and sampling sites in the upper stream of Chengmi river
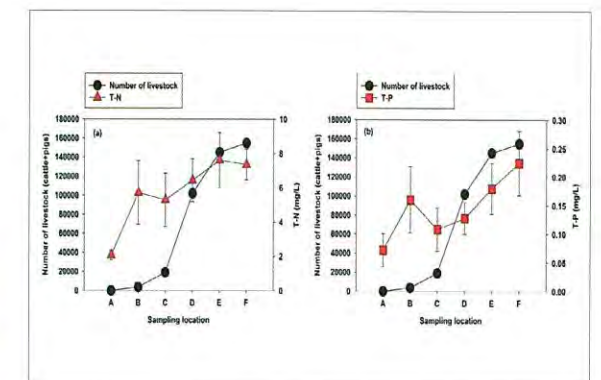
Correlation between the number of livestock and water pollution

Research for protecting humans and aquatic organisms

In order to expand protection standards for human health and aquatic organisms, the pollution levels in 114 river streams in the mid-watersheds were investigated based on reference substances. Also, we conducted risk assessment to set the priority standard and prepared a draft guidance on developing water quality standards. In addition, we revised 'Standard for Evaluating Sediment Pollution in Rivers and Lakes' (No. 687, Established rule of National Institute of Environmental Research) after investigating geological characteristics of domestic sediments and impacts of sedimentary pollutants on benthic organisms. With the aim to assess sediment pollution based on the monitoring data, the revised standard is expected to further strengthen its reliability and objectivity.

Before revision		After revision
• Based on the U.S. and Canadian standards. • 1 grade for 10 items: 'Clearly or severely polluted state.'	→	• Characteristics of domestic benthic ecosystems applied. • 11 items with 4 grades. • Addition of four-stage evaluation criteria where assessment results for each item are integrated.
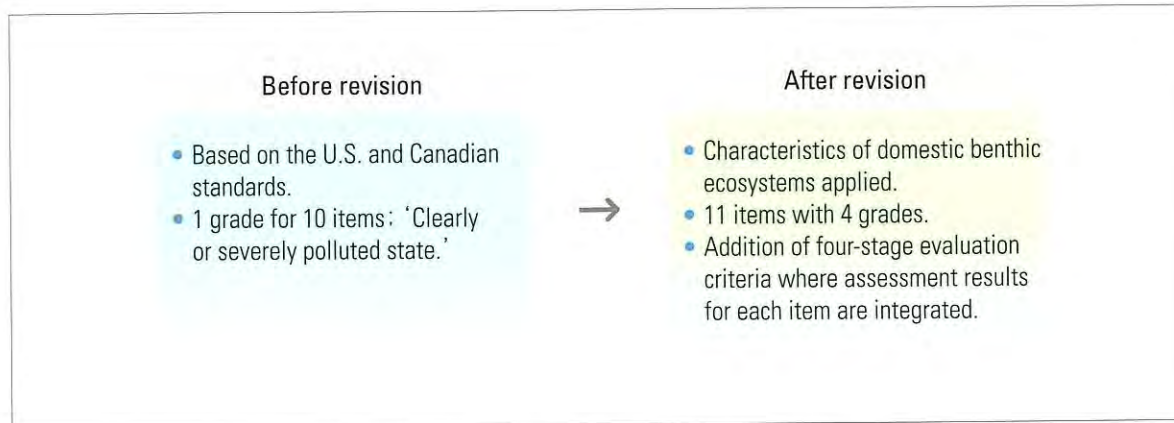
Major amendments to the standard for evaluating sediment pollution

Research on industrial wastewater management and improvement of ecotoxicity tests

The purpose of this study was (1) to provide appropriate disposal and management measures for 3 types of phenol compounds (nonylphenol, pentachlorophenol and octylphenol), soon to be designated as new water pollutants, and (2) to strengthen relevant stakeholders and the public's understanding of water pollutants that are annually increasing by publishing 'Handbook for Treating New Water Pollutants.' Furthermore, we developed improvement measures for expanding the range of assessment using a single test species (water flea) by adding more ecotoxicity test species. Also, 'Guidance on Ecotoxicity Test Methods and the Operations' was released to enable analytical institutes to better analyze acute toxicity with water fleas.
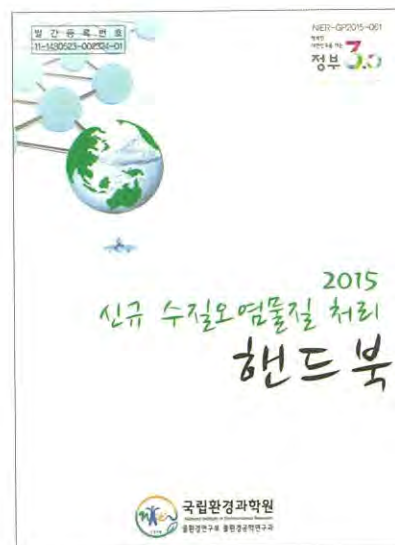
The handbook on treating new water pollutants
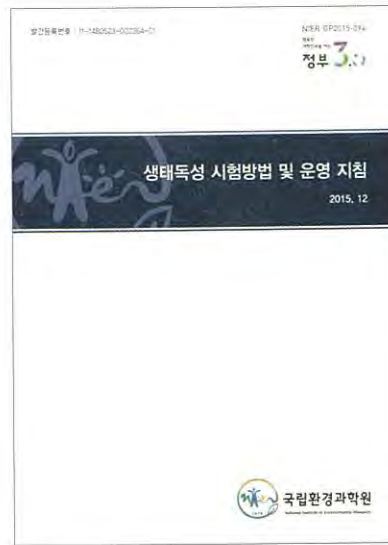
The guidance on ecotoxicity test methods and the operations

Strengthening green algae research for safer aquatic environments

For scientific and preemptive response to algal blooms, we conducted research on the mechanism of green algae occurrence using a continuous culture system at site scale: the characteristics of algae occurrence and fate according to changes in physicochemical aquatic environments including precipitation conditions, detention period and sediments. Also, we prepared measures to improve the algal bloom warning system by expanding water supply source sites (1 lake and 4 rivers), changing the warning criteria (simplification of the number of cyanobacteria cells), and designating new water-friendly recreation areas. The new algal bloom warning system will be operated from 2016.

※ Site-scale pilot testing system is designed and manufactured to monitor the occurrence and transport patterns of algae by environmental changes: it consists of test tanks, storage tanks, distribution tanks, effluent storage tanks, etc.

※ A sediment sampling device is designed and manufactured to identify the characteristics of algal occurrence according to sediment: it consists of opening and closing types of devices at the top and the bottom.

※ Algae alert system has been implemented since 1998, which is to respond to cyanobacterial blooms promptly by monitoring major lake and river waters supplying safe drinking water.

Site-scale pilot testing system

A sediment sampling device

Assessment of aquatic ecosystem health in rivers

For lively aquatic environments, we evaluated the hydro-ecological health by investigating epilithic diatoms, benthic macro-invertebrates, fish, and inhabitation and waterfront environments in 960 river sites, 81 open estuaries, and 10 close estuaries across the country. We visited the U.S., Germany, the U.K. and Italy for case studies, and collected opinions on improvement of hydro-ecological health evaluation by holding 4 expert forums. Furthermore, in order to build the evaluation network for aquatic ecosystem health and raise the public awareness, we provided elementary, middle and high school students in Seoul and health and environment researchers from 16 cities and provinces with field experience education on aquatic ecosystem evaluation and the sampling and analysis methods for each test item. For this year's National Dissertation Presentation Contest, which aims to train professional experts and strengthen the research infrastructure, 14 teams participated from across the country.

Visit to a European agency for a case study on aquatic ecosystems

2015 field experience education on aquatic ecosystem

Research on water quality modeling for better prediction accuracy of occurrence and fate of cyanobacteria

To effectively predict the process of occurrence, distribution and regression of cyanobacteria, which are frequently detected in major rivers and lakes in summer, we continuously and closely monitored 3-D water flow, vertical water temperature, quality and algal changes in Uiam Lake of Bukhan river streams. In particular, we improved the function of the three-dimensional water quality monitoring model by increasing the number of algae available for simulation and applying the unique physiological characteristics of cyanobacteria vertically-moving with gas vesicles. With the upgraded numerical model, we reproduced temporal and spatial concentration variations of certain cyanobacteria in Uiam Lake. Also, this is expected to be useful in predicting changes in algal concentration from external environmental factors including combination by wind and dam effluent in a qualitative manner.

※ Gas vesicles are small pockets filled with air in some cyanobacteria.
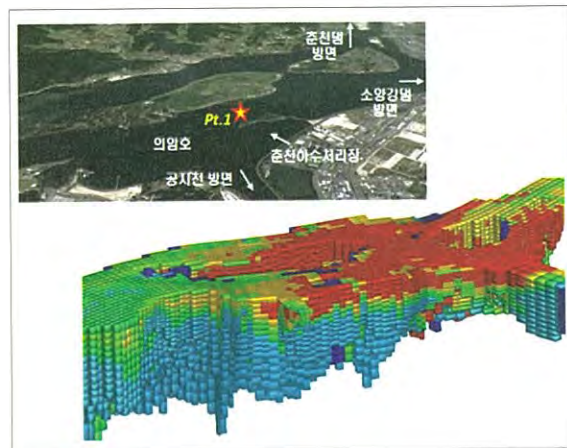
3D algal bloom forecasting model (EFDC-NIER)
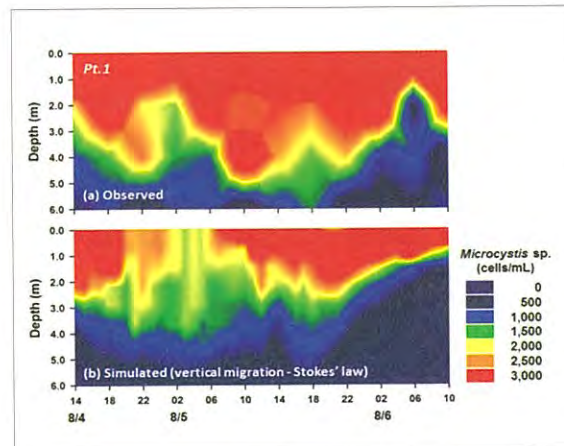
Simulation results of vertical transport of cyanobacteria

Remote algae monitoring using spectrum characteristics

We carried out a study for remote monitoring of algal blooms that simultaneously occur in wide water bodies using unique spectral characteristics of algae. We developed a model for estimating concentrations of chlorophyll-a and phycocyanin (pigment contained in cyanobacteria) by comparing and analyzing the wavelength of radiant energy reflected from river surface, and radiation and transmission of light occurring in water bodies. Also, in order to improve the accuracy of the image-based algae estimation model, spectral characteristics of colored dissolved matters (interference substances) and particular matters were analyzed; the comparison between the estimated values from the developed model and the measured values revealed high correlations. It is expected that follow-up studies will verify additional models under different conditions to be utilized for science-oriented management of harmful cyanobacteria.

※ Phycocyanin is a blue pigment-protein complex contained in cyanobacteria, which absorbs light energy transferring to chlorophyll-a.

Measuring radiant energy from the water surface
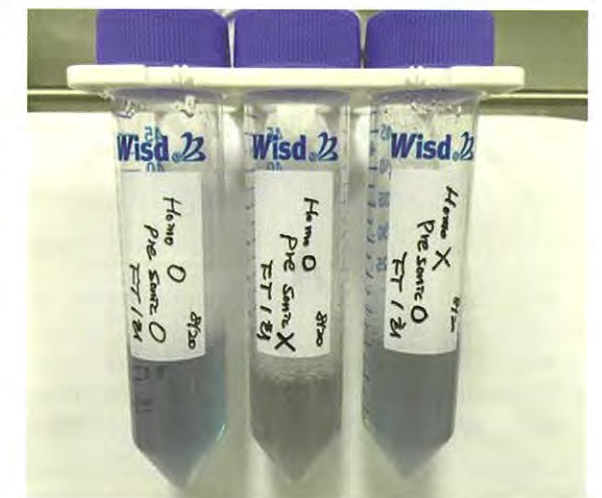
Extracts of phycocyanin
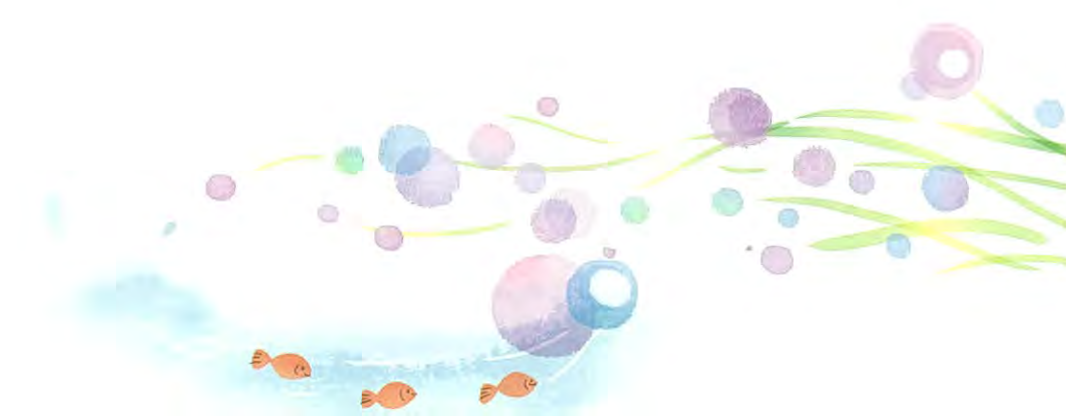
Environmental Resources Research Department

Suggesting a provisional list of Korean wastes and legislating Waste Control Act

We support development of Korean Waste Catalogue (KWC) for proper management of industrial wastes by improving existing waste classification system, designating waste types prohibited and restricted from recycling, drawing up guidelines for waste classification (definition, types and determination process of controlled wastes, etc.), and investigating the current status of waste generation by industrial process. We also developed provisional criteria for hexavalent chromium contents in cement products and Perfluorooctane Sulfonate (PFOS) in wastes including new POPs. Moreover, we studied on domestic generation of wastes containing mercury (ultraviolet lamps) and silica nanomaterials, operated a forum on mercury legislation, and conducted Evaluation on Ripple Effects by Hazardous characteristics Application.

※ Korean Waste Catalogue (KWC) : A list of wastes generated by business sites in Korea classified by process and industry.
※ Persistent Organic Pollutants (POPs) : Toxic organic chemicals that are accumulated in the bodies of animals and plants through food chains without photochemical, biological and chemical degradation in the environment.
※ Perfluorooctane sulfonic acid (PFOS) is a non-degradable fluoro-organic compound widely used for surface coating materials, waterproof clothes and construction materials due to its water and oil repellency.
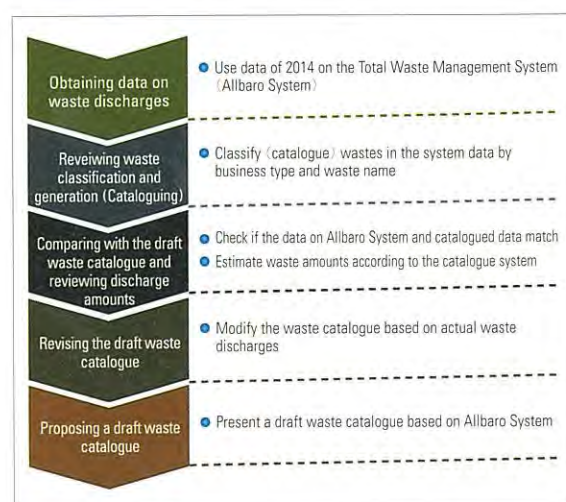
Review on a provisional list of waste classification for on-site use
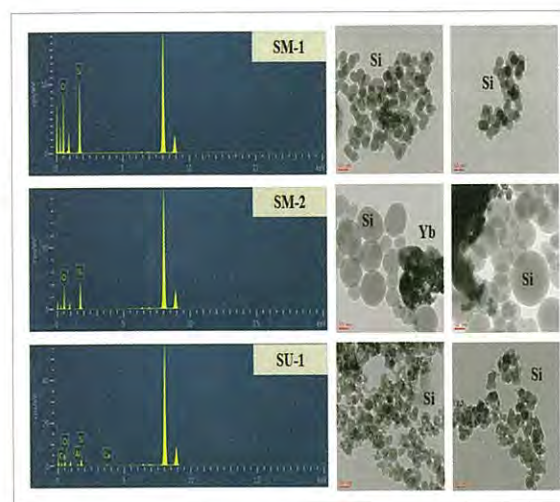
TEM analysis results on silica nanomaterials

Suggesting a provisional notification on recycling methods and usage of wastes

In response to the revision and enactment of Waste Control Act (Jul 2016), we developed 19 regulations about detailed waste classification criteria, recycling principles and standards, environmental assessment for waste recycling, and designation of environmental assessment organizations for wastes. In addition, we drew up environmental assessment flow charts on recycling waste exposed by media such as fill and cover materials, base materials and fillers and provisional standards and regulations on environmental assessment of recycling, and suggested 19 provisional notifications by reviewing waste recycling usage including sludges from water treatment plants and paper-making processes. Moreover, we studied types of and classification criteria for waste organic solvents other than halogenated compounds and investigated measures to manage non-ferrous slags for preserving alternative resources.

※ Recycling waste exposed by media : Recycling wastes from roads, public waters, reclaimed lands, road improvement and restoration areas into fill and cover materials, base materials and fillers (except for environmental protection areas or children protection zones).
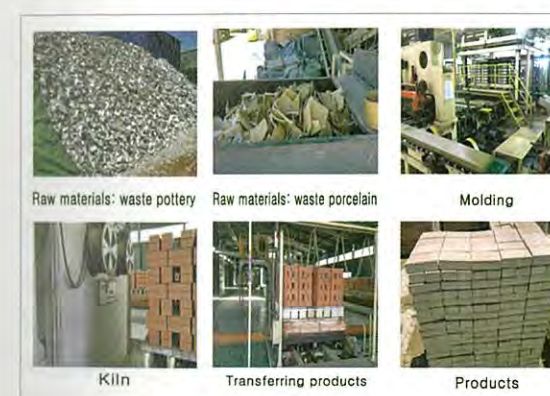
Recycling waste ceramics into paving blocks.

Process of Environmental Assessment of Recycling

Developing technical guidelines for integrated biogas plants

Since the prohibition of disposal of organic wastes into the ocean, a number of new food and livestock waste biogas plants have been established. Due to the poor efficiency of the facilities, however, the need to draw up technical guidelines for efficient and stable designing and operating of biogas plants has been raised. In order to develop guidelines for combined biogas, we conducted on-site investigations for 12 facilities, 4-season detailed monitoring and technology diagnosis. The more food wastewater in livestock excretions, the more methane is generated while the less volatile fatty acids are produced. As such, the lower alkalinity makes digestion tanks stable, preventing methane production rates getting too low until about 40% of animal dungs are inputted.

※ Volatile fatty acids (VFA) : Organic acids generated as organic materials are decomposed. There are 8 types of VFA including acetic acid and propionic acid.
※ Biogasification facility produces gas through methane fermentation of biomass such as animal excrements and food waste.
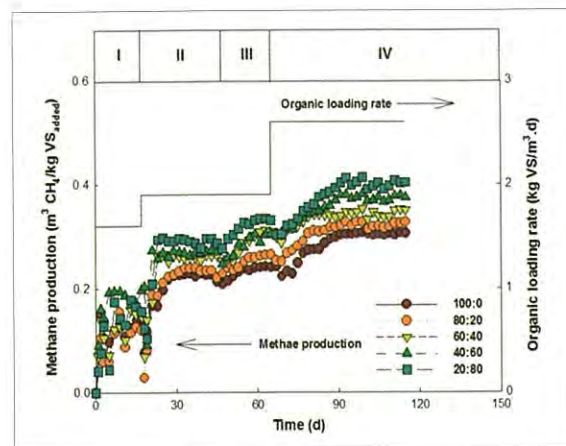
Methane production rates according to the mixture ratio of food wastewater.
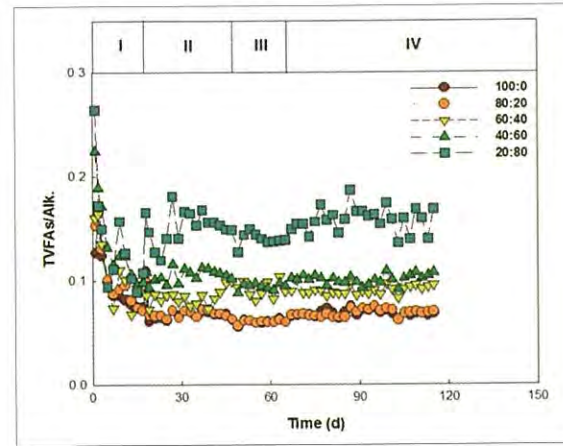
Volatile fatty acids/alkalinity according to the mixture ratio of food wastewater

Energy recovery rates of domestic waste incineration plants

Energy recovery rates of industrial waste incineration plants

Developing a provisional guideline on how to estimate waste-to-energy recovery and use rates

For energy recovery tests of waste treatment facilities with using energy instead of produced energy, the need to assess propriety of the Korean energy recovery standard and develop reasonable test methods has increased. Accordingly, we conducted on-site and questionnaire surveys for 53 domestic waste treatment plants, 57 industrial waste incineration facilities and 10 paper industry incineration plants to develop measures and standards for energy recovery and use. Using the law of conservation of energy and the first law of thermodynamics, we estimated low heating values based on the relationship between heat input and output in a state of equilibrium. The average recovery and use rates of waste resources energy were 38.6% for domestic waste treatment plants, 30.3% for industrial waste incineration facilities (integrated types: 46.9 %, separate types: 24.9 %) and 56.8% for paper industry incineration plants (integrated types 65.9 %, separate types 50.8 %).

A study on supporting eco-friendly and sustainable development and creating eco-cities

In order to fully support the linkage of spatial and environmental planning system for sustainable development, we presented measures to utilize the spatial environmental data required for environmental conservation plans for local governments, and published materials about the current status of the integral spatial and environmental management in Germany and analysis on environmental and ecological planning cases. Moreover, we developed a guideline on how to draw up urban biotope maps, and based on which Siheung City's biotope map and Seongnam City's green network map, which is necessary for environmental and urban planning, were created. We also developed Korean evaluation indices for urban ecological security by analyzing internationally-recognized equivalents such as CBI, GCI and EPI, and tested and verified the utility in 25 cities and provinces.

※ Urban biotope maps are drawn by local governments by investigating the jurisdiction's natural environments and rating the conservation values based on the ecological zoning map (the Article 34, Section 6 of the Natural Environment Conservation Act).
※ CBI: City Biodiversity Index / GCI: Green City Index / EPI: Environmental Performance Index
※ No Net Loss of Green Space is a policy that does not allow any development plans without securing a certain amount of green space within environmental capacity.

Conceptual diagram of the heat balance method - separate types

Conceptual diagram of the heat balance method - integrated types
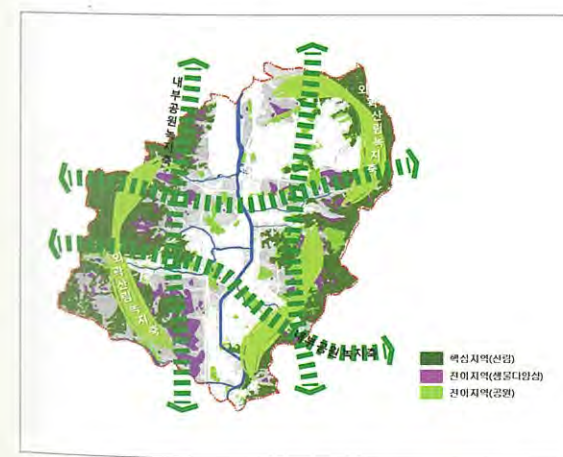
Seongnam City's green network map
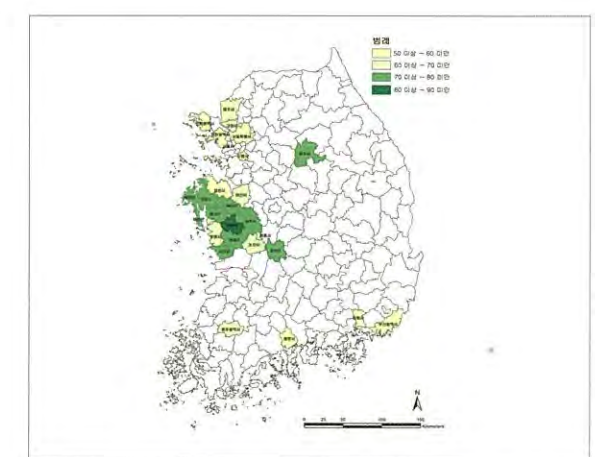
The result of testing evaluation indices for urban ecological security

Environmental Infrastructure Research Department

A tracking study on reduction of natural disasters and environmental changes caused by pollution

We monitored coastal erosions and analyzed coastline changes in order to prepare measures to trace and reduce environmental variations caused by climate change and to alleviate damages due to natural disasters in coastal areas including tsunami and typhoon. Also, we evaluated the effect of artificial and natural shields so as to develop measures to maintain sandy beaches that help reduce the impacts of natural disasters. For verifying the effectiveness of environmental policies and monitoring environmental background concentrations by time, National Environmental Specimen Bank established in 2009 collected 9 representative samples in ecosystems such as pine tree leaves and eggs of black-tailed gulls from 24 areas in Korea, stored around 1,600 cryogenically homogenized samples, and developed an environmental monitoring method through organic and inorganic analysis. Additionally, it verified its effectiveness as an environmental index by conducting research on uncertainty evaluation for Standard Operating Procedure (SOP) from sampling to analyzing by process.

※ Homogenization is to make the size of over 90% of target samples below 200 μm through cryogenic grinding.
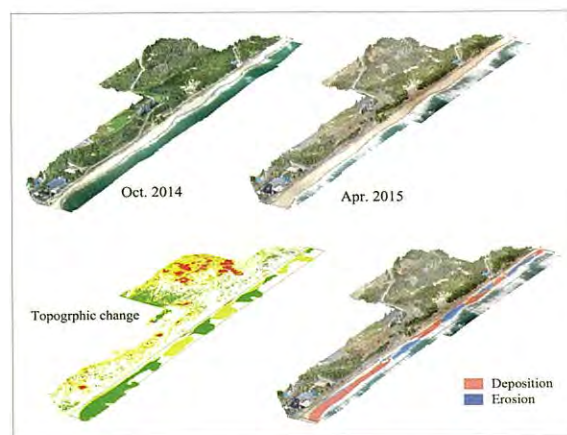
Coastal erosion in Hasi-dong.

Cryogenic liquid nitrogen freezers

A study on the applicability of human exposure assessment to Naturally Occurring Asbestos

Naturally Occurring Asbestos (NOA) are fibrous minerals that are produced during the geological formation process, found in the rocks or soil and released into the air by human or natural activities. As NOA can cause respiratory diseases such as asbestosis pulmonum, it is necessary to study the current status and efficient assessment methods for the exposure possibility. Accordingly, we measured asbestos concentrations in NOA areas using Transmission Electron Microscope (TEM) and Polarization Microscope (PLM); ND was below 0.01 f/cc in both outdoor and indoor air, below the criteria level. In addition, the result of hazard assessment of exposure by major patterns of daily life using Activity Based Sampling (ABS) revealed that there was no activity exceeding the EPA's recommended criteria.

※ Asbestos refers to a group of six naturally occurring fibrous silicate minerals: white asbestos from the serpentine family, brown asbestos belonging to the amphibole class, blue asbestos, anthophyllite asbestos, tremolite asbestos and actinolite asbestos.
※ Activity Based Sampling is to identify the human health impacts from asbestos released into the air by human activities in NOA areas.
※ f/cc: fibers per cubic centimeter.

Monitoring asbestos in the air

Activity-based sampling for assessing asbestos

A study on management of light pollution by artificial lightings

Since it was revealed that exposure to light at night can cause health problems including lowered immune functions and growth impairment, light has been considered a new type of pollution in the field of living environment. Accordingly, the Korean Ministry of Environment implemented 'Act on the Prevention of Light Pollution by Artificial Lighting' in 2013 and developed guidelines for installation and management of security lights, street lights and advertisement lights to control light pollution. Meanwhile, as a result of research on light intrusion into homes in 6 Korean cities, about 20% exceeded the acceptable limit for light radiation in residential areas (below 10 lx). We are continuing to study how to reduce light pollution caused by outdoor lightings and advertisement lights, and have identified the correlation with light intensity according to the distance and light output and developed a light blocking panel that reduces light leakage.

※ The level of trespassing light is measured with luminance of windows (luminance: intensity of light emitted from a surface per unit area in a given direction, lx).

※ The permissible amount of light emissions for residential areas in lighting environment management districts is 10 lx.

Light pollution by trespassing light in residential areas

Measuring light pollution by advertisement lights

A study on how to manage corrosive water quality in water pipe networks

In order to develop effective management measures for corrosion of water pipe systems known to be the culprit of secondary tap water pollution, we examined the characteristics of tap water corrosion and target facilities and evaluated the effect of chemicals on water pipe networks at demonstration water treatment plants. As a result of the corrosion evaluation of Korean water treatment plants using Langelier index (LI) and Bailey's curve, it was revealed that most were corrosive enough to affect the water pipe systems. when the goal of corrosion management (LI) was set based on the Japanese standard (-1~0), 70% of the facilities in the Han River water system and 98% in the Sumjin River water system were classified into management targets. The corrosion control effect of limewater, phosphoric acid and sodium hydroxide under the optimal condition was increased by 45%, 40% and 34%, respectively, at the demonstration plants. The corrosion inhibitors are expected to reduce disinfection by-products by decreasing reactivity of residual chlorine with organic substances and increasing the lasting effect of the by-products more than 4 times.

※ Langelier index determines the tendency to form calcium carbonate scale in water: below 0 means the water is corrosive.
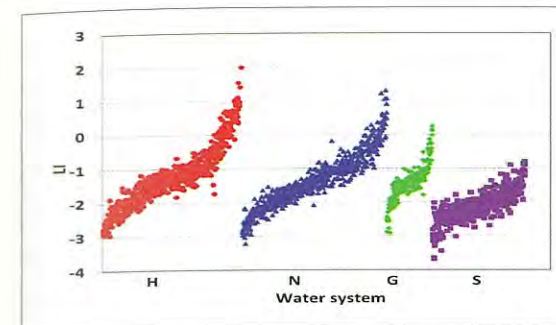
Langelier index of clean water in Korean water treatment plants
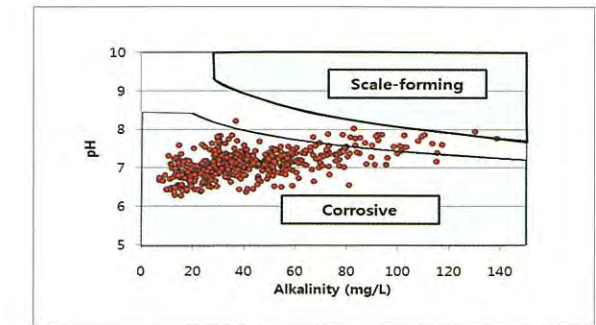
Evaluation based on Bailey's curve

Research on microorganisms in bioaerosol

With the recent increased attention on high-concentrate particulate matter and reports on human diseases related to the respiratory system, more people are recognizing the importance of bio-aerosol in the air. Accordingly, we conducted regular investigations more than 2 times a month for floating germs/fungi in places likely to have higher indoor air pollution than others. We also studied the most common germs in the air and environmental factors that can affect them according to region, environmental type and concentration of particulate matter. The study is expected to serve as foundation materials for developing measures to manage concentrations and types of possible microorganisms in the air including yellow dust.

※ Bioaerosol is an assembly of particles sized about 0.02 to 100μm, which includes not only microorganisms such as viruses, germs, molds and protists but biogenic substances including mold spores, toxins of microorganisms, allergens of plant and animal origin, pollens, human coughs, body fluids and glucans.
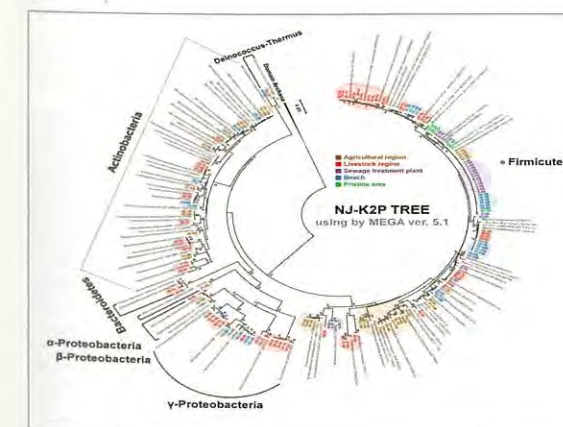
Variety of culturable bacteria in bioaerosols
(by environmental type and genus level)
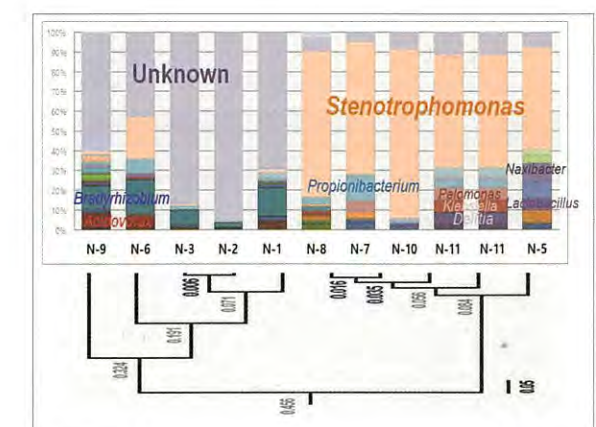
Environmental factors that affect genetic ratios of microorganisms according to the β -Diversity analysis.

A tracking study on environmental pollutants using strategic equipment

In order to address people's concerns and environmental conflicts on environmental pollution accidents in a scientific way, we conducted various studies by upgrading the existing concentration analysis approach with stable isotopes. The system of analyzing stable isotope ratios of molecular and gaseous trace pollutants was introduced to set a technique for tracking sources of pollutants where stable isotopes in nitrate nitrogen and fatty acid are used as tracers. We also developed measures to classify sources of intake with mercury isotopes so as to actively respond to the international mercury treaty. Based on the advanced analysis system, we developed measures to solve current environmental problems from a new perspective; we estimated the range of environmental impacts in regions where pollutants had leaked and reverse-traced the history using annual rings of street trees.

※ Stable isotopes: An atom whose nuclei contain the same number of protons but a different number of neutrons is called 'isotope.' Accordingly, it has a different mass number. Isotopes that do not decay radioactive are referred to as 'stable isotopes.'

Deciding on nitrogen origin using stable isotopes
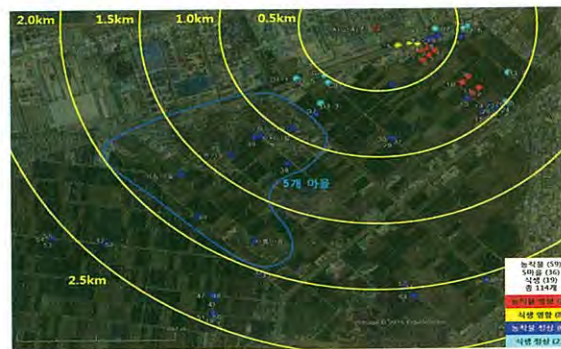
Estimating the range of environmental impacts by pollutants leakage

Advancement of analysis skills of environmental assessment and evaluation institutes

For the purpose of enhancing analysis capacity of environmental assessment and evaluation institutes and credibility of measurement data, we carried out proficiency tests on 90 items of 9 areas for about 1,440 labs and on-site evaluation for around 270 labs. Moreover, we published and distributed 'Guideline for Safe Operations and Management of Environmental Laboratories' so as to minimize cross-contamination and protect health of lab researchers. With the implementation of 'Cross-ministerial Operations of National Standards,' the Specialized Committee for National Standards was expanded and reorganized into Environmental Standard Council, and opinions of stakeholders from the Council and other test and inspection institutions were collected through a public hearing. As a result, the two different systems of 'Official Test Method for Environmental Pollution' and 'Environmental KS' are expected to be integrated, and a platform for better response to ISO international standards has been established.

※ KS: Korean Industrial Standard
※ ISO: International Organization for Standardization

Specialized Committee for National Standards workshop

The public hearing on environmental national standards

Diversifying soil contamination management methods and reinforcing the Soil and Groundwater Information System

We prepared a provisional standard for soil contamination by inspecting about 200 areas where soil contamination is suspected based on 10 criteria items including fluorine. Also, a revised draft of the guideline for risk assessment was developed in regard to pilot projects for establishing soil contamination risk management system (2 sites including a resource recycling site) and to adding a criteria item (fluorine) for soil contamination risk assessment. Furthermore, we developed a revised draft of the guideline for follow-up environmental impact assessment in abandoned mining areas by introducing intense investigation for restoration and pollution prevention. As for naturally-occurring radioactive materials in soil across the country, we investigated the current distribution status in about 1,000 sites in Honam, identified the background concentrations of 5 items including uranium and drew a distribution map. With the advanced Soil and Groundwater Information System (sgis.nier.go.kr) project, we improved the quality of space information and functions of the system to expand its utility. In addition, we developed mobile access to off-site soil management system so that statements of contaminated soil transfer can be registered with smart phones on site.

Seminar on Risk Management for Soil Conservation

Upgraded Soil and Groundwater Information System

Establishing the foundation for safe use of groundwater and scientific water quality management

For safe groundwater in 850 livestock burial sites, we assessed on 4 items including nitrate nitrogen. We established a nitrogen budget model (SNIPE) by investigating pollution sources in 100 areas and water quality in 2,000 sites, and drew up a nationwide nitrate nitrogen map to better maintain groundwater in rural regions. Moreover, we prepared a provisional basic plan for water management in agricultural regions and created promotional materials called 'Protection and Restoration of Clean and Safe Groundwater in Rural Regions' as long and short-term solutions. For areas with limited water supply (25,900 sites in 78 cities), we provided free water quality inspection service in cooperation with the Ministry of Environment. We studied contents and distribution of naturally-occurring radioactive materials including radon and gross alpha in 612 waterworks, made a content distribution map and tested uranium and radon mitigation devices (reverse osmosis devices for 60 homes and aeration systems in 2 sites). Also, we designated new candidate materials, ammoniacal nitrogen and boron, through a nationwide evaluation of water pollution to expand water quality criteria and reinforce monitoring for unregulated groundwater. As a result, 3 items including carbon tetrachloride were detected and a draft standard for water quality was developed after reviewing the hazard levels.
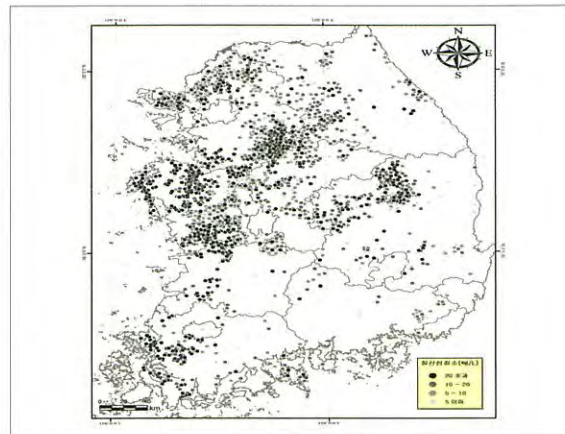
A map of nitrate nitrogen in agro-livestock areas
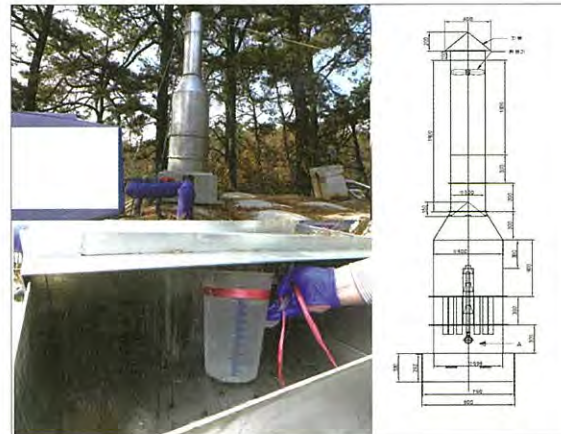
Pilot project for reducing naturally-occurring radioactive materials in groundwater

Sampling unregulated pollutants from groundwater

Agreement ceremony of Safe Groundwater Project in areas with limited water supply

Transportation Pollution Research Center

Improving vehicle emissions under the real-driving conditions and responding to the international environmental standards for vehicles

Transportation Pollution Research Center identified that light-duty diesel vehicles emit excess nitrogenous compounds in actual on-road driving conditions. Hence, we started to control vehicle emissions by developing driving test roads in Korea and conducting assessments on pollutants from various diesel cars under the real-driving conditions. The new standards are expected to contribute to improving air quality by minimizing the emissions difference between certification test modes and actual driving conditions.
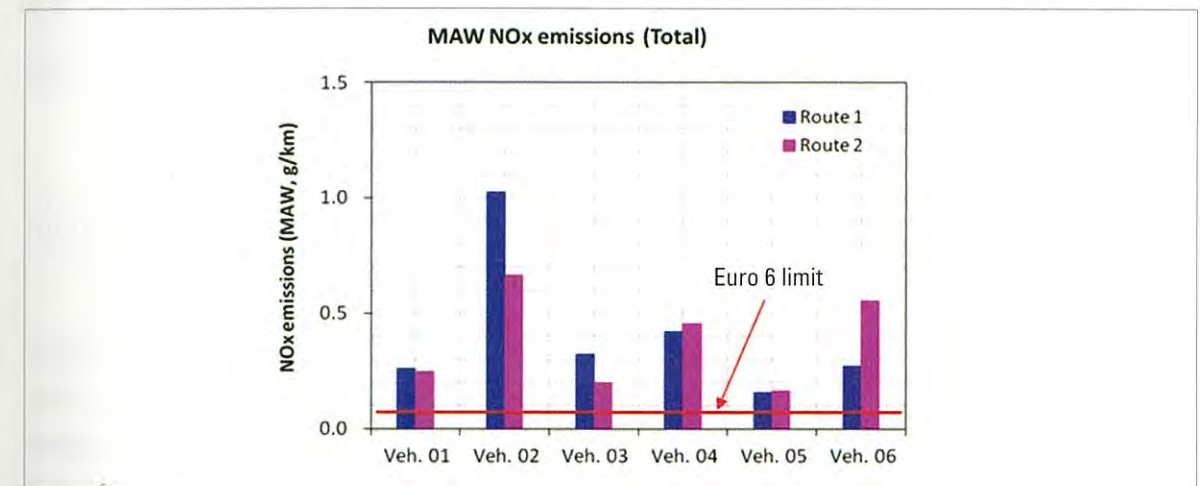
NOx emissions from diesel vehicles to meet Euro 6 standards under the actual on-road driving conditions

A test car equipped with PEMS and its driving test routes

※ PEMS (Portable Emission Measurement System) is a system equipped in cars to measure emissions under real driving conditions.

Developing vehicle emissions factors for enhancing the national emissions estimation method in the transport sector

Exact estimation of the major air pollution source, vehicle emissions, is critical in establishing and evaluating national air policies. As such, it is necessary to continuously develop emissions factors for various car types including new vehicles. The study updated emissions factors for small vans and trucks (EURO 5) and CNG buses (EURO 4 and EURO 5), and created new ones for petrol hybrid cars.

※ Emissions factors are used to calculate vehicle emissions: the amount of pollutants emitted per unit distance (g).
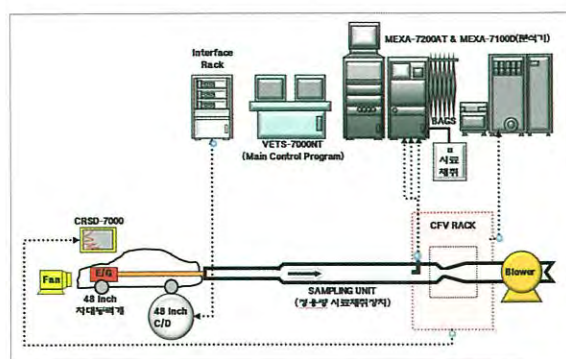
A system to measure emissions from light-duty diesel trucks

Emissions characteristics of trace hazardous air pollutants in the transportation environment and measures for the proper management

It is important to control not only pollutants legally regulated due to the large emissions but also hazardous substances emitted in small amounts. Transportation Pollution Research Center investigated how much trace hazardous materials such as Volatile Organic Compounds (VOCs) and aldehyde were released from automobiles and two-wheeled vehicles that are frequently used in residential areas. The result of the research is expected to tackle management blind spots in the field of Korean transportation environment, providing crucial data for effective implementation of policies.
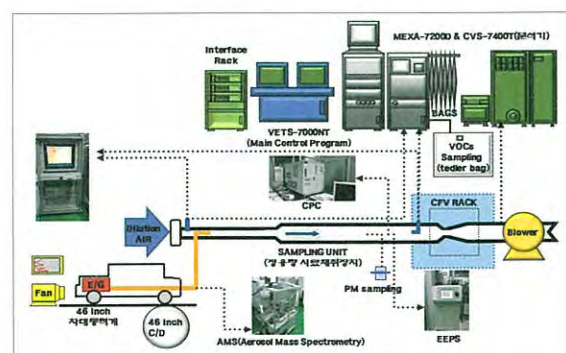
The system to measure trace hazardous materials emitted from vehicles
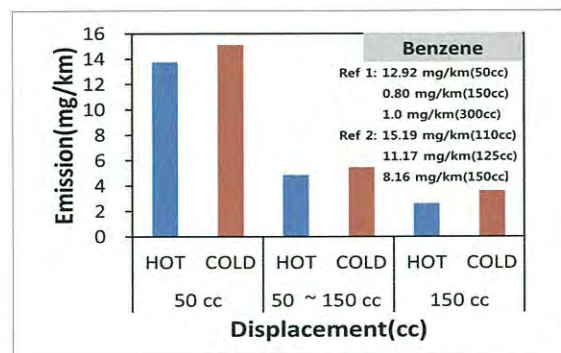
Characteristics of benzene emitted from two-wheeled vehicles by displacement
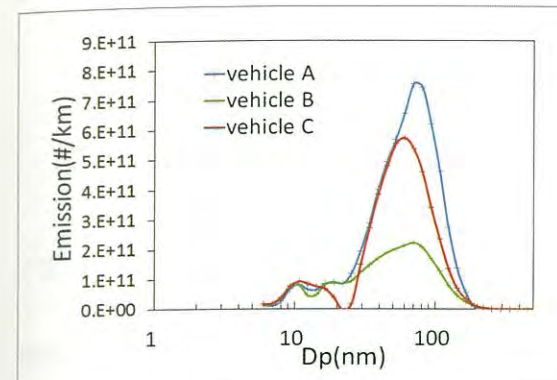
Additional emissions particle sizes due to cold start engine
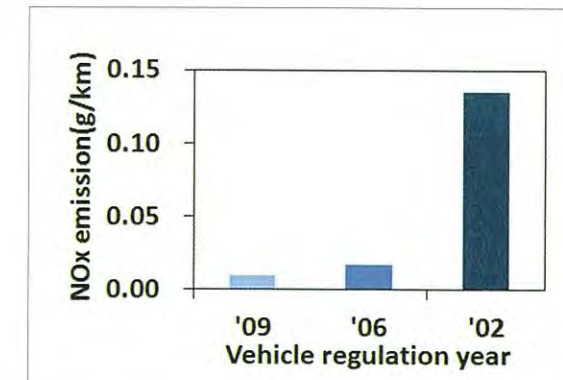
NOx emissions by regulation year of petrol vehicles

Implementation of advanced management system in the sector of transportation environment

For widespread adoption of electric vehicles, we developed a driving distance test on a single charge for electric vehicles that requires a 1/3 testing period, and adapted the international standards for noise measurement implemented at World Forum for Harmonization of Vehicle Regulations (WP 29) to the domestic circumstances. Furthermore, we revised regulations to test vehicle fuel additives (8 heavy metals) by introducing new microwave acid digestion method.

Electric vehicle charging station

Heavy metal analysis using microwave acid digestion method

Four Major River Research Centers

Research on physiological and ecological characteristics of algae in Paldang Lake (Ⅱ)

Since excessive proliferation of algae in Paldang Lake causes odor problems and difficulties in source water management, we analyzed causes of dominant algae in Paldang Lake and studied physiological and ecological characteristics of cyanobacteria by growth developmental phase. The research revealed that colonial types of *Microcystis* (cyanobacteria producing toxic microcystins) contained higher levels of toxicity than unicellular types, with more intracellular toxicity contents than exocellular levels. The result of physiological and ecological assessment on three types of cyanobacteria that frequently occur in Bukhan river, *Anabaena crassa, A. planktonica and A. circinalis*, found that they produced geosmin, an odor causing matter, up to the concentration of 0.202ng/cell. In particular, we cultured *Oscillatoria princeps* and *Phormidium chlorinum* (benthic cyanobacteria) from sediment layers and found for the first time that they produced geosmin. For the morphological fate of algae, we examined them with a microscope and drew the figures, and identified species using a genetic analysis technique, which will be used as basic data for algal research.

※ Benthic Cyanobacteria live in mud, gravels, etc. in the bottom of lakes and rivers.
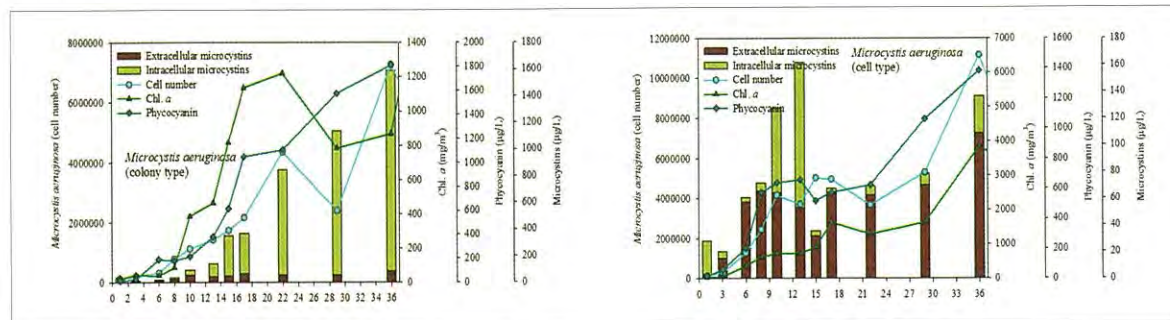
Metabolite production by growth of *Microcystis* colonial type (left) and unicellular type (right)
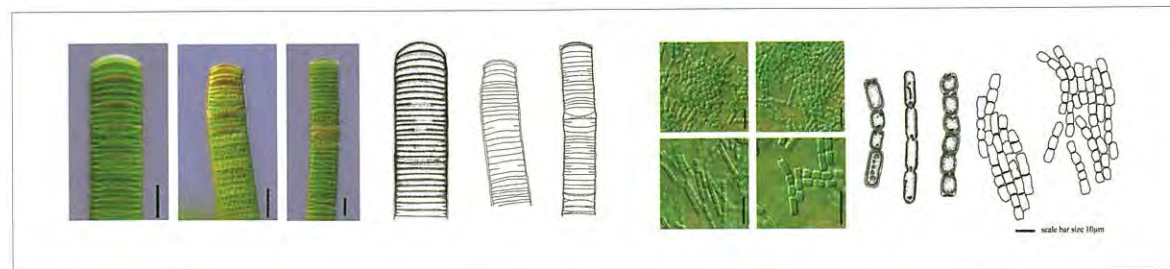
Photomicrograph and pictures of blue-green algae (*Oscillatoria princeps* (left) and *Pseudanabaena mucicola* (right))

Preventive management of algae by removing hypnospores (Ⅰ)

To investigate algal occurrence according to removal conditions of hypnospores in sediment layers, we installed 3 sets of rectangular test beds in Uiam Lake that move up and down according to water depth variations. At the site, hypnospores were most widely distributed in the surface deposit, and the inside of the test beds showed less and stable changes of nutrient salt concentrations. There was no significant difference according to the removal of sediments, but germination and proliferation of hypnospores were found in sediment layers. Also, we confirmed that cyanobacteria caused taste-and-odor substances and they were produced by certain genes. The result of indoor tests on sedimentary column cultivation showed that harmful cyanobacteria randomly appeared in all columns, and more hypnospores germinated as cultivation continued, forming colonial forms in surface layers. Moreover, less geosmin (taste-and-odor substances) and 2-MIB were found when the sedimentary surface layers containing hypnospores were removed. The higher the temperature, the more phosphorus produced from sedimentary layers : as low as maximum 0.774 mg DTP/m^2 · day.

※ Nutritive salt is necessary for phytoplanktons living in freshwater or saltwater to generate energy and cells.
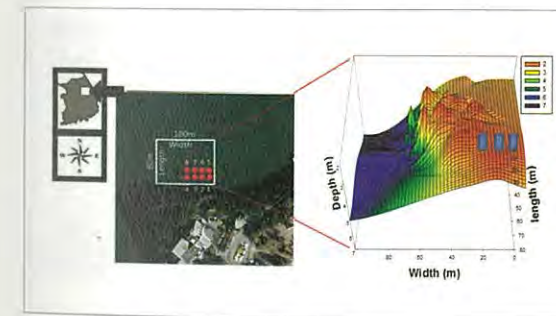
Test bed sites
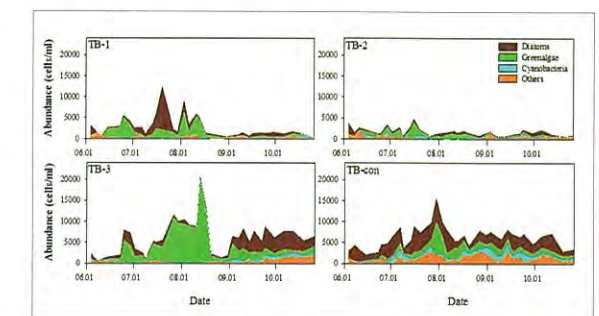
Patterns of colonial occurrence of phytoplankton by test bed
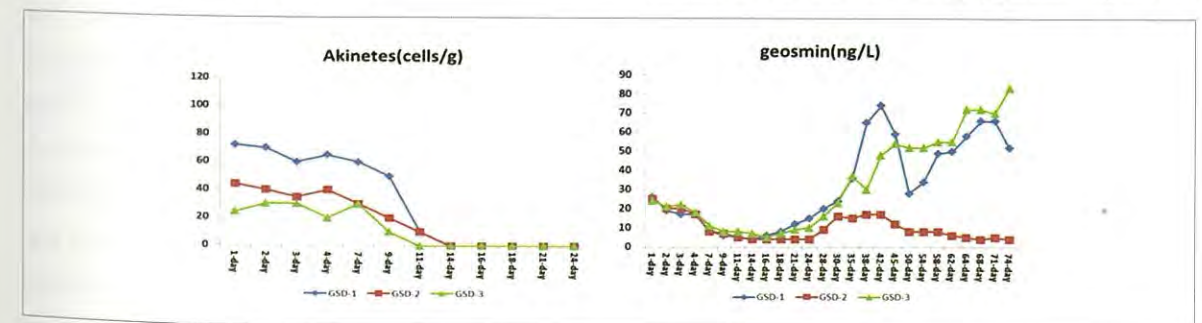
Changes in hypnospores and taste-and-odor substances in the column test

Research on management of harmful substances derived from wastewater in the Nakdong river water system(Ⅰ)

The Nakdong river water system used for water supply and located near industrial complexes is exposed to possible water pollution accidents. Therefore, it is necessary to conduct various investigation and studies on unregulated hazardous substances. In this study, we analyzed 36 hazardous materials in wastewater effluent treatment facilities located in Daegu and Gyeongsangbuk-do, and selected 34 priority chemicals among substances detected from unknown screening. Based on this, we aim to establish a systematic monitoring system for hazardous substances released from industrial wastewater in Nakdong river, and secure safe water sources by supporting precautionary management system.

※ Unknown monitoring is a method to select unknown substances and confirm the components.
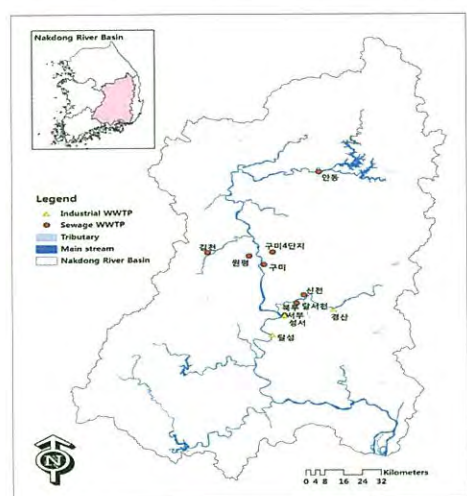
Surveyed wastewater effluent treatment facilities
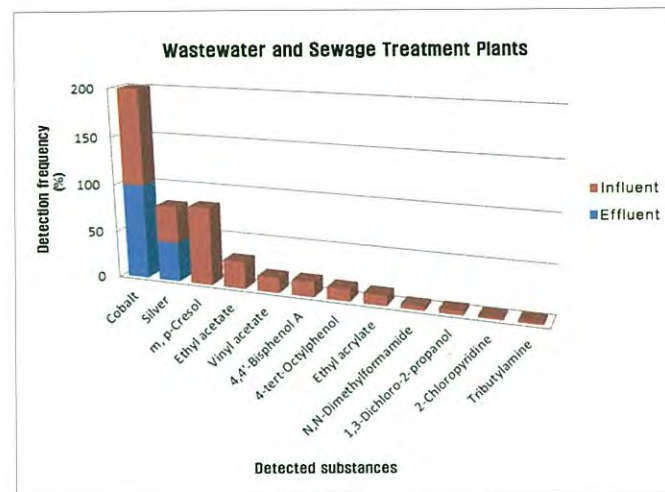
Detection frequency of substances surveyed

Assessment and management of the fate of non-degradable materials derived from forest in lakes used as water sources

When it comes to water quality of large lakes used for water sources, BOD (Biochemical Oxygen Demand) has been steadily improved due to expansion and advancement of infrastructure including wastewater treatment facilities, while COD (Chemical Oxygen Demand) has increased. The reason is mainly attributed to the increase of non-degradable materials from both natural origin, forest that accounts for 64% of the national territory, and artificial origin such as construction of forest trails, disaster prevention, and pest management. Under the circumstances, we identified the fate of those substances by studying on the basic water quality criteria and background concentrations and distribution of non-degradable materials of both natural and artificial origin in the junctions of upstream and downstream of inflow streams with large lakes, and conducted research on environmental exposure evaluation.

※ Non-degradable describes substances that are not broken down easily by microorganisms.
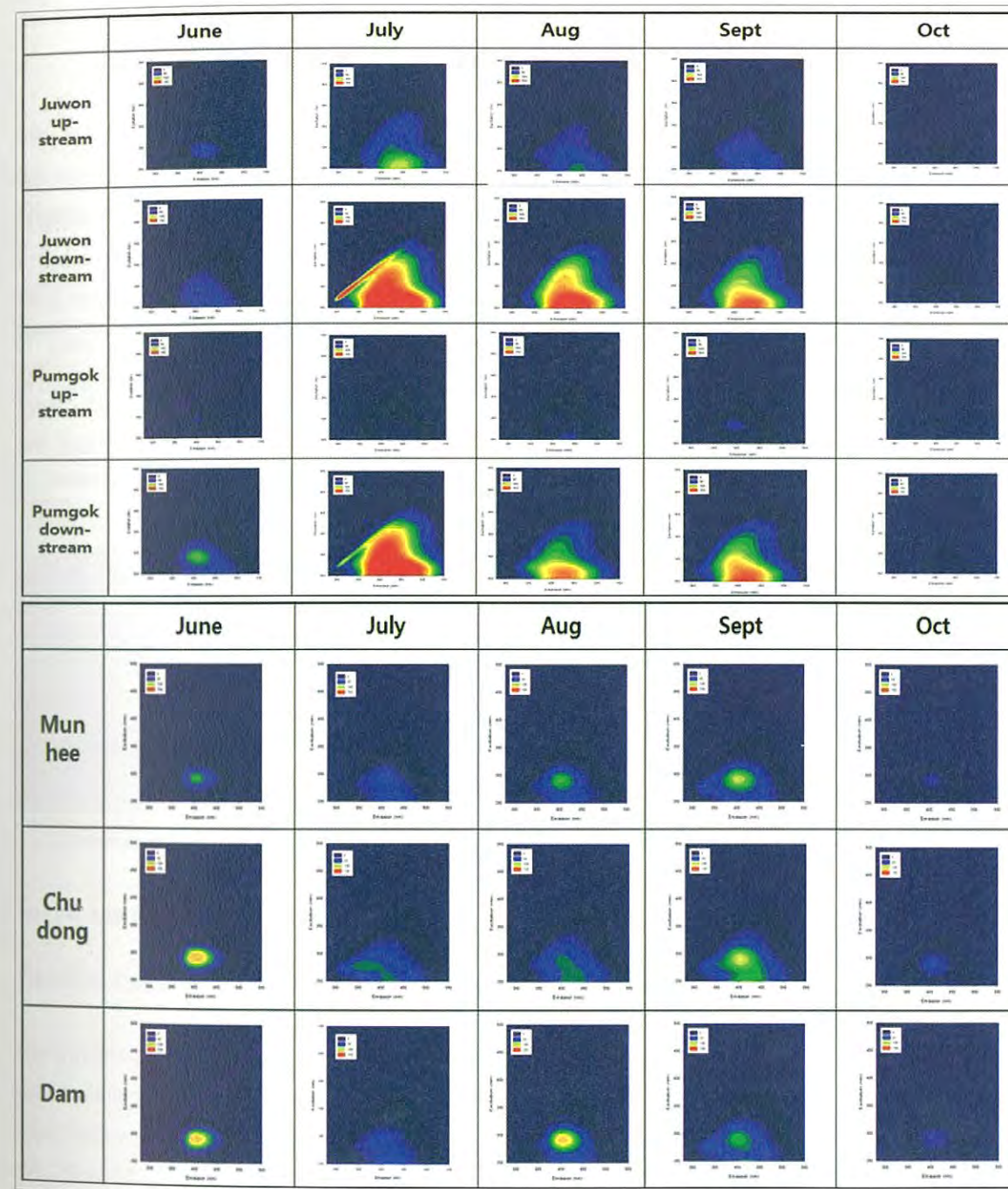
Distribution of non-degradable substances of natural origin by month and site

Research on the impacts of an agricultural reservoir in Yeongsan river on the water quality and algal blooms in the main stream

The upstream of Yeongsan river water system has only an agricultural reservoir instead of a multipurpose dam controlling the water volume and quality. Therefore, there are increasing needs for scientific research on the impacts of pollutants in the reservoir entering into the main stream via branches and sub-streams. Accordingly, we have conducted research for identifying the origins of different pollutants as well as the transfer process of nitrogen and carbon pollutants using stable isotope techniques. For the first time as one of the Four Major River Research Centers, we introduced Isotope Ratio Mass Spectrometry (IRMS) in developing data on $\delta^{13}C$ and $\delta^{15}N$ values of various pollutants in Yeongsan river, and have studied the nitrogen and carbon cycle mechanism in aquatic ecosystems.

※ Isotope Ratio Mass Spectrometer is an analytical device to measure isotopic ratios of carbon, nitrogen, oxygen and hydrogen with no radioactive decay; it shows the difference with standard materials in permillage.
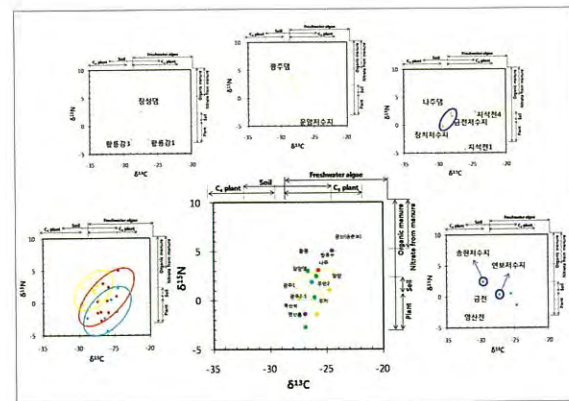
Isotopic ratios of nitrogen and carbon in the Yeongsan river water system
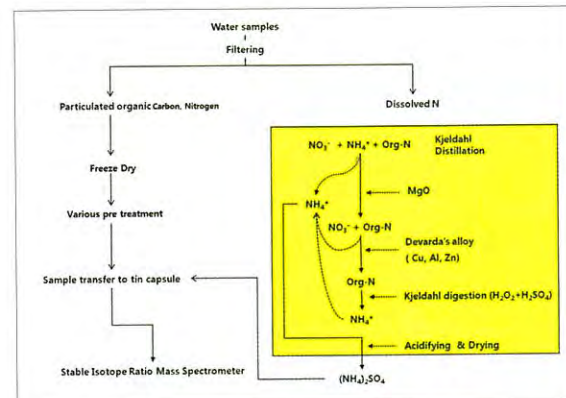
Flow chart for measuring isotopic ratios of nitrogen and carbon

National Wetlands Center

Discovering new wetlands and managing and re-evaluating existing national wetlands

General investigation of national inland wetlands in 2015 identified 314 new wetlands, totaling the number of discovered wetlands from 2011 to 2015 to 1,324. Moreover, after monitoring on existing 1,916 national inland wetlands, the number has been brought down to 1,328 through integrating, renaming and confirmation of losses. Also, we rated wetlands for conservation significance, which will be used for national wetland inventory and ecological zoning maps.

Chimsil wetland in Gokseong (Stream wetland)

Myeonsan wetland in Bonghwa (Mountain wetland)

Detailed investigation on national inland wetlands, wetland protection areas and river estuaries

Our intensive survey on national inland wetlands aims to identify biodiversity and values of well-preserved wetlands including the following 4 sites: Chimsil wetland in Gokseong, Baekgokji wetland in Jincheon, Myeonsan wetland in Bonghwa and Wansa wetland in Sacheon. As for intensive wetland protection area survey, we researched 2 wetlands including Sinbul Mountain alpine wetland and Sajapyeong alpine wetland by observing changes in ecosystems to prepare measures to manage and conserve the Wetland Protection areas. Also, we carried out detailed investigation and created basic data on two well-preserved river estuaries of Seonjin river and Sueocheon stream to protect them from development and destruction. Each detailed investigation revealed that various wetland plants and endangered wild animals and plants had inhabited those sites.

※ A river estuary is a brackish water zone where freshwater meets sea water; this region is rich in biodiversity and productivity.

Marsh trefoil (Endangered species class II)

Northern Harrier (Endangered species class II)

Proposal of a system for wide use of wetlands and activities to improve awareness

'Wetland City Accreditation of Ramsar Convention' suggested jointly by Korea and Tunisia for attracting local residents to preserve and maintain wetlands was adopted as the 10th resolution at the 12th Meeting of the Conference of the Contracting Parties to the Ramsar Convention held in Punta del Este, Uruguay in June 2016. National Wetlands Center, for adoption of the resolution, had held a side event on the necessity and similar examples of the Convention in several countries. In addition, we published 'Wetland Protection Areas make Changes' that explains socioeconomic effects of designation as Wetland Protection areas so that local people can improve pride in their towns and further protect and maintain their wetlands.

※ Wetland City Accreditation of the Ramsar Convention is for villages (including cities and local communities) closely related to Ramsar wetland sites to be approved as 'Ramsar Wetland Cities' so that wetlands are preserved and used wisely with local and international cooperation and the local residents are benefited from sustainable socioeconomic development.

The 12th Conference of the Parties to the Ramsar Convention

The cover of Wetland Protection Areas Make Changes

Our key **achievements** for a better environment

Annex

I. Research Achievement in 2015

II. International Cooperation in 2015

01

Research Project List

NIER Total **234** Project / Budget **45,627** million KRW

Research Strategy and Planning Division

No.	Project	Budget (million KRW)	Division
Subtotal	**1 projects**	**180**	
1	Investigation and Analysis of Future Environmental Demands at Home and Abroad	30	Research Strategy and Planning Division
2	Investigation and Analysis of Research and Development Performance of National Institute of Environmental Research (2015)	150	Research Strategy and Planning Division

Environmental Health Research Department

No.	Project	Budget (million KRW)	Division
Subtotal	**54 projects**	**10,036**	
1	Basic Investigation on Major Environmental and Health Issues and the Approaches in Asian Developing Countries (2014-2015)	20	Environmental Health Research Division
2	Research on the Actual Condition of Foot and Mouth Disease and Bovine Tuberculosis fromHydropotes inermis in the Environment (IV)	80	Environmental Health Research Division
3	A Study on Changes and Mechanisms of Avian Influenza Viruses in Wild Birds (I)	70	Environmental Health Research Division
4	Avian Influenza Surveillance and Molecular-Biological Characterization of the Spatiotemporal Distribution of Avian Influenza Viruses (2015)	150	Environmental Health Research Division
5	Development of the Environmental Health Management System for Abandoned Metal Mines (II)	110	Environmental Health Research Division
6	A Study on Utilizing National Big Data Including Health Insurance System for Establishing Environmental and Health Monitoring System (I)	100	Environmental Health Research Division
7	Monitoring of Exposure to Environmental Pollutants and Health Effects of Inhabitants in Industrial Complexes (2015) -Sihwa-Banwol complex-	64	Environmental Health Research Division
8	Estabilshment of Diagnostic System for wildlife Disease (II) - Avian Influenza -	80	Environmental Health Research Division
9	The 3rd (2015~2017) Korean National Environmental Health Survey (I)	976	Environmental Health Research Division
10	Environmental Exposure and Health Impacts on Korean People	50	Environmental Health Research Division
11	Research on Health Effect of Environmental Pollution (2015) - Environmental Exposrue Assessment for Mine Residents in Mongolia -	70	Environmental Health Research Division
12	Comparison of the Susceptibility of on Wild Bird Avian Influenza (I)	300	Environmental Health Research Division
13	Environmental and Health Effects Survey of Residents Around 2nd Phase Abandoned Metal Mines (III)	400	Environmental Health Research Division
14	A Study on Improving Environmental Safety Assessment in Child Care Centers	70	Environmental Health Research Division
15	Development of Measures to Analyze Hazardous Environmental Factors Related to Breast Cancer	100	Environmental Health Research Division
16	Establishment of Wild Animal Disease Study System (III)	150	Environmental Health Research Division
17	Monitoring of Exposure to Environmental Pollutants and Health Effects of Inhabitants in Industrial Complexes (2015) - Pohang -	100	Environmental Health Research Division
18	Project of Sharing Family Warmth Together (I) - A Study on Monitoring and Service of Environmental Health for Vulnerable Groups -	90	Environmental Health Research Division

No.	Project	Budget (million KRW)	Division
19	Monitoring of Exposure to Environmental Pollutants and Health Effects of Inhabitants in Industrial Complexes (2015) - Gwangyang Bay Area -	230	Environmental Health Research Division
20	Monitoring of Exposure to Environmental Pollutants and Health Effects of Inhabitants in Industrial Complexes (2015) - Ulsan -	115	Environmental Health Research Division
21	Monitoring of Exposure to Environmental Pollutants and Health Effects of Inhabitants in Industrial Complexes (2015) - Cheongju and Daesan -	125	Environmental Health Research Division
22	A study on National and Local Environmental Health Assessment (V)	60	Environmental Health Research Division
23	A Health Survey on Residents Living near the Port of Donghae	250	Environmental Health Research Division
24	Environmental and Health Effects Survey of Residents in Areas Near General Industrial Complex (V)	400	Environmental Health Research Division
25	A Study on the Infection of Severe Fever with Thrombocytopenia Syndrome (SFTS) Viruses in Natural Environment and Beneficial Substances for Repellents Against Ixodes (I)	250	Environmental Health Research Division
26	Intensive Monitoring for Early Response for Avian Influenza Outbreaks in Wild Birds (2015)	700	Environmental Health Research Division
27	Development of Early Detection System and Response Manual for Wildlife Diseases (II)	150	Environmental Health Research Division
28	A Health Survey on Residents Living near Refineries	160	Environmental Health Research Division
29	A Research to Establish the Analysis Platform for Environmental Pollutants in Biological Samples (I)	100	Environmental Health Research Division
30	Study on Aquatic Environmental Fate and Bioaccumulation of Manufactured Nanomaterials (II)	220	Risk Assessment Division
31	Inhalation Toxicity Study of Chemical Mixture (II)	225	Risk Assessment Division
32	Study on the Technique of Consumer Risk Assessment (II)	200	Risk Assessment Division
33	Establishment for Foundtation for Risk Assessment for Hazardous Substances Contained in Household Products (II)	180	Risk Assessment Division
34	A Study on Toxic Sensitivity of Freshwater Organisms and the Applicability Assessment in Korea	250	Risk Assessment Division
35	A Study on Health Impacts of Hazardous Substances Contained in Household Products (II)	200	Risk Assessment Division
36	Development of Risk Assessment and Information Disclosure System for chemicals under the Act on the Registration and Evaluation, etc. of Chemical Substances (K-REACH)	150	Risk Assessment Division
37	Studies on the Accumulation Status of Persistent Organic Pollutants in the Freshwater Fish (IV)	150	Risk Assessment Division
38	Development of Critical Safety Assessment Technology for Chemicals in Response to K-REACH (IV)	220	Risk Assessment Division
39	A Study on Labelling of and Information Provision on Chemical Substances in Preparation for the Implementation of the Act on the Registration and Evaluation of Chemicals of Korea (K-REACH) and Toxic Chemicals Control Act (II) - Chemical Classification and Information Delivery -	200	Risk Assessment Division
40	Study on the Exposure Factors of Korea Children (III)	50	Risk Assessment Division
41	Environmental Exposure Assessment of Manufactured Nanomaterials (II)	220	Risk Assessment Division
42	Risk Assessment According to Transformation of Nanomaterials in the Environment	100	Risk Assessment Division
43	Development of Guidelines on Drawing up Risk Materials for Industries	170	Risk Assessment Division
44	A Study on the Test and Evaluation Methods for Establishing the Ground for Nano Safety System (NANoREG) (II)	400	Risk Assessment Division
45	Inhalation Exposure Scenarios and Toxicity References for Nano Products under the Control of the Ministry of Environment	150	Risk Assessment Division
46	A Study on Source Tracking of Long-range Transported Heavy Metals Using Stable Isotopes (III)	200	Chemicals Research Division

No.	Project	Budget (million KRW)	Division
47	Establishment of the exposure assessment test method for children's products（Ⅶ）	220	Chemicals Research Division
48	Building Data Library of Stable Isotopic Compositions for Anthropogenic Emissions（Ⅲ）	145	Chemicals Research Division
49	Study on Mercury Deposition Monitoring in Background sites for effective evaluation of the Minamata Convention（Ⅰ）	60	Chemicals Research Division
50	A study on Setting Risk Management Goals for Food Contaminants of Environmental Origin（Ⅰ）	200	Chemicals Research Division
51	A Study on Establishing Infrastructure to Implement the Stockholm Convention for New POPs（Ⅰ）	137	Chemicals Research Division
52	Integrated Multimedia Monitoring for Food Contaminants of Environmental Origin（Ⅰ）	300	Chemicals Research Division
53	Studies on the Revision of the Official Method of Persistent Organic Pollutants-Focusing on the General Introduction Establishment	70	Chemicals Research Division
54	The study of metabolomics on identification of the impacts of environmental pollutansts（Ⅱ）	99	Chemicals Research Division

Climate and Air Quality Research Departmnet

No.	Project	Budget (million KRW)	Division
Subtotal	42 projects	8,258	
1	A Study on Chemical Characteristics of Ambient Aerosol during Asian Dusts and High PM Episodes（PM$_{2.5}$）（Ⅱ）	100	Air Quality Research Division
2	Analysis of Causes of Ozone in Korea by Analyzing Characteristics of Phytochemicals（Ⅰ）	90	Air Quality Research Division
3	The Study on the Emission and Deposition of BVOCs using Eddy Covariance in the Trees（Ⅱ）	150	Air Quality Research Division
4	A Study on Regional Characteristics of Air Pollution（Ⅱ）- Fostering Flagship Universities and Creating Jobs	300	Air Quality Research Division
5	Establishing Quality Management and Data Assessment System for Air Pollution Observation Network（Ⅰ）	360	Air Quality Research Division
6	Monitoring Method of Hazardous Air Pollutants（HAPs）in Industrial Complex Areas（Ⅱ）	200	Air Quality Research Division
7	Monitoring Method of Hazardous Air Pollutants（HAPs）in Urban Areas（Ⅲ）	214	Air Quality Research Division
8	Preparation of Nitrogen Oxide Analysis Methods with Chemical Ionization Mass Spectrometry	90	Air Quality Research Division
9	Development of Guidelines for Estimating Contribution Ratios of Particulate Matter and Applying the Acceptance Models in Korea and Overseas（Ⅰ）	240	Air Quality Research Division
10	Identification of the Process of Secondary Particulate Matter Formation in the Metropolitan Areas（Ⅰ）	300	Air Quality Research Division
11	A Study on Vertical Distributions and Optical Properties of Particulate Matter in the Metropolitan Areas（Ⅰ）	200	Air Quality Research Division
12	A Study on the Improvement of Fine Particles Measurement Method in Flue Gas（Ⅱ）	150	Air Pollution Engineering Division
13	A Study for Greenhouse Gases Monitoring Using Environmental Satellite（Ⅲ）	302	Global Environment Research Division
14	A Study on Integrated Strategy for Climate Change and Air Pollution Using GAINS-Korea-Focusing on Road Transport（Ⅱ）	150	Global Environment Research Division

No.	Project	Budget (million KRW)	Division
15	A Study on Measures to Reduce Greenhouse Gases in the Public Sectors（Ⅰ） - Focusing on the Energy Reduction Technology of Zero Carbon Buildings -	80	Global Environment Research Division
16	The Study on the Physio-chemical Characteristics of Air Pollution Plume in Northeast Asia（Ⅲ）	80	Global Environment Research Division
17	Study on Improvement and Policy Support Reinforcement of Air Pollutants Emission Inventory（Ⅱ）- Focusing on Estimation of the Current Emissions -	200	Global Environment Research Division
18	Prepiminary Research on KORUS Joint Observation for Cal/Val of Environmental Satellites	120	Global Environment Research Division
19	A Study on Efficient Operations of National Environmental Satellite Center	95	Global Environment Research Division
20	Joint Research on the Impacts of Transboundary Air Pollutants in Northeast Asia（Ⅲ）	230	Global Environment Research Division
21	Studies for improvement of air pollutants & GHGs integrated inventory system（Ⅱ） - Focusing on Unestimated Nonroad Emissions Inventory -	100	Global Environment Research Division
22	Development of the Optimal Climate Change Scenario of East Asia for Minimizing the Risk in the Korean Peninsula（Ⅱ）- Focusing on Prediction of the Future Climate and Air Qualith in East Asia and the Korean Peninsula -	159	Global Environment Research Division
23	Analysis of Economic Effect Based on Various Scenarios Considering Mitigation and Adaptation in East Asia（Ⅰ）- Focusing on Prediction of the Climate and Air Quality -	850	Global Environment Research Division
24	A Study on Improving Measures to Sample , Analyze and Test Greenhouse Gases	200	Global Environment Research Division
25	Development of Verification and Accreditation of Emissions Trading Scheme（Ⅰ）	180	Global Environment Research Division
26	A Study on the Effect of Reduction Technology of Mercury and Continuous Emission Monitoring for Reduction of Mercury Emission（Ⅱ）- Focusing on Coal-fired Power Plants and Cement Kilns -	100	Air Pollution Engineering Division
27	A Study on the Development of the Air Pollutants Emission Factor from Using Other Fuels（Ⅰ）	80	Air Pollution Engineering Division
28	A Study on Improvement of Sampling Tubes for PM$_{10}$ and PM$_{2.5}$ Considering the Shape of Measuring Device	100	Air Pollution Engineering Division
29	A Feasibility Study on Introduction of Allowable Emission Standards for Particulate Matter from Discharging Facilities（Ⅰ）	270	Air Pollution Engineering Division
30	A Study on Improving Measures to Investigate and Evaluate Odor Pollution	240	Air Pollution Engineering Division
31	Development of Guidelines for Operational Management of Discharging Facilities	100	Air Pollution Engineering Division
32	A Study on the Estimating of the Plant Emission Standards for Hazardous Air Pollutants（Ⅱ）	70	Air Pollution Engineering Division
33	Production of Air Quality Analysis Data Using Modeling Techniques（Ⅰ）	158	Air Quality Monitoring and Forecasting Center
34	A Study on Data Assimilation for Improving Air Quality Predictions（Ⅰ）	150	Air Quality Monitoring and Forecasting Center
35	A Study of Accuracy Improvement for National Air Quality Forecasting（Ⅱ）	100	Air Quality Monitoring and Forecasting Center
36	International Observation Campaign for Identifying Pollution Formation Mechanism in Megacities（Ⅰ）- Modeling for Investigating Air Pollution in Big Cities and Verifying Emissions in Korea -	400	Air Quality Monitoring and Forecasting Center
37	A Study of Accuracy Improvement for Air Quality Forecasting Models（Ⅱ）	400	Air Quality Monitoring and Forecasting Center
38	Establishment of Air Quality Forecasting and Analysis System for Detail Regions（Ⅰ）	250	Air Quality Monitoring and Forecasting Center
39	A Study on Modeling Techniques for Producing Air Quality Re-analysis Data（Ⅰ）	150	Air Quality Monitoring and Forecasting Center
40	Improvement of the Accuracy of Ozone Forecasts and Emission Process Models（Ⅱ）	200	Air Quality Monitoring and Forecasting Center

No.	Project	Budget (million KRW)	Division
41	Korea-China Collaborative Study to Abate Trans-boundary Air Pollution（Ⅱ）	200	Air Quality Monitoring and Forecasting Center
42	A Study on the Development of High-PM10 Episode Forecast Techinique in Statistics-Dynamics Hybrid System（Ⅱ）	150	Air Quality Monitoring and Forecasting Center

Water Environment Research Department

No.	Project	Budget (million KRW)	Division
Subtotal	41 projects	9,465	
1	A Study on the Improvement for TMDL System Enforcement（Ⅱ）- Focusing on Cases of Solved Local Issues	39	Watershed and Total Load Management Research Division
2	A Study for Preparing Standards for TMDL Evaluation by Stage	70	Watershed and Total Load Management Research Division
3	Decision of Prioritization of Catchments and Determination of Control Target for Non-point Source Pollution Management（Ⅲ）	72	Watershed and Total Load Management Research Division
4	A Pilot Study on Nonpoint Source Pollutants by Livestock Manure in Agricultural Areas	212	Watershed and Total Load Management Research Division
5	A Study for Preparing a Provisional Detaild and Comprehensive Plan for Mid and Long-Term Investigation on Livestock Manure	60	Watershed and Total Load Management Research Division
6	A Study on Measures to Set Water and Air Pollution Background Concentrations for Integrated Environmental Management System	100	Watershed and Total Load Management Research Division
7	Nationwide On-site Pollution Investigation (Focusing on Livestock Pollutants)	940	Watershed and Total Load Management Research Division
8	A Study on Establishing the Roadmap for Nationwide Pollutant Investigation (2016~2020)	100	Watershed and Total Load Management Research Division
9	Enactment and Revision of Official Test Standards for Water Quality - Focusing on New Water Pollutants -	113	Water Environmental Engineering Research Division
10	Estimation of the Treatability and Management Practices to treat Water Pollutant Candidates（Ⅳ）	100	Water Environmental Engineering Research Division
11	Standardization of Sediment Release Measurement and Water Quality Impact Assessment - A Study on Organic Matter Decomposition Paths for Sediment and Water Layers in Gangjeong Goryeong Weir and Jooksan Weir -	70	Water Environmental Engineering Research Division
12	A Study on Evaluation of TOC Best Available Technology in Industrial Wastes	100	Water Environmental Engineering Research Division
13	A Study on Origins of Nitrogen in Public Waters（Ⅰ）	55	Water Environmental Engineering Research Division
14	A Study on the List of Provisional Criteria for Water and Aquatic Ecosystem Quality (2015)	180	Water Environmental Engineering Research Division

No.	Project	Budget (million KRW)	Division
15	Standardization of Sediment Release Measurement and Water Quality Impact Assessment - Procedures Establishment -	180	Water Environmental Engineering Research Division
16	A Study on Management Measures for Facilities Discharging Eco-Toxicological Substance, High-Concentration Salt（Ⅱ）	115	Water Environmental Engineering Research Division
17	A Study on Methods to Draw Evaluation Standards for Sediment Contamination and the Application	340	Water Environmental Engineering Research Division
18	Preparation of Environmental Criteria for Protecting Aquatic Organisms（Ⅱ）	280	Water Environmental Engineering Research Division
19	Development of New Standard Test Species for Ecotoxicity（Ⅲ）	201	Water Environmental Engineering Research Division
20	Selection of Reference Streams for Better Utilization of the Result of Health Assessment of Aquatic Ecosystems	120	Watershed Ecology Research Team
21	The Characteristics of algae blooms mechanism to environmental changes（Ⅱ）	240	Watershed Ecology Research Team
22	A Study on Changes in Ichthyofauna and Habitats in Public Waters（Ⅰ）- Focusing on the Nakdong River and Geum River Watersheds -	150	Watershed Ecology Research Team
23	Establishing an Aquatic Ecosystem Health Network（Ⅱ）	100	Watershed Ecology Research Team
24	River Aquatic Ecosystem Survey and Assessment（Ⅷ）	2886	Watershed Ecology Research Team
25	Estuary Ecosystem Survey and Assessment（Ⅷ）	980	Watershed Ecology Research Team
26	A Study on Improving Mid and Long-term Monitoring of Aquatic Ecosystems in Weir Sections	100	Watershed Ecology Research Team
27	A Survey on the Distribution of Pectinatella Magnifica and the Ecological Characteristics	200	Watershed Ecology Research Team
28	A Study on Biological Magnification of Algal Toxins in Freshwater Environment（Ⅰ）	200	Watershed Ecology Research Team
29	A Study on Distribution Characteristics of Fish and Zoobenthos in Major Midstream of Nakdong River	100	Watershed Ecology Research Team
30	A Study on Cyanobacteria Measurement through Phycocyanin Analysis	120	Watershed Ecology Research Team
31	Monitoring Program for Radioactive Materials in Public Waters（Ⅱ）	80	Water Quality Assessment Research Division
32	Development and Improvement of Automated Water Quality Monitoring System（Ⅰ）	94	Water Quality Assessment Research Division
33	Advection-dispersion Analysis of Oil Spill using GPS Floaters（Ⅱ）	35	Water Quality Assessment Research Division
34	A Hydrodynamic and Water Quality Modeling Study on the Algal Dynamics in the Nakdong River, Korea（Ⅱ）	73	Water Quality Assessment Research Division
35	A Spatially Distributed Modeling Study on the Algal Dynamics in the Middle-upper Reaches of the North Han River, Korea（Ⅲ）	60	Water Quality Assessment Research Division
36	Establishment of Ensemble Prediction System for Water Quality Based on Data Assimilation（Ⅰ）	120	Water Quality Assessment Research Division
37	Development of water quality forecasting methods for protection of river recreation activities（Ⅱ）	150	Water Quality Assessment Research Division
38	Development and Application of Validation Technique for Advection-Diffusion of Dissolved Pollutants Using Tracer Experiments（Ⅱ）- Focusing on water systems in Nakdong River -	110	Water Quality Assessment Research Division

No.	Project	Budget (million KRW)	Division
39	A Study on Remote Monitoring of Birds with Unique Spectral Characteristics (2015)	20	Water Quality Assessment Research Division
40	Impact Assessment of Climate Changes on Water Quality by Land Surface Modeling (Ⅲ)	150	Water Quality Assessment Research Division
41	A Study on Management Program to Improve Accuracy of Real-time Water Quality Analyzers (Ⅲ)	50	Water Quality Assessment Research Division

Environmental Resources Research Department

No.	Project	Budget (million KRW)	Division
Subtotal	**26 projects**	**2,537**	
1	Material Flow Analysis of Mercury containing Products (Ⅵ)	50	Resource Recirculation Research Division
2	Study on Management of Industrial Waste for Alternative Resource of Natural Materials (Ⅲ)	70	Resource Recirculation Research Division
3	Methodology of the Environmental Assessment on the Recycled Products and Wastes (Ⅱ)	120	Resource Recirculation Research Division
4	Preparation of Standards for Hazardous Materials in Cement Products	100	Resource Recirculation Research Division
5	Evaluation of Ripple Effects by Hazardous Characteristics Application (Ⅱ) - A Study on Proper Waste Management in Response to International Conventions (Focusing on Wastes under the Basel Convention) -	132	Resource Recirculation Research Division
6	A Study on Improvement of the Standard for Classification of Organic Solvents (Ⅱ)	100	Resource Recirculation Research Division
7	A Study on Occurrence Properties and Proper Management of Wastes Containing Nanomaterials (Ⅰ)	50	Resource Recirculation Research Division
8	A study on Standards and Methods of Waste Recycling (Ⅱ)	70	Resource Recirculation Research Division
9	Development of Standards for New POPs Contents (Ⅰ)	60	Resource Recirculation Research Division
10	A Study on Hazardous Waste Catalogue and Identification Test (Ⅱ)	160	Resource Recirculation Research Division
11	A Study on System Improvement and Discharge of Waste Containing Mercury (Ⅳ)	150	Resource Recirculation Research Division
12	Evaluation on the Incineration Capability of Small-scale Incinerators	100	Waste to Energy Research Division
13	A Study on Optimization of Operation in the Bio-gasification Facility of Organic Waste (Ⅱ) - Technical Guidebook for Integrated Bio-gasification Facilities -	120	Waste to Energy Research Division
14	A study on Standard of energy recovery and estimation method of environmental factors (Ⅱ) - High-efficient Waste-to-Energy Conversion -	120	Waste to Energy Research Division
15	A Study on Landfill Criteria by Landfill Zero Policy (Ⅱ) - Standards for Landfill of Industrial Wastes -	120	Waste to Energy Research Division
16	A Study on Thermal Treatment of Wastes Containing New POPs (Ⅱ) - Focusing on Wastes Containing Brominated Flame Retardants -	70	Waste to Energy Research Division
17	A Study on Estimation of Emissions and Emission Factors of Unintentional POPs	45	Waste to Energy Research Division

No.	Project	Budget (million KRW)	Division
18	Developing Guidelines of Biotope Maps for Spatial Planning (Ⅱ)	170	Waste to Energy Research Division
19	Evaluation of the Measurement Uncertainty from the SOP of the Environmental Specimen Bank (Ⅱ)	30	Waste to Energy Research Division
20	Improvement of Urban Environment through Urban Green Space (Ⅱ) - Focusing on Urban Heat Island	100	Natural Environment Research Division
21	The application of geomorphic landforms for environment-friendly land use planning (Ⅱ)	70	Natural Environment Research Division
22	Reduction of natural disaster risk due to climate change of coastal area (Ⅲ)	90	Natural Environment Research Division
23	A Study on Development and Application of Korean Environmental Sustainable City Index (ESCI) for Urban Environmental Management in Korea (Ⅱ)	70	Natural Environment Research Division
24	Study on urban spatial environmental planning preparing linkage policy of land planning and environmental planning (Ⅱ)	100	Natural Environment Research Division
25	Technique to Draw up Spatial Environmental Information Maps (Ⅰ) - Focusing on the Natural Ecology	200	Natural Environment Research Division
26	A Study on the Introduction of No Net Loss of Green for Urban Ecosystem Health Improvement (Ⅱ)	70	Natural Environment Research Division

Environmental Infrastructure Research Department

No.	Project	Budget (million KRW)	Division
Subtotal	**41 projects**	**11,150**	
1	A Study on the Practical Application of Permissible Amount of Light Emissions from Advertising Lights	100	Indoor Environment and Noise Research Division
2	A Study of performance for reduction of indoor air pollutants by building materials (Ⅰ)	80	Indoor Environment and Noise Research Division
3	A study on the microbial management of living space air quality (Ⅱ)	120	Indoor Environment and Noise Research Division
4	Study on the improvement of management for sources of indoor air pollutants (Ⅲ)	100	Indoor Environment and Noise Research Division
5	Feasibility study on exposure assessment method of Naturally occurring asbestos (Ⅱ)	150	Indoor Environment and Noise Research Division
6	A Study on Inter-floor Noise in Real Life by Noise Source	70	Indoor Environment and Noise Research Division
7	Nationwide Survey of Indoor Radon Levels in Homes (2015-2016)	620	Indoor Environment and Noise Research Division
8	A study on standard of activated carbon and real-time analysis system for management of taste and odor (Ⅱ)	100	Water Supply and Sewerage Research Division
9	A Study on Best Available Technologies of Sewage Treatment Facilities for the Planning of Basin Sewerage (Ⅲ)	70	Water Supply and Sewerage Research Division
10	Study on the Microorganisms of Bioaerosol for Surroundings (Ⅱ)	71	Water Supply and Sewerage Research Division
11	A Study on Management Methods of Water Quality Hazardous Materials in Public Sewage Treatment Facilities (Ⅱ)	120	Water Supply and Sewerage Research Division

No.	Project	Budget (million KRW)	Division
12	Corrosion Control of Distribution System in Drinking Water (Ⅱ)	80	Water Supply and Sewerage Research Division
13	A Study on Management of Unregulated Trace Hazardous compounds in Drinking Water (Ⅳ)	500	Water Supply and Sewerage Research Division
14	A Study on Environmental Effects of Microorganisms in Bioaerosols Including Yellow Dust and the Control Measures (Ⅱ)	100	Water Supply and Sewerage Research Division
15	The Monitoring of Environmental Microorganisms and Pathogens Respond to Climate Change (Ⅲ)	130	Water Supply and Sewerage Research Division
16	The Survey of Norovirus Contamination of Ground Water and the Suggestion of Management Plan (Ⅲ)	120	Water Supply and Sewerage Research Division
17	A Study on the Current Status of Water Treatment Standards and the Improvement Measures (Ⅱ)	50	Water Supply and Sewerage Research Division
18	Investigation of Pathogenic Microorganisms in Groundwater Around Livestock Burial Sites (Ⅴ)	160	Water Supply and Sewerage Research Division
19	Establishment of Prompt Identification Techniques for Unknown Pollutants in Response to Environmental Pollution Accidents (Ⅰ) - Focusing on Water Quality and Fish Using GC/MS -	50	Environmental Measurement and Analysis Center
20	Establishment of Pollutant Tracking Methods in Multimedia System for Responding to Environmental Issue (Ⅱ) - Analysis on Stable Isotope Ratios of Organic and Inorganic Matters and Establishment of Pollution Tracing Techniques -	50	Environmental Measurement and Analysis Center
21	A Study on Tracking Long-distace Movement of Mercury and Pollutants Using Stable Isotopes (Ⅰ) - Accuracy and Precision Evaluation of Analysis on Mercury Stable Isotopes Using Certified Reference Materials and the Application to Physiological Samples -	70	Environmental Measurement and Analysis Center
22	A Study on Development of Standard Samples for Environmental Proficiency Tests (2015)	320	Environmental Measurement and Analysis Center
23	Stuclies on Valiclity of Introduction for Flowmeter Type Approval at Water discharge facility (Ⅱ)	60	Environmental Measurement and Analysis Center
24	A study on the provision of analytical methods for the non-regulated concern pollutants (Ⅱ)	50	Environmental Measurement and Analysis Center
25	Research base establishment for environmental pollution trace using stable isotope (Ⅱ)	100	Environmental Measurement and Analysis Center
26	Development of Measurement Uncertainty Evaluation System for Air Quality Data	50	Environmental Measurement and Analysis Center
27	Assessment of Fate and Transport Characteristics for New Soil Contaminants (Ⅱ)	227	Soil and Groundwater Research Division
28	A Study on Naturally Occurring Radioactive Materials in Groundwater in South Korea (2015)	361	Soil and Groundwater Research Division
29	Investigation of Unregulated Contaminants in Groundwater Based on the Priority List (2015)	173	Soil and Groundwater Research Division
30	A Study on Naturally Occurring Radioactive Materials in Groundwater in Multi-geologic Areas (2015)	350	Soil and Groundwater Research Division

No.	Project	Budget (million KRW)	Division
31	A Study on Advancement of Soil Contamination Standards (2015)	146	Soil and Groundwater Research Division
32	A Pilot Study on Potable Groundwater Management in Areas With Limited Water Supply (Ⅱ)	200	Soil and Groundwater Research Division
33	A Pilot Project for Risk Assessment in Areas with Pollution of Natural Origin (2015)	150	Soil and Groundwater Research Division
34	A Detailed Investigation on 'Safe Groundwater' and Research on the Systemization (Ⅱ)	2600	Soil and Groundwater Research Division
35	A Pilot Project for Risk Assessment in Soil Contamination Areas and its Advancement (2015)	250	Soil and Groundwater Research Division
36	A Survey on Contamination Status Including Background Concentrations in Groundwater in Livestock Complexes (2015)	1580	Soil and Groundwater Research Division
37	Investigation of Well Water Quality in Areas Near Carcass Disposal Sites (2015)	552	Soil and Groundwater Research Division
38	Determining Background Concentrations in Groundwater and Improving Water Quality Criteria (Ⅲ)	80	Soil and Groundwater Research Division
39	A Study on Environmental Effects of Residual Chemicals in Golf Course Areas (Ⅱ)	90	Soil and Groundwater Research Division
40	A Survey on the Distribution Status of Naturally Occurring Radioactive Materials in Soil (2015)	800	Soil and Groundwater Research Division
41	A Study on Guidelines for Detailed Soil Investigation and Soil Remediation Verification (Ⅱ)	100	Soil and Groundwater Research Division

Transportation Pollution Research Center

No.	Project	Budget (million KRW)	Division
Subtotal	15 projects	1,761	
1	Establishment of Statistics on National Air Pollutant Emission for Transportation Section (Ⅱ)	60	Transportation Pollution Research Center
2	Emissions Standard Improvement for In-use Vehicles Using Database of the Test Results	61	Transportation Pollution Research Center
3	A Study on Characteristics of Exhaust Gases According to Fuel Additives and Improvement of the Test Procedures	80	Transportation Pollution Research Center
4	The Study on the Emission Characteristics of Mobile Source Air Toxics and Management Strategy (Ⅱ)	100	Transportation Pollution Research Center
5	Development of Light Duty Vehicle Emission Factors and Inventories Based on Experimental Results over Various Driving Cycles and Operating Conditions (Ⅱ) - A Study on the Activity of the Transport Sector and Advancement of Local Allocations -	200	Transportation Pollution Research Center
6	A Study on Measures to Improve the Performance of DPF for In-use Vehicles and Construction Equipment (Ⅱ) - Supporting Post-management of In-use Vehicles' Emissions Reduction Devices -	40	Transportation Pollution Research Center
7	Selection of Test Vehicles for Checking Emission Defects of Production Cars (2015)	220	Transportation Pollution Research Center
8	A Study on Introduction of the Global Technical Regulation and Effective Vehicle Emission Reduction in Real-driving Conditions (Ⅱ)	80	Transportation Pollution Research Center
9	Characteristics of Hazardous Pollutants Emitted under Actual Driving Conditions	250	Transportation Pollution Research Center

No.	Project	Budget (million KRW)	Division
10	A Study on Measures to Improve the Performance of DPF for In-use Vehicles and Construction Equipment (Ⅲ)	100	Transportation Pollution Research Center
11	A Study on Emissions Evaluation for Heavy-duty Hybrid Cars Using the International Standard Test Methods	130	Transportation Pollution Research Center
12	Measurement of Emissions from Small Vehicles Under Actual Driving Conditions	140	Transportation Pollution Research Center
13	Evaluation of Pollution Distribution According to the Management Policy for Mobile Pollution Sources and Changes in Exposed Population	100	Transportation Pollution Research Center
14	Characteristics of Secondary Particulate Air Pollution Generated by Vehicle Emission Particles and Gases	120	Transportation Pollution Research Center
15	A Study on the Development of Greenhouse Gas Emission Factor and Emission Estimation from the Domestic Coastal Shipping (Ⅲ)	80	Transportation Pollution Research Center

Four Major River Research Center

No.	Project	Budget (million KRW)	Division
Subtotal	7 projects	874	
1	A Study on Algae Prevention and Control by Removing Resting Spores in Lake Uiam (Ⅰ)	125	Han River Research Center
2	Comprehensive Diagnosis and Assessment for Water Conservation in Paldang Basin (Ⅰ)	95	Han River Research Center
3	A Study on Nonpoint Source Pollution Management and Reduction for Highland Agriculture in Doam Lake Areas (Ⅰ)	74	Han River Research Center
4	A Study on Physiological and Ecological Characteristics of Algae in Lake Paldang (Ⅱ)	100	Han River Research Center
5	A Study on Management of Hazardous Substances of Industrial Waste Origin in Nakdong River Water System (Ⅰ)	164	Nakdong River Research Center
6	Evaluation and Management of the Behavior of Non-degradable Substances from Forests in Lakes Used for Water Supply (Ⅰ)	193	Geum River Research Center
7	A Study on the Effect of Agricultural Reservoir on the Mainstream Water Quality and Algal Blooms In Youngsan River Water system (Ⅰ)	123	Yeongsan River Research Center

National Wetlands Center

No.	Project	Budget (million KRW)	Division
Subtotal	6 projects	1,366	
1	The 3nd General Survey on National Inland Wetlands (2015)	203	National Wetlands Center
2	The 3nd Intensive Survey on National Inland Wetlands (2015)	218	National Wetlands Center
3	A Study on Soil Characteristics for Conservation and Management of Mountain Wetlands (Ⅱ)	50	National Wetlands Center
4	The 2nd Intensive Survey on Estuarine Ecosystem (2015)	128	National Wetlands Center
5	The Second Phase of Intensive Survey on the Wetland Protected Areas (2015)	300	National Wetlands Center
6	The Primary Monitoring for National Inland Wetlands (2015)	467	National Wetlands Center

SCI Paper List

No.	Title	Journal	Vol.	Page
1	A systems toxicology approach on the mechanism of uptake and toxicity of MWCNT in Caenorhabditis elegans	Chemico-Biological Interactions	239(1163)	153-163
2	Analysis of Long-Range Transport of Carbon Dioxide and Its High Concentration Events over East Asian Region Using GOSAT Data and GEOS-Chem Modeling	Advances in Meteorology	680264	1-13
3	Antimicrobial air filters using natural euscaphis japonica nanoparticles	PLoS One	10(5)	0126481-0126495
4	Application of barley straw to dammed river for algal control	Desalination and Water Treatment	54(2015)	3728-3736
5	Assessment of future climate change impacts on snowmelt and stream water quality for a mountainous high-elevation watershed using SWAT	Paddy and Water Environment	13(0)	557-569
6	Assessment of soil loss in South Korea based on land-cover type	Stochastic Environmental Research and Risk Assessment	29(8)	2127-2141
7	Behavior of Air Particles Associated with Atmospheric Recirculation over Complex Coastal Area	Asia-Pacific Journal of Atmospheric Sciences	51(4)	311-322
8	Bioavailability of heavy metals in soils : definitions and practical implementation - a critical review	Environmental Geochemistry and Health	37(6)	1041-1061
9	Characteristics of residual metals from phosphorus removal in sewage treatment plants around Paldang lake, Korea	Desalination and Water Treatment	53(7)	1888-1894
10	Characterization of Aerosol Composition Concentrations and Sources at Baengnyeong Island, Korea using an Aerosol Mass Spectrometer	Atmospheric Environment	2015(120)	297-306
11	Characterization of River Natural Organic Matter by High-Performance Size Exclusion Chromatography	Analytical Letters	48(1)	2936-2946
12	Characterizations of organic compounds in diesel exhaust particulates	Journal of Environmental Sciences-China	34(8)	171-183
13	Chemical Composition of Water Soluble Inorganic Species in Precipitation at Shihwa Basin, Korea	Atmosphere	2015(6)	732-750
14	Chlorophyll-a concentration estimation using three difference bio-optical algorithms, including a correction for the low concentration range : the case of the Yiam reservoir, Korea	Remote Sensing Letters	7(5)	407-416
15	Comparative Studies of Different Imputation Methods for Recovering Streamflow Observation	Water	7(12)	6847-6860
16	Comparison of nanoparticle exposure levels based on facility type small-scale laboratories, large-scale manufacturing workplaces, and unintended nanoparticle-emitting workplaces	Aerosol and air quality research	15(1)	1967-1978
17	Comparison of the treatment performance of hybridconstructed wetlands treating stormwater runoff	Water Science and Technology	72(12)	2243-2250
18	Comparisons of the nanoparticle emission characteristics between GDI and PFI vehicles	Journal of Nanoparticle Research	2015(17)	486-499
19	Continuous aerosol size separator using inertial microfluidics and its application to airborne bacteria and viruses	Lab On a Chip	15(0)	1889-1897

No.	Title	Journal	Vol.	Page
20	Degradation of algae and cyanobacteria in water supply source using dielectric barrier discharge (DBD) plasma	Research Journal of Biotechnology	10(8)	58-65
21	Development of Enhanced Primer Sets for Detection of Norovirus	Biomed Research International	2015(103052)	1-9
22	Dissolved air flotation separation for pretreatment of membrane bioreactor in domestic wastewater treatment	Journal of Water Supply Research and Technology-Aqua	64(2)	186-193
23	Ecotoxicity of bare and coated silver nanoparticles in the aquatic midge, Chironomus riparius	Environmental Toxicology and Chemistry	34(9)	2023-2032
24	Effect of anthropogenic sulphate aerosol in China on the drought in the western-to-central US	Scientific Reports	5(14305)	1-8
25	Effect of Volatile Fatty Acid Concentration on Anaerobic Degradation Rate from Field Anaerobic Digestion Facilities Treating Food Waste Leachate in South Korea	E-Journal of Chemistry	640717(1)	1-9
26	Effects of leaf nitrogen allocation on the photosynthetic nitrogenuse efficiency of seedlings of three tropical species in Indonesia	Journal of the Korean Society for Applied Biological Chemistry	58(4)	511-519
27	Enhanced sonocatalytic treatment of ibuprofen by mechanical mixing and reusable magnetic core titanium dioxide	Chemical Engineering Journal	264(3)	522-530
28	Enhancement of Nutrient Removal in a Hybrid Constructed Wetland Utilizing an Electric Fan Air Blower with Renewable Energy of Solar and Wind Power	E-Journal of Chemistry	813827(1)	1-8
29	Estimation of PM10 concentrations over Seoul using multiple empirical models with AERONET and MODIS data collected during the DRAGON-Asia campaign	Atmospheric Chemistry and Physics	15(2015)	319-334
30	Ethyleneglycol potentiated DDAC toxicity in human bronchial epithelial cells	Molecular & Cellular Toxicology	11(2)	147-157
31	Evaluating the efficiency of an asbestos stabilizer on ceiling tiles and the characteristics of the released asbestos fibers	Journal of Hazardous Materials	300(1)	378-386
32	Evaluation of the relationship between allergeric diseases in school children at Seoul's roadside elementary schools and air pollution	Atmospheric Pollution Research	6(6)	1004-1012
33	Evaluation of toxicity to triclosan in rats following 28 days of exposure to aerosol inhalation	Regulatory Toxicology and Pharmacology	71(2)	259-268
34	Evaluation of Watershed Susceptibility to Contaminants of Emerging Concern	Journal American Water Works Association	107(4)	174-186
35	Flavisolibacter swuensis sp. nov. Isolated from Soil	Journal of Microbiology	53(7)	442-447
36	Future ozone and oxidanats change under the RCP scenarios	Atmospheric Environment	101(2015)	103-115
37	Identification of key factors influencing primary productivity in two river-type reservoirs by using principal component regression analysis	Environmental Monitoring and Assessment	187(213)	1-12
38	Improvements of a COMS Land Surface Temperature Retrieval Algorithm Based on the Temperature Lapse Rate and Water Vapor/Aerosol Effect	Remote Sensing	7(2)	1777-1797

No.	Title	Journal	Vol.	Page
39	Influence of the fuel spray angle and the injection strategy on the emissions reduction characteristics in a diesel engine	Proc IMechE Part D: J Automobile Engineering	229(5)	563-573
40	Inhalation of talc induces infiltration of macrophages and upregulation of manganese superoxide dismutase in rats	International Journal of Toxicology	1(1)	1-9
41	Length-weight relationships of 19 freshwater fishes from Daechung Reservoir in South Korea	Applied Ichthyology	31(5)	937-938
42	Length-weight relationships of 19 freshwater fishes from Saemangeum Reservoir in South Korea	Applied Ichthyology	31(5)	951-953
43	Long-range transport of air pollutants originating in China: A possible major cause of multi-day high-PM10 episodes during cold season in Seoul, Korea	Atmospheric Environment	109(1)	23-30
44	monitoring and modeling of chlorophyll-a concentrations in rivers using a high-resolution satellite image: a case study in the naldong river, korea	International Journal of Remote Sensing	36(6)	1645-1660
45	Occurrence and removal of hazardous chemicals and toxic metals in 27 industrial wastewater treatment plants in Korea	Desalination and Water Treatment	54(1)	1141-1149
46	Optimizing low impact development (LID) for stormwater runoff treatment in urban area, Korea-Experimental and modeling approch	Water Research	08(038)	1-10
47	Performance and emission characteristics of a vehicle fueled with enriched biogas and natural gases	Applied Energy	139(1)	17-29
48	Performance IQ in children is associated with blood cadmium concentration In early pregnancy	Journal of Trace Elements in Medicine and Biology	30(1)	107-111
49	Predicting long-term change of groundwater level with regional climate model in South Korea	Geosciences Journal	19(3)	503-513
50	Prevalence of avian influenza virus in wild birds before and after the HPAI H5N8 outbreak in 2014 in South Korea	Journal of Microbiology	53(7)	475-480
51	Projections of summertime ozone concentration over East Asia under multiple IPCC SRES emission scenarios	Atmospheric Environment	106(2015)	335-346
52	Seasonal changes in mycosporine-like amino acid production rate with respect to natural phytoplankton species composition	Marine Drugs	13(11)	6740-6758
53	Sonocatalytic-TiO2 nanotube fenton, and CCl4 reactions for enhanced oxiddation, and their application to acetaminophen and naproxen degradation	Separation and Purification Technology	141	1-9
54	Source apportionment of PM10 mass and particulate carbon in the Kathmandu Valley, Nepal	Atmospheric Environment	2015(123)	190-199
55	Spatial distribution of heavy metal accumulation in the sediments after dam construction	Environmental Monitoring and Assessment	187(12)	1-14
56	Spatial relationships between radon and topographical, geological, and geochemical factors and their relevance in all of South Korea	Environmental Earth Sciences	74(74)	5155-5168
57	Spatiotemporal variations of air pollutants (O3, NO2, SO2, CO, PM10, and VOCs) with land-use types	Atmospheric Chemistry and Physics	15(1)	10857-10885

No.	Title	Journal	Vol.	Page
58	Static and dynamic flow analysis of PBDEs in plastics from used and end-of-life TVs and computer monitors by life cycle in Korea	Science of the Total Environment	506507(2015)	76-85
59	Submicron fungal fragments as another indoor biocontaminant in elementary schools	Environmental Science	17(4)	1164-1172
60	Temporal and spatial distribution of tropospheric NO_2 over Northeast Asia using OMI data during the years 2005~2010	Atmospheric Pollution Research	6(6)	768-777
61	Temporal changes in urinary levels of cadmium,N-acetyl-d-glucosaminidase and 2-microglobulin in individuals in acadmium-contaminated area Yong	Environmental Toxicology and Pharmacology	39(1)	35-41
62	The association between ambient temperature and children's lung function in Baotou, China	International Journal of Biometeorology	59(59)	791-798
63	The effect of total maximum daily loads (TMDL) program on water quality improvement in the Geum River basin, Korea	Desalination and Water Treatment	2014(12)	1-13
64	The Effects of different noise types on heart rate variability in men	Yonsei Medical Journal	56(1)	235-243
65	Tracing metal sources in core sediments of the artificial lake An-Dong, Korea: concentration and metal association	Science of the Total Environment	527(1)	384-392
66	Variation in sap flux density and its effect on stand transpiration estimates of Korean pine stands	Journal of Forest Research	20(1)	85-93

International Conference and Academic Activities

No.	Date	Research Activities	Host Country	Division
1	1.11~17	The 70th meeting for UNECE/WP29 working party for pollution and energy	Switzerland	Transportation Pollution Research Centers
2	1.26~30	The 48th meeting of the Standing Committee, the Ramsar Convention	Switzerland	National Wetlands Center
3	2.27	The 14th KOREA-JAPAN JOINT SYMPOSIUM and GOM	Japan	Risk Assessment Division
4	3.16~21	Asia and Pacific Regional Preparatory Meeting for the 2015 Conferences of the Parties to Basel, Rotterdam and Stockholm Conventions	Indonesia	Chemicals Research Division
5	4.8	International Seminar for Vehicle Emission Management in Real Driving Conditions	Korea	Transportation Pollution Research Centers
6	4.13~19	27th Meeting of Working group on National coordinators of the Test guidelines programme	France	Risk Assessment Division
7	4.16	International Symposium on 2015 World Water Forum	Korea	Water Quality Assessment Research Division
8	4.16~17	29th Meeting of the Working Group on GLP	France	Risk Assessment Division
9	5.4~15	Seventh Meeting of the Conference of the Parties to the Stockholm Convention	Switzerland	Chemicals Research Division
10	5.7~13	The 12th meeting of the Conference of the Parties to the Basel Convention	Switzerland	Resource Recirculation Research Division
11	5.9-18	Promoting the capacity buinding of MARN through establishing the Central Laboratory for Environmental Quality	Guatemala	Environmental Measurement and Analysis Cneter
12	5.19~21	NANoREG(Regulatory testing of Nanomaterials) 5th Consortium Meeting	Portugal	Risk Assessment Division
13	5.21~23	The 2nd 3R International Conference	Korea	Resource Recirculation Research Division
14	6.1~9	12th Meeting of the Conference of the Parties to the Conventtion On Wetlands, Ramsar COP12	Uruguay	National Wetlands Center
15	6.8~14	The 71th meeting for UNECE/WP29 working party for pollution and energy	Switzerland	Transportation Pollution Research Centers
16	6.12	Korea-China Air Quality joint Research Team Workshop	China	Air Quality Forecasting Center
17	6.13~19	2015 APLAC-PAC Joint Meetings & committee meeting	Sri Lanka	Environmental Measurement and Analysis Cneter
18	6.14~19	12th International Conference on Mercury as a Global Pollutant	Korea	Chemicals Research Division
19	6.15~18	7th Meeting of the Task Force on Exposure Assessment, 8th Meeting of the Task Force on Hazard Assessment	France	Risk Assessment Division

No.	Date	Research Activities	Host Country	Division
20	6.14~20	Aerosol Technology 2015 conference	Finland	Air Pollution Engineering Division
21	6.15~19	The Fourteenth Working Group on Future Development of EANET (WGFD14)	Thailand	Air Quality Research Division
22	6.17	International Workshop on Mercury Waste	Korea	Resource Recirculation Research Division
23	6.22~24	The Tripartite Policy and Technology Seminar on the Management of VOCs Emissions from Industrial Sources among China, Japan and Korea	China	Air Pollution Engineering Division
24	6.23~26	The 7th ASIATOX 2015	Korea	Risk Assessment Division
25	7.12~17	KORea-US Air Quality Study (KORUS-AQ) Committee of Research Plan Evaluation	USA	Air Quality Research Division
26	7.18~24	52nd North American Chemical Residue Workshop	USA	Environmental Measurement and Analysis Cneter
27	7.19~21	World Congress & Expo on Recycling 2015	Spain	Resource Recirculation Research Division
28	7.23	Korea-China Environmental Health Forum	Korea	Environmental Health Research Division
29	8.6~7	Korea-Japan 3rd Meeting for Bilateral Cooperation on PM$_{2.5}$ General	Korea	Transportation Pollution Research Centers
30	8.6~21	25th Goldschmidt 2015 Conference	Czech	Environmental Measurement and Analysis Cneter
31	8.15~21	The 6th Regional 3R Forum in Asia and the Pacific	Maldives	Resource Recirculation Research Division
32	8.20~21	The 2nd Working- level Meeting on Korea-Japan for Bilateral Cooperation on PM$_{2.5}$	Korea	Air Quality Forecasting Center
33	8.19~21	Fourth meeting of the task force on monitoring for EANET dry deposition	Japan	Air Quality Research Division
34	8.25~26	The Sixteenth Senior Technical Managers Meeting (STM16)	Mongolia	Air Quality Research Division
35	9.2~4	The 8th Recycling & Waste Management Exhibition	Korea	Resource Recirculation Research Division
36	9.3~4	International Conference/Exhibition on K-CIPEC	Korea	Transportation Pollution Research Centers
37	9.6~12	Expert workshop for case study of Green Space Management in German cities	Germany	Natural Environment Research Division
38	9.13~19	Technical interchange and training of the international compatibility of environmental testing	Japan	Environmental Measurement and Analysis Cneter
39	9.20~27	2015 General Meeting and Working group Meeting on Air (ISO/TC 146)	Netherlands	Indoor Environment and Noise Research Division
40	9.27~10.2	Fourth session of the International Conference on Chemicals Management (ICCM4)	Switzerland	Chemicals Research Division

No.	Date	Research Activities	Host Country	Division
41	10.4~10	2015 General Meeting and Working group Meeting on ISO/TC 190 Soil	Austria	Soil and Groundwater Research Division
42	10.6~8	The 6th GEMS Science Team Meeting	Korea	Global Environment Research Division
43	10.12~15	12th OECD training course for GLP (Good Laboratory Practice) inspectors	India	Risk Assessment Division
44	10.14~21	KORea-US Air Quality Study (KORUS-AQ) Science Team Meeting	USA	Air Quality Research Division
45	10.16	Symposium for Freshwater Ecology and Cyanobacterial Bloom Dynamics	Korea	Han River Research Center
46	10.19~23	China Hubei Sheng Environemntal measurement Center Joint presentation	China	Environmental Measurement and Analysis Cneter
47	10.26~28	The 11th meeting of the Chemical Review Committee to the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC CRC11)	Italy	Risk Assessment Division
48	10.26~28	Tripartite Seminar on Industrial Volatile Organic Compounds Management Practice among China, Japan and Korea	China	Air Pollution Engineering Division
49	11.1~5	The 6th cooperation committee on Remediation and Management of Soil and Groundwater between Korea and Taiwan	Taiwan	Soil and Groundwater Research Division
50	11.1~6	Conference for Using and referencing ISO and IEC standards to support bulinc policy	Switzerland	Environmental Measurement and Analysis Cneter
51	11.2~6	The 12th Tripartite Presidents Meeting among NIER, CRAES and NIES	Korea	Research Strategy and Plannig Division
52	11.4~6	15th Meeting of Working Party on Manufactured Nanomaterials (WPMN)	France	Risk Assessment Division
53	11.9	The 9th Tripartite Dialogue on Chemical Management policy among China, Japan and Korea Joint Research for Chemicals	China	Risk Assessment Division
54	11.18~20	The 18th Expert Meeting on Long-range Transboundary Air Pollutants in Northeast Asia	Korea	Global Environment Research Division
55	11.23~26	Meeting of the thematic working group on water, sanitation and hygiene	The Philippines	Water Supply and Sewerage Research Division
56	11.24	10th Workshop on Information Warehouse of Persistent Organic Pollutants (POPs) in the East Asian Countries	Korea	Chemicals Research Division
57	11.25~27	5th Analysis Training of Persistent Organic Pollutants (POPs) in the East Asian Countries	Korea	Chemicals Research Division
58	11.30~12.5	First Regional Training Workshop on Health, Environment and Sustainable Development (HEAD)	Korea	Environmental Health Research Division
59	12.13~18	American Geophysical Union 2015 Fall Meeting	USA	Air Quality Research Division

International Joint Research

No.	Research Topic	Country and Institute	Division
1	Research on Health effect of Environmental Pollution - Evaluation of Heavy Metal Exposure to Residents in Mining Areas in Mongolia -	Public Health Institute Mongolia	Environmental Health Research Divison
2	Monitoring and Accumulation Study on POPs by Environmental Medium	Japan/NIES	Risk Assessment Division
3	Comparative study on acute toxicity testing of 2-aminophenol using daphnia	Japan/NIES, China/CRAES	Risk Assessment Division
4	Risk and Management of Chemical Substances	Japan/NIES, China/CRAES	Risk Assessment Division
5	Development of Test Methods for Nano-material Safety (NANoREG)	EU member nations	Risk Assessment Division
6	An International Cooperative Air Quality Field Study in Korea (KORUS-AQ)	USA/NASA	Air Qualith Research Division
7	Joint Research on Acid deposition monitoring network (EANET) in East Asia	Japan/ACAP	Air Quality Research Division
8	Joint Research on International Monitoring Network for Fine Particulate (IMPROVE NETWORK)	USA/EPA and NOAA	Air Quality Research Division
9	A Study on Global Carbon Cycle Estimation Using the Greenhouse Gases Observing Satellite (GOSAT)	Japan/NIES	Global Environment Research Division
10	Establishment of Korea-China Joint Research Group	China/CRAES	Air Quality Forecasting Center
11	Research on Environmental Quality in Gaesung Industrial Complex	North Korea	Water Environment Engineering Research Division
12	GEMS/Water Programme	UNEP	Water Environment Engineering Research Division
13	Development of water quality forecasting system and data assimilation techniques for real-time water quality forecasts	Netherland/Deltares	Water Environment Engineering Research Division
14	Development of data assimilation techniques for improved accuracy of watershed models	USA/University of Texas	Water Environment Engineering Research Division
15	Korea-Japan Joint Research on Waste Resource Management and Environmental Assessment Techniques on Recycling	Japan/NIES	Resource Recirculation Research Division

International Partnership

No.	Title of Cooperation	Country and Institute	Date
1	Agreement on Improved Cooperative Environmental Research	Japan, The Institute of Public Health	Oct. 9, 1992
2	Agreement on Development of Water Improvement System	Japan, Japan International Cooperation Agency (JICA)	Jun. 10, 1993
3	Agreement on Development of Water Improvement System	Japan, JICA	Jul. 16, 1993
4	Agreement on Development of Water Improvement System	Japan, JICA	Aug. 27, 1993
5	Agreement on Establishment of Cooperative System	China, CRAES	Jun. 3, 1994
6	Agreement on Improved Cooperative Environmental Research	Japan, The Institute of Public Health	Sep. 13, 1994

No.	Title of Cooperation	Country and Institute	Date
7	Exchange of personnel and information on environmental protection technologies	Japan, National Institute of Environmental Science (NIES)	Sep. 16, 1994
8	Agreement on Implementation of Korea-China Joint Committee for Environmental Research	China, CRAES	Nov. 8, 1996
9	Mechanism and Control Techniques of Freshwater Eutrophication	Russia, the Limnological Institute of the Siberian Branch of Russian Academy of Sciences	Jan. 29, 1994
10	Exchange of Environmental Science and Technology	Russia, The Russian Research Institute for Nature Protection, State Committee of Russian Federation for Environmental Protection	Feb. 4, 1997
11	Personnel exchange and joint research projects in fields of common interest	Russia, Moscow State University	Feb. 4, 1997
12	Agreement on Implementation of Korea-China Joint Committee for Environmental Research	China, CRAES	Oct. 2, 1997
13	Memorandum of Understanding on Establishment of Korea-China Science and Technology Exchange Center	China, CRAES	Jun. 8, 1999
14	Agreement on Improvement of Cooperation for Korea-China Science and Technology Exchange Center	China, CRAES	Aug. 1, 1999
15	Memorandum of Understanding on Science and Technology Cooperation	Canada, University of British Columbia	Dec. 18, 2000
16	Compliance with existing agreements and Development and Exchange of environmental technologies	China, CRAES	Jul. 4, 2001
17	A Project for Improving Air Quality Data Compatibility and Developing Environmental Data Training Center in Northeast Asia	UN Economic and Social Commission for Asia and the Pacific (UNESCAP)	Nov. 19, 2002
18	Memorandum of Understanding on Vehicle Emissions	Joint Research Center, Directorates-General of the European Commission	Oct. 27, 2005
19	Exchange of personnel and information on environmental health	Japan, National Institute of Minamata Disease	Nov. 7, 2006
20	LIDAR research and cooperation	Germany, IfT (Leibniz Institute for Tropospheric Research)	Jan. 12, 2011
21	Mutual cooperation on establishment of international monitoring network for securing data on air quality improvement	USA, IMPROVE NETWORK Steering Committee	Dec. 27, 2012
22	Cooperation among member countries for international parity for accreditation of greenhouse gas validation and verification bodies	Asia Pacific Accreditation Cooperation	Jun. 26, 2014
23	Cooperation in the field of environmental radioactivity	Japan, Japan Chemical Analysis Center	Nov. 10, 2014
24	Development of climate and air quality modeling and measurement technologies, and exchange of personnel	USA, Air Resources Laboratory, NOAA	Dec. 24, 2014
25	Memorandum of Understanding on Joint Research Group of Air Quality Field	China, CRAES	Jun. 12, 2015
26	Memorandum of Understanding on Korea-US Joint Research of Air Quality in the Korean Peninsula (KORUS-AQ)	the USA, NASA	Oct. 14, 2015

National Institute of
Environmental Research
Republic of Korea

NIER takes the lead to improve the people's quality of life with better 'environmental services.'

Since its establishment as the National Environmental Protection Institute in 1978, NIER has been committed to supporting the development of Korea's environmental policy and institutions, addressing urgent environmental issues and leading environmental research.

To realize environmental welfare, NIER conducts research in a wide range of fields including environmental health, climate & air, water, resources, energy, indoor environment and soil. Building upon our accumulated scientific knowledge and expertise in the environment, we have contributed to developing Korea's environmental science and technology, improving environmental policy and addressing environmental problems which directly affect people's lives.

The effect of recent various environmental issues including particulate matter, algal blooms, noise and light pollution is increasingly becoming a matter of great public concern, threatening people's health. As a result, the public demands for safer and more pleasant environment are greater than ever before. We are in no position to ensure our future without consideration for the environment.

Accordingly, we will further strengthen a range of joint research projects and practical studies in order to address advanced, future-oriented and everyday life environmental issues efficiently. Based on these efforts, we set out the goal of becoming one of the world's best environmental institutions with expertise.

Going forward, we will stay committed to developing and enhancing environmental services and quality to make the people healthier and happier.

President of NIER, Jin-won Park

Our Vision

A leader of high-quality and technology-based environmental welfare policy (Becoming one of the world's best environmental institutions within 10 years)

Our Mission

For the safe and pleasant environment

For the coexistence of environmental protection and economic development

For the sustainable future society

Research Priorities

- Protecting people's health from hazardous materials

- Creating pleasant daily life environment

- Eliminating dangerous environmental factors in local communities

- Supporting policy for becoming a natural resource-rich country

- Establishing the technological base for integrated environmental management system

- Improving science-based environmental policies

- Developing the virtuous cycle of water resources management

- Supporting the sound management of national territory

- Taking pre-emptive actions and reinforcing international cooperation against climate change

HISTORY

July 1978
Established as the National Environmental Protection Institute (NEPI) in Seoul

January 1980
Reorganized as a subsidiary body of the National Environment Agency

October 1986
Renamed as the National Institute of Environmental Research (NIER)

July 2000
Relocated to the Environmental Research Complex in Incheon

May 2014
Reorganized into 5 Departments, 17 Research Divisions, 5 Research Centers, and 3 Centers

NIER Research Department

🧪 Environmental Health Research ·······················

We have strengthened research on preventive measures to protect the public health from environmental hazards.

- Producing national statistical data on environment and health such as representative values of public exposure to environmentally harmful substances and calculating environmental health indicators.
- Monitoring and evaluating health of people vulnerable to environmental pollution and investigating health impacts.
- Surveillance of avian influenza, early detection of wildlife diseases and development of response manuals.
- Risk assessment on environmental pollutants and chemicals contained in potential risk products.
- Ecological and inhalation toxicity assessment for environmental pollutants using a biological test system.
- Producing and publicizing chemical information through registration and risk assessment of chemicals.
- Trace-driven research on environmental pollutants using stable isotopes and multiple search methods.
- Research on environmental fate of chemicals of global concern: the Stockholm Convention (POPs), the Minamata Convention (mercury), etc.

🌳 Climate & Air Quality Research ·······················

We are committed to making the air we breathe cleaner and healthier.

- Establishing and operating national air quality monitoring system.
- Protecting public health by investigating the composition of particulate matter ($PM_{2.5}$) and its sources.
- International joint research on air pollution in Northeast Asia.
- Developing a geostationary environmental satellite for prediction and monitoring of climate change.
- Research on creating a low-carbon society through green lifestyle.
- Improving accuracy and credibility of emissions data through air pollutant investigation.
- Developing emissions coefficients and establishing national emissions inventory.
- Contributing to establishment of Air Quality Management Plan of Seoul Metropolitan Area.
- Providing real-time air quality forecasting service for the public and establishing national air quality forecast system.
- Improving accuracy of air pollution forecasts and the technologies.

💧 Water Environment Research ·······················

We provide support for water environment policy based on scientific research and conduct research to preemptively respond to changes in the water environment of rivers and lakes.

- Establishing management base and providing technical support for the Total Water Pollution Load Management System and non-point pollutant sources.
- Investigating causes of water pollution nationwide and establishing a foundation for integrated management of pollutants.
- Research on standards of water environment and industrial wastewater.
- Assessment of environmental quality of sediments.
- Evaluating aquatic health of rivers and studying algal bloom mechanisms.
- The world's first river water quality forecasting system.
- Research on physiological and ecological characteristics of algae and pre-emptive measures to control algal blooms.
- Research on harmful substances originated from industrial wastewater in Nakdong River.
- Research on fate evaluation and management of non-degradable substances originated from forests in lakes used for water supplies.
- Research on the impacts of reservoirs for agricultural purposes in Yeongsan River water systems on the mainstream sections and algal blooms.

NIER Research Department

Environmental Health Research

We have strengthened research on preventive measures to protect the public health from environmental hazards.
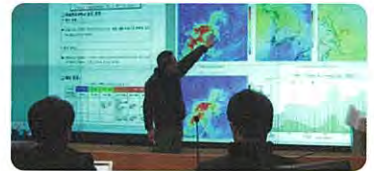

- Producing national statistical data on environment and health such as representative values of public exposure to environmentally harmful substances and calculating environmental health indicators.
- Monitoring and evaluating health of people vulnerable to environmental pollution and investigating health impacts.
- Surveillance of avian influenza, early detection of wildlife diseases and development of response manuals.
- Risk assessment on environmental pollutants and chemicals contained in potential risk products.
- Ecological and inhalation toxicity assessment for environmental pollutants using a biological test system.
- Producing and publicizing chemical information through registration and risk assessment of chemicals.
- Trace-driven research on environmental pollutants using stable isotopes and multiple search methods.
- Research on environmental fate of chemicals of global concern: the Stockholm Convention (POPs), the Minamata Convention (mercury), etc.

Climate & Air Quality Research

We are committed to making the air we breathe cleaner and healthier.

- Establishing and operating national air quality monitoring system.
- Protecting public health by investigating the composition of particulate matter ($PM_{2.5}$) and its sources.
- International joint research on air pollution in Northeast Asia.
- Developing a geostationary environmental satellite for prediction and monitoring of climate change.
- Research on creating a low-carbon society through green lifestyle.
- Improving accuracy and credibility of emissions data through air pollutant investigation.
- Developing emissions coefficients and establishing national emissions inventory.
- Contributing to establishment of Air Quality Management Plan of Seoul Metropolitan Area.
- Providing real-time air quality forecasting service for the public and establishing national air quality forecast system.
- Improving accuracy of air pollution forecasts and the technologies.

Water Environment Research

We provide support for water environment policy based on scientific research and conduct research to preemptively respond to changes in the water environment of rivers and lakes.

- Establishing management base and providing technical support for the Total Water Pollution Load Management System and non-point pollutant sources.
- Investigating causes of water pollution nationwide and establishing a foundation for integrated management of pollutants.
- Research on standards of water environment and industrial wastewater.
- Assessment of environmental quality of sediments.
- Evaluating aquatic health of rivers and studying algal bloom mechanisms.
- The world's first river water quality forecasting system.
- Research on physiological and ecological characteristics of algae and pre-emptive measures to control algal blooms.
- Research on harmful substances originated from industrial wastewater in Nakdong River.
- Research on fate evaluation and management of non-degradable substances originated from forests in lakes used for water supplies.
- Research on the impacts of reservoirs for agricultural purposes in Yeongsan River water systems on the mainstream sections and algal blooms.

Environmental Resources Research

Environmental Health Research

Environmental Infrastructure Research

Climate & Air Quality Research

Transportation Pollution Research

Water Environment Research

Wetland Research

NIER is committed to conducting valuable environmental studies for our next generations

Environmental Resources Research

We are at the forefront of realizing a healthy ecosystem by creating a virtuous cycle of resource recirculation.

- Improving waste classification system for safer management of hazardous waste.
- Supporting environmental evaluation system for recycled products to reuse and recycle waste resources safely.
- Preparing methods to maximize energy recovery through safe waste treatment.
- Spatializing environmental information and developing environmental planning techniques for the linkage of spatial planning and environmental planning system.
- Reviewing environmental impact assessments and developing environmental impact index and prediction techniques.
- Collecting and preserving environmental samples at the National Environmental Specimen Bank.

Environmental Infrastructure Research

We are committed to improving the quality of people's lives by creating better living environment.

- Improving indoor air quality in multi-use facilities, houses, etc.
- Reducing harmful factors in living environment including noise, light pollution, asbestos and electromagnetic waves.
- Strengthening safety management of drinking-water.
- Developing standards for public wastewater treatment.
- Developing drinking-water management system for pathogenic microorganism treatment.
- Establishing quality control system for environmental test and inspection organizations to comply with international standards.
- Securing international equality in official test standards for environmental pollution through compliance with KS and ISO.
- Establishing a foundation for trace-driven research with strategic environmental research equipment.
- Strengthening risk assessments to improve treatment of contaminated soil.
- Introducing evaluation and reduction methods for groundwater contamination in rural communities.

Transportation Pollution Research

We conduct research on mobile air pollution sources from various angles and support the national transportation environment policy.

- Improving air quality by controlling vehicle emissions under real road conditions.
- Standardizing vehicle test methods internationally for certifications and follow-up management of production cars.
- Regular and frequent tests for production cars and defect inspection for in-use cars.
- Developing national emissions coefficients in the transportation sector and improving emissions estimation methods.
- Research on proper management of trace hazardous substances in traffic.
- Conducting performance assessment of emissions reduction devices and technologies and distributing eco-friendly vehicles.
- Developing quality management and assessment methods for vehicle fuels, additives and catalysts.

Wetland Research

We conduct research and investigation on effective preservation and management of inland wetlands and promote public awareness of wetlands.

- Proposing designation of wetland protected areas and Ramsar sites.
- Establishing an inventory and a database of inland wetlands across the nation.
- Introducing Wetland City Accreditation of the Ramsar Convention.

Q What does NIER do?

>> Research for resolving environmental problems that are closely linked to people's lives.

① We provide reliable air quality information through improved accuracy of fine particle concentrations.
② We increase the accuracy of water quality forecasts to respond to variations in aquatic environment through advanced algal monitoring system.
③ We expand surveillance of avian influenza and identify causes by establishing Biosafety Testing building.

>> Research to find scientific grounds required for environmental systems and policies.

① We study domestic implementation of emissions management system for diesel vehicles under actual on-road driving conditions.
② We prepare the draft guidelines to reduce environmental exposure of vulnerable populations by conducting comprehensive evaluation and analysis on results of health impact assessment on mothers, young children and the elderly.
③ We prepare the foundation of indoor environmental management for inter-floor noise, light pollution and indoor radon.

>> Research to create a sustainable future.

① We develop a geostationary environmental satellite to be launched in 2019.
② We strengthen research of tracing pollution sources through environmental forensic sciences.
③ We study safe recycling and reuse of waste resources and waste-to-energy.

ORGANIZATION

President

- Research Support Division
- Research Strategy and Planning Division
- Transportation Pollution Research Center
- Four Major River Research Centers
- National Wetlands Center

Environmental Health Research Department
- Environmental Health Research Division
- Risk Assessment Division
- Chemicals Research Division

Climate and Air Quality Research Department
- Air Quality Research Division
- Global Environment Research Division
- Air Pollution Engineering Division
- Air Quality Forecasting Center

Water Environment Research Department
- Watershed and Total Load Management Research Division
- Water Environmental Engineering Research Division
- Water Quality Assessment Research Division

Environmental Resources Research Department
- Resource Recirculation Research Division
- Waste Energy Research Division
- Natural Environment Research Division

Environmental Infrastructure Research Department
- Indoor Environment and Noise Research Division
- Water Supply And Sewerage Research Division
- Environmental Measurement and Analysis Center
- Soil and Groundwater Research Division

Main Functions and Roles

1. Installation and operation of environment monitoring network and control center for air and water quality.
2. Installation and operation of environment facilities such as wastewater and sewage disposal and waste to energy recovery.
3. Research on evaluation of soil and groundwater environment and management of its remediation
4. Reduction, circulation, and eco-friendly disposal of wastes.
5. Examination, analysis, harmful test, and evaluation management of chemical materials that are harmful to the environment.
6. Handling of international agreement on environmental issues such as climate changes and reduction of greenhouse gas emission.
7. Development and support of policy research related to prevention of environmental pollution and environmental improvement and resource circulation.

Communication & Location

Homepage	www.keco.or.kr
Facebook	www.facebook.com/kecopr
Blog	blog.naver.com/kecoprumy
Twitter	www.twitter.com/kecotwt

Division	Address	Telephone
Head office	Enviroment Research Complex, 42, Hwangyeong-ro, Seo-gu, Incheon	82-32-590-4000
HQ of Eastern Metropolitan Area	42, Jangmi-ro, Bundang-gu, Seongnam-si, Gyeonggi-do	82-31-776-5103
HQ of Western Metropolitan Area	8F, Gangseo IT valley, 82, Hwagok-ro 68-gil, Gangseo-gu, Seoul	82-2-3513-0616
HQ of Busan Ulsan Gyeongnam Region	34, 681gil, Nakdongbuk-ro, Buk-gu, Busan	82-51-366-3606
HQ of Daegu Gyeongbuk Region	209, Muhak-ro, Suseong-gu, Daegu	82-53-280-3887
HQ of Chungcheong Region	156, Cheongsa-ro, Seo-gu, Daejeon	82-42-939-2211
HQ of Honam Region	217, Mujin-daero, Gwangsan-gu, Gwangju	82-62-949-0704

Keco
Korea Environment Corporation

Closer to Nature, Closer to People

Keco
Korea Environment Corporation

Preserves Clean Air

Keco

| GHG Reduction Policy Support

▶ Support for Greenhouse Gas Emission Trading Policy
▷ Operation and Management of Compliance Offset Program
▶ Establishment of National and Local Infrastructure for Greenhouse Gas Management
▷ Operation of GHG and Energy Target Management Scheme
▶ Establishment of Foundation for Management and Processing of Air Conditioner Refrigerant

| Reinforcement of Capacity for Climate Change Response

▶ Nurturing Professionals for GHS Management
▷ Operation of Carbon Points System
▶ Operation and Support of Graduate Schools Specialized in Climate Change
▷ Support for Designation and Operation of Green Campus
▶ Operation of Promotion Portal for Climate Change

| Management of Ambient Air Quality and Environment

▶ Operation and Management of National Ambient Air Quality Monitoring Network
▷ Operation of the Air Pollutant Emission-Total Management System in Seoul Metropolitan Business Fields
▶ Operation of Smokestack Tele-Monitoring System
▷ Operation of Road Dust Mobile Monitoring System

| Management of Vehicle Environment

▶ Vehicle Certification Test and Inspection
▷ Regular Check of Remote Sensing Device for On-Road Vehicle Emission Gas (RSD)
▶ Activation of Vehicle Supply
▷ Operation of Integrated Management System for Vehicle Emission

Makes Clean Water and Soil

Keco

| Sewerage Policy Support

▶ Establishment and Management of Integrated Sewerage Information Database System
▷ Technical and Institutional Support for Sewerage Network System and Urban Inundation Prevention.

| Water Policy Support

▶ Integrated Operation of Regional Water Network
▷ Establishment of Water Network Optimization System
▶ Sewage Advancement Program for Urban Inundation Prevention
▷ Demonstration Project for Military WASCO

| Soil and Underground Water Management

▶ Soil Investigation and Purification of Polluted Soil
▷ Verification of Soil Purification
▶ Evaluation of Soil Risk
▷ Evaluation of Soil Environment
▶ Installation and Operation of Underground Water Quality Monitoring Network
▷ Investigation and Management of Areas with Polluted Underground Water

| Water Pollution Management and Control

▶ Water pollution Incident Monitoring and Recovering
▷ Management and Operation of National Auto Water Quality Monitoring Network
▶ Establishment and Operation of Remote Water Quality Monitoring System
▷ Technical Support for Ecological Toxicity Management System

Facilitates Resource Circulation

Keco

| Resource Circulation Program

▶ Confiscated Goods Recycling Program
▷ Financial Support for the Establishment of Recycling Businesses and Technical Consulting
▶ Provision of Environment Statistical Information
▷ Packaging Material and Method Inspection and Material Test for Recycling Mark
▶ Agricultural Waste Collection and Disposal Program

| Operation and Management of Resource Circulation System

▶ Eco-Assurance System
▷ Waste Charge System
▶ Extended Producer Responsibility System
▷ Recycling Mark System

| Waste Management

▶ Operation of Allbaro System
▷ Business Wastes Reduction System
▶ Operation of RFID-Based Integrated Food Waste Management System
▷ Operation of Export and Import Wastes Portal
▶ Operation of The Recyclable Resources Market
▷ Operation of Livestock Excreta Electronic Transfer Management System

| Management of Waste to Energy

▶ Inspection of SRF(Solid Refuse Fuel) Quality and Manufacture·Use Facility
▷ Management of Integrated Waste to Energy Information System

Keco

Keco

| Installation Support of Aquatic Ecology Restoration and Water Treatment Facility

▶ Ecological Restoration for the Riparian Area
▷ Non-Point Pollution Reduction
▶ Support for Water Treatment Facility Installation

| Installation and Operation of Water and Sewage Facility

▶ Support for Water and Sewage Facility Installation
▷ Validity Evaluation of Environmental Facility Design
▶ Integrated Operation of Local Sewage Systems
▷ Sewage Advancement Program for Urban Inundation Prevention
▶ Technical diagnosis and supports for wastewater treatment facilities and sewer system

| Installation and Support of Low Carbon Energy Facility

▶ Expansion of Foundation for Waste to Energy Facility
▷ Installation and Support of Waste Treatment, Waste to Energy Facility
▶ Survey and Evaluation of Waste Treatment Facility Installation and Operation

| Expansion of International Business

▶ Promotion of International Environment Projects
▷ International Environment Exchange & Cooperation

| Provision of Life-Based Environmental Services

▶ Operation of Environmental Love PR Center
▷ Operation of Among Neighbors Center for Floor Noise
▶ Light Pollution Investigation and Foundation Establishment
▷ Operation and Management of Noise and Vibration Monitoring Network
▶ Operation and Management of Indoor Air Quality Automatic Monitoring Network
▷ Technical Diagnosis of Malodor in Public Environmental Facilities and Technical Support for Business Sites with Malodor

| Provision of Environmental Public Health Service

▶ Free Measuring and Reduction Consulting Service on Radon
▷ Operation of Asbestos Damage Relief System
▶ Asbestos inspection and analysis

| Management of Hazardous Materials

▶ Inspection and Diagnosis of harmful chemical substance handling facilities
▷ Test and analysis of hazardous materials
▶ Good Laboratory Practice (GLP)

| Prevention and Reduction of Pollutant Discharge

▶ Vapor Collection Facility and Low-NOx Monitoring
▷ Environmental Monitoring Equipment Inspection
▶ Technical Diagnosis on Water Treatment Sewage Pipe in Public Environmental Facility
▷ Inspection and Diagnosis of Waste Treatment Facilities
▶ Test, Inspection and Certification of Environmental Products

Korea Environment Corporation

Keco

K eco will make an environmental welfare society where every person in Korea can enjoy the healthy environment

Korea Environment Corporation

Overview

Establishment	January 1. 2010
Classification	Commissioned-service-based quasi-governmental instiutions

Background and Objective of Foundation

K eco aims to contribute to the eco-friendly development of Korea by effectively operating prevention of environmental pollution, improvement of environment, and promotion of resource circulation and business related to greenhouse gas to adapt to climate changes
(Law No. 12519 of K eco Act)

01 Mission
Contribution to the development of eco-friendly nation by improving environment and promoting resource circulation

02 Vision
Create more healthy and happy environment for human and nature

Core Value
| Professionalism | Entrepreneurship |
| Customer focus | Globalization |

Management Policies
| Innovation | Harmony | Transparency |

History

1980. 9	Establishment of Korea Resources Recovery and Reutilization Corporation (KORECO)
1987. 3	Enactment of Environment Pollution Control Agency
1987. 11	Establishment of Environmental Management Corporation Act (Name changes from Environment Pollution Control Agency to Environment Management Corporation(EMC))
2004. 7	Enactment of Korea Environment&Resources Corpora tion Act (Name changes from Korea Resource Recovery and Reutilization Corporation to Korea Environment & Resources Corporation(ENVICO))
2008. 8	Integration of ENVICO and EMC (as the 2nd Public Organization Advancement Plan)
2009. 2	Enactment and declaration of Korea Environment Corporation Act, Start of Korea Environment Corporation establishment committee (Implementation of organization integration)
2010. 1	Establishment of Korea Environment Corporation
2012. 5	Amendment of Korea Environment Corporation Act

5 Strategic Directions 15 Strategic Initiatives

01 Response to air pollution and climate change
- Strengthen resilience and adaptative capacity to combat climate change and it's impacts
- combat climate change and it's impacts Establish a scientific air quality monitoring system
- Advance air pollutants management

02 Create healthy water environment
- Enhance water risk management
- Restore water-related ecosystem
- Build and manage water infrastructure for sustainable development

03 Build a sustainable resource circulation society
- Advance resource circulation management
- Strengthen ICT based waste management system
- Establish waste-to-energy system

04 Create safe living environment
- Ensure safety environment from hazardous chemicals
- Expand environmental services for daily lives
- Improve safety of soil environment

05 Implement capacity development to prepare for the future
- Promote potential growth engines and Endeavour to foster them
- Enhance business and security management capacity
- Improve public trust

SOOSIRO
Water Tele Monitoring System

Part 1

What is Water Tele Monitoring System?

Water TMS is on-line system monitoring water pollutant discharged from sewage-waste water treatment plants and wastewater discharging facilities by automatic measuring instrument installed in the each facility.

Related legislation

Article 38, Section 2 to Section 5 of the 『WATER QUALITY AND ECOSYSTEM CONSERVATION ACT』
Article 35 and Article 37 of the 『WATER QUALITY AND ECOSYSTEM CONSERVATION ENFORCEMENT』
Regulation of TMS control center operation [Ministry of Environment, 2010-107]

Effects of Water TMS

- To increase effectiveness and transparency in environment administration
- To promote reliability, transparency and continuity in policy
- To clean up irrationality with promoting efficiency in inspection of discharging facilities

Administrative authority

- To resolve distrust in facilities discharging water pollutant

Local resident & Civil group

Facilities

Water Tele Monitoring System
SOOSIRO

Environment

- To prevent violation of regulation by predicting / warning system
- To Improve waste water treatment procedure by understanding discharging water quality in real-time

- To prevent water pollution accident
- To improve river water quality by improving discharging water quality

Water Tele Monitoring System
SOOSIRO

The meaning of SOOSIRO is "always, all the time" in Korean language. It stands for the constant monitoring system managing wastewater quality changing constantly.

Water Tele Monitoring System
SOOSIRO

Part 2

How do we operate Water TMS control center?

Water TMS control center issues pollution alert when real-time data exceeds the effluent standard so that facilities and administrative offices can take prompt and adequate action.

WATER TMS FACILITIES

TMS STATION

Public sewer treatment facilities

Waste water terminal treatment facilities

Place of business of class I ~ III

- To collect data every 10 seconds from each Automatic measuring instrument
- To make 5min / 1hr data

- Dump
- Request Real Time Data
- Reboot Data logger
- Change password
- Remote sampling

REMOTE COMMANI

INTERNET

send data to TMS center every

PREDICTIVE / WARNING SYSTEM

Water TMS control center issu
Alert when real-time d

TMS STATION

T-N / T-P   BOD / COD
pH / SS   Data logger
Auto sampler

MEASURED ITEMS
• Organic matter(COD/BOD)
• Suspended Solids(SS)
• Total Nitrogen(T-N)
• Total Phosphorus(T-P)
• Potential of Hydrogen(pH)

Functions of Water TMS center

- To collect real-time water quality data
- To provide water quality information with the Ministry of Environment and Local governments
- To impose effluent charges after judging whether pollution exceeds the standard or not
- To provide predictive/warning system(SMS, ARS, FAX)
- To check measuring instruments state by on-line control
- To recollect untransmitted data

- Real time data
- Administrative data

ADMINISTRATIVE AUTHORITY

Local Authority
or basin environmental office

Ministry of Environment

USAGE OF ADMINISTRATIVE DATA

- To check whether pollution exceeds the standard or not
- To impose effluent charges
- To implement administration

Part 3

Which Facilities should install Water TMS?

Public sewer treatment facilities, Waste water terminal treatment facilities and Place of business of class I~III over a certain size are required to install measuring instruments and send real time data to TMS control center.

Water Tele Monitoring system
Water TMS control center

The status of TMS station (2014. 9)

SOOSIRO Total	Section	Public sewer treatment facilities	Waste water terminal treatment facilities	Place of business	Total
	Stations	529	103	236	868

SOOSIRO SUDOKWON	Section	Public sewer treatment facilities	Waste water terminal treatment facilities	Place of business	Total
	Stations	200	22	86	308

SOOSIRO CHUNGCHEONG	Section	Public sewer treatment facilities	Waste water terminal treatment facilities	Place of business	Total
	Stations	90	39	58	187

SOOSIRO HONAM	Section	Public sewer treatment facilities	Waste water terminal treatment facilities	Place of business	Total
	Stations	102	15	38	155

SOOSIRO YEONGNAM	Section	Public sewer treatment facilities	Waste water terminal treatment facilities	Place of business	Total
	Stations	137	27	54	218

SUDOKWON (308)

CHUNGCHEONG (187)

YEONGNAM (218)

HONAM (155)

Home page (http://www.soosiro.or.kr)

www.soosiro.or.kr

For more information about water TMS, please visit our Web site

Water TMS Control Center

Water TMS Control Center	Assignment Area	Address	TEL
Water TMS Center		Korea Environment Corporation 42 Hwangyeong-ro, Seo-gu Incheon	+82-32-590-3955
Eastern SUDOKWON Control Center	Sudokwon, Kangwonkwon	612 Leaders B/D, 42 Jangmi-ro Bundang-gu, Seongnam-si Gyeonggi-do	+82-31-776-5132
CHUNGCHEONG Control Center	Chungcheongkwon	5F 156 Cheongsa-ro, Seo-gu Daejeon	+82-42-939-2253
HONAM Control Center	Honamkwon	217 Mujin-daero, Gwangsan-gu Gwangju	+82-62-945-0433
GYEONGBUK Control Center	Yeongnamkwon	209 Muhak-ro, Suseong-gu Daegu	+82-53-280-3871