Delegation of Tanah Sutera Development

Accompanied by Overseas Dept. of EMRO and EMRO Malaysia

Period: March 10th -14th, 2013

Location: Okinawa, Japan

Number of Delegation: 19 people

REFERENCE

1. NPO Nozomi No Sato (Haebaru town)
2. Yonabaru Monastery (St. Clare Catholic Church Yonabaru)
3. EM Wellness Resort COSTA VISTA Okinawa Hotel & Spa
   - 3-1. What is EM Wellness Resort?
   - 3-2. Before and After the Renovation
   - 3-3. EM Spa CORAZON Okinawa
   - 3-4. EM Diatomite Showroom
   - 3-5. EM Recycled Water System
   - 3-6. Hotel's Food Waste Recycle System
4. EMRO- Sunshine Farm
5. Uruma City Library
6. EM Construction at T-House
   - 6-1. Examination of EM Concrete at T-House
7. EM Construction at Y-House (Uruma city)
8. EM Construction Sites
   - 8-1. Hokuno Kaikan (Nago city)
   - 8-2. N-House (Nago city)
   - 8-3. Analysis result of chemical level in the air at N-House
9. EM Application at Meio University
10. Examples of EM Diatomite for Houses
    - 10-1. K-House (Nago city)
    - 10-2. Café (Ginowan city)
    - 10-3. Two-family House (Kadena town)
    - 10-4. M-House (Naha city)
    - 10-5. Japanese Restaurant (Nago city)
    - 10-6. Renovating the Old House (Motobu town)

1. **NPO Nozomi No Sato (Haebaru town)**

Nozomi no Sato is a NPO group dedicating to provide job assistance to disabled people by teaching work skills applying EM technology in recycling organic waste while creating a community deeply linked with the disabled. Since 2009 received an entrustment from Haebaru town office and started the recycling organic waste program.

The “Haebaru Style Recycling Loop” works as follows:

【Collection of garbage from houses and commercial kitchen】

【Reused for swine feed】

【Sale on market as “Haebaru pork”】

- EM Use:

Spraying Activated EM・1 in the hog pen, and raising pigs with EM feed

Effects: Haebaru pork do not have strong smell and it is popular for its mild sweet taste of fat

Sales of pork: Giving back safe and secure pork meat to the community

Nozomi no Sato also make their own EM compost mixing the swine manure with the recycled organic waste and Activated EM・1. This compost is used at their small farm and providing for free to the community farmers.

They grow sweet potato vine to feed the pigs besides other edible vegetables.

Recycling kitchen waste for making EM compost and feed

Hog pen

Knitting recycled clothes

Members of the Nozomi no Sato

2. **Yonabaru Monastery (St. Clare Catholic Church Yonabaru)**

Located in Yonabaru town, Southern Okinawa, the Yonabaru monastery was built in 1958 by design of the famous architect, Mr. Ken Kataoka originally from Kyoto.

In 2003 the international organization of Modern Japanese Architecture DOCOMOMO Japan selected this monastery as one of the 100 relevant buildings and it is the only one selected from Okinawa. In 2009 it was renovated using EM in construction materials aiming to control degradation of concrete rebar and prevent sick building syndrome.

EM was applied in materials such as mortar, paint, waterproofing, wall coating and adhesive agents. Furthermore, EM sheet was used inside the tatami.

Strengths of the building was proved on February 27, 2010 when a big earthquake of magnitude 6.9 (Japanese seismic scale 5) hit near Okinawa and no cracks nor damaged were found throughout the building.

The sisters and members living in the monastery also use EM in daily life such as Activated EM・1, EM Bokashi, EM Fermented Plant Extract (FPE), and also make their own made EM soap recycling the waste kitchen oil. Their hand-made EM soap is considered as less smelly and high quality soap.

View of church – during spring dandelion blooms on the slope

North side decorated with encrusted colored glasses

Tatami made with EM sheet

3. **EM Wellness Resort COSTA VISTA Okinawa Hotel & Spa**

Development of EM Wellness Resort:

In 1972		The Okinawa Hilton Hotel was established.
	May 15	Okinawa's independence from U.S. occupation.
In 1985		The Sheraton Okinawa Hotel was established.
In 1990		The Hotel Star Hill was extended and reconstructed.
In 1991		The construction of the hotel was canceled.
In 2002		EMRO bought the Hotel Star Hill.
In 2004		EMRO commenced the construction of the hotel.
In 2005	Sep.	The Hotel Costa Vista Okinawa was established.
	Nov.	EMRO started the construction of the EM Spa (CORAZON) building.
In 2006	Apr.	The grand opening of the EM Spa CORAZON.

Full View

Terrace

3-1. What is EM Wellness Resort?

EM Wellness Resort Costa Vista Okinawa Hotel & Spa is a place to relax mind and body health with the best use of EM technology.

Since the establishment of the Okinawa Hilton Hotel in 1972, 42 years have passed until now. In 1991, due to a cessation of extension and construction for the Hotel Star Hill, this building was abandoned for 13 years. Based on common sense, old buildings are demolished. On the other hand, according to a theme of regeneration for historical and old buildings, this building has been remodeled with a high-quality structure which cares for the environment through the use of EM technology on almost all of the construction, and for human's health like no one can imagine.

Using EM technology for construction, buildings are expected to have some benefits like "improved endurance", "minimizing the bad effects of various chemical materials", "comfort of living spaces" and "improvement of environmental hazards". In addition, the whole building is resurged by periodic maintenance.

General Description:

Framework: Reinforced concrete structure (5th floor above ground and 2nd floor in the basement)

Ground-floor area: 43,618m²

Building area: 6,440m²

Architectural area: 20,611m²

Facility:

Total guest room: 214 rooms

Parking area: 180 cars

Japanese cuisine, all day dining restaurant, café, bar, conference rooms, banquet, souvenir shops and fitness room.

EM application for construction

1. Application to grounds
2. Application to reinforcing bars and formworks
3. Application to concrete and mortar
4. Application to blocks
5. Application to asphalt
6. Application to EM paint
7. Application to waterproof treatment
8. Application to EM wallpapers
9. Application to the EM carpet and adhesion bond

1. Application to grounds

2. Application to reinforcing bars and forms

3. Application to concrete and mortar

4. Application to blocks

5. Application to asphalt

6. Application to EM paint

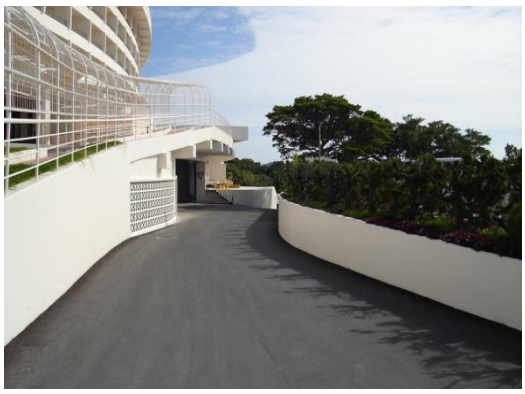
7. Application to waterproof treatment

8. Application to EM wallpapers

9. Application to the EM carpet and adhesion bond

3-2. Before and After the Renovation

Before	After
	
Hotel Appearance →	
	
Entrance →	

A carry-in entrance →

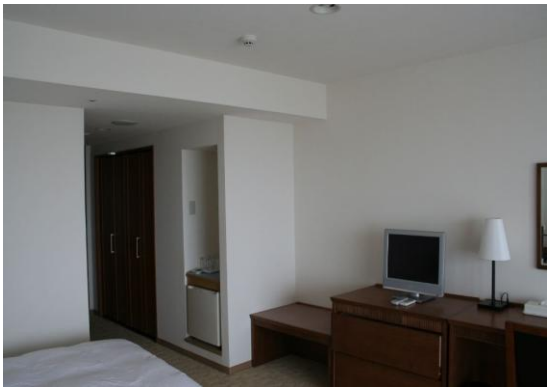

Entrance Lobby →


Courtyard of the Japanese Restaurant →


Bar lounge on the first basesment level →

Restaurant on the first basement level →

Hallway →



Guest room →

Hotel Appearance

3-3. EM Spa CORAZON Okinawa

General Description:

Framework: Reinforced concrete structure (3rd floor above ground)

Building area: 993.83m2

Architectural area: 2,076.48m2

Facility:

1st floor: Information, Bedrock bath, Treatment room and courtyard.

2nd floor: Dressing room, Relaxation room and Main bathhouse (Dry sauna, Mist sauna, half body bath area, Air bubble bath, silky bath, Scrubbing room and powder room.).

3rd floor: Relaxation room, Café and Rooftop gardening

EM Application to Construction

- Mortar, concrete, EM block and EM tile
- Soil treatment
- Reinforcing bar and iron frame treatment
- Paint (Exterior and inner packaging)

Appearance of EM Spa CORAZON Okinawa

In 2004 before the repair work

Nov. 2005 preparation of the construction

In Jan. 2006 Spa building under construction

6 April, 2006 Spa CORAZON opened

Body Treatment

Bedrock Bath

EM Capsule

Reflexology

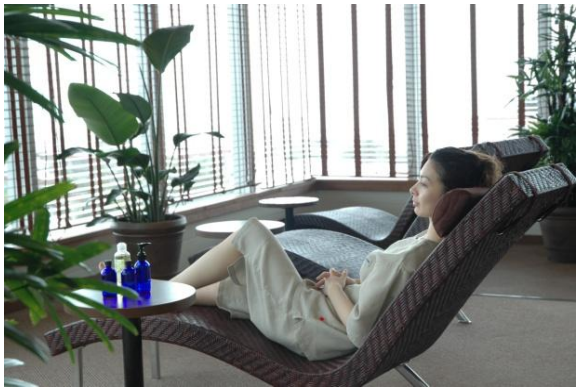
Main bathhouse

Air bubble bath

Mist sauna

Dry Sauna

Terrace (1st floor)



Relaxation room (2nd floor)

Relaxation room (3nd floor)

Café (3rd floor)

3-4. EM Diatomite Showroom

Development: Two rooms made with EM diatomite materials from the OKUTA Co., Ltd. in July 2010

Objective:

- Provide a show room
- Provide a different option to stay and experience the effect of EM
- Propose the EM Lifestyle to guests concerned on health problems

Characteristics:

- EM diatomite is applied on the roof
- EM diatomite flat is applied on walls
- Natural materials used on flooring
- EM diatomite flat is also applied on furniture and bed boards

Finishing touch with EM Diatomite flat

EM Diatomite flat applied on bed board

3-5. EM Waste water treatment

The water discharged from the Spa building is treated and accumulated into the water storage tank ($50m^3$). Next, it is processed inside the water treatment equipment (processing ability: max. 70t) and delivered to the water receiving tank ($50m^3$), accumulated till sent to the Spa's water receiving tank.

EM treated water is reused for flushing toilets at the first floor and basement of the hotel, as well as flushing toilets at the Spa.

However, water for hand wash and bidet is Waste water (not reused water).

Moreover, there is a treatment system for reusing rainwater.

Waste water treatment equipment for reusing

The receiving tank and the storage tank (50m^3 each)

Buffer tank for rain water (2m^3)

Photo Collection

Aerial photo

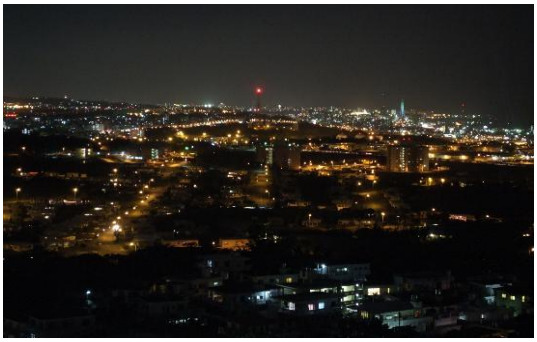
Hotel appearance

Spa CORAZON

Hotel front view

Hana-Fuu (Japanese Cuisine)

Sunset View from the terrace



Night view from the hotel

Night view of the hotel

3-6. Hotel's Food Waste Recycle System

Food waste processor (Ability:70L/10min)

Amount of the food waste from the hotel: 200L/day

Processing the same amount of food waste and Activated EM・1

Crush approx. 100L of solid waste for 10min

The liquid mixture is fermented for 1 week and then moved to the farm's fermentation tank (5t).

A month aged liquid mixture is used as a fermented fertilizer sprayed by the sprinkler.

Well fermented liquid fertilizer is used in Banana and Papaya field.

It s also good to make nursery soil and / or compost.

4. **EMRO Managed EM Organic Farm: "SUNSHINE FARM"**

Entrance board

Shade net greenhouse for typhoon and wind

PVC greenhouse: tomato cultivation

Frame greenhouse for events, seedling

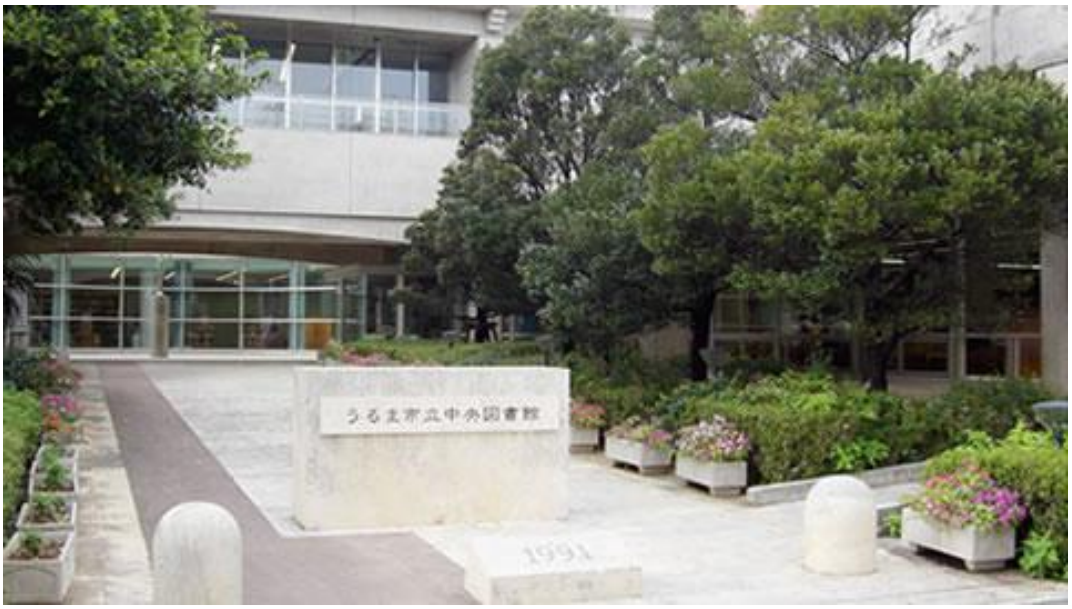
Visiting tour

EM workshop

Cultivation of greens

Harvesting radish

5. **Uruma City Library (EM Water Treatment)**



Structure: Reinforce concrete building of one basement and 2 stories

Lot area: 4,217m^2

Floor space: 1,737m^2

Total floor space: 3,284m^2

Total construction cost: 1,011,727,000 Yen

Completed: January 31, 1990

Okinawa was known for its water shortage and water supply problem.

In 1991 Uruma City library (former Gushikawa City) developed a new design system with the purpose of reusing rainwater. The 250 ton storage tank set on the basement connected with double water pipes and sillcok for watering, make it easier to handle. However, without enough rain this system could not work.

Therefore, under the instructions of Prof. Higa, EM technology was introduced in the system and made possible the recycling and using the source of water.

The Purification System

- General Information:

It is a conventional combined septic tank with a long aeration process due to the exposure of activated sludge.

After adding EM・1 into the septic tank, the treated water is filtered through sand filter and next it is accumulated at the storage tank. The filtered water is conducted to the elevated tank and used for water irrigation excluding drinking water. Waste water from toilets including water from hand washing and drainage is all treated and recycled using EM technology.

- Difference with conventional system:

Aerobic bacteria works as the main key during the activated sludge treatment. Also needs to increase the dissolved oxygen necessary to aerate for a long term.

The EM treatment uses the anaerobic bacteria as the key so that it is a very simple process adding EM and no specialized equipment is needed.

- Dose of EM:

On February 1991, 14L of EM・1 had been poured directly into the grit tank, raw water, regulating tank. Then 3L of EM・1 was applied in intervals of 3 months totaled 12L per year.

- Effects of EM:

Reduction of sludge

The space velocity in the aeration tank is approximately of 5%

- Water quality:

Influent quality control standard is: BOD 20ppm and SS (suspended substances) 50ppm.

However, the test results were BOD 3.9ppm and SS 1.8ppm.

Almost no coli forms were detected and the EM control effect on coli forms was clearly proved.

Figure 1　Comparison within Waste Water and EM treated water (sampled 14 May, 1991)

	Waste water	EM treated water	EM treated＋sand filtration water
Sampled Time	10:55	11:00	11:00
pH	7.0	7.2	7.3
SS (MG/1)	84.0	1.8	<1.0
BOD (mg/1)	80.0	3.9	1.6

- Elimination of Nitrogen and phosphorus:

More than 75% of Nitrogen and phosphorus are eliminated during the EM treatment.

It is estimated that EM decomposes the organic matter meanwhile the nitrogen is eliminated into the air and the phosphorus is incorporated into the microbes.

Figure 2 (Unit: mg/L)

Sampled Date	T - N		T - P	
	Waste water	Effluent water	Waste water	Effluent water
November 1991	67.0	19.5	8.25	2.00
April 1994	64.0	8.2	3.95	1.01

- Savings

The cost of water for the first year (1991) was 60,000 yen (USD 600) while the prior year was of 1,200,000 yen (USD12,000). Applying EM the cost reduced in 20 times.

In 2003, the budget was fixed and reduced to 75,000 yen.

- Running cost:

Cost of 12L of EM applied is approximately of 30,000 yen.

The electric bill down to 1/12 of the cost that will be incurred with a 24 hours aeration time.

The aeration motor's lifetime will last longer.

- Safety:

The EM treated water has almost no coli forms so that is safe to be used in irrigation or draining.

Amino acids and organic acids produced during the EM decomposing process have antioxidant effect that helps to prevent degradation of metal structures and consequently maintain the equipment in perfect condition for a long term.

No particular upgrade was needed in the EM septic tank, therefore the total cost was limited to construction expenses for setting pipes and the pomp.

- Use of EM Treated Water

EM contributes to saving water by making a good recycling of sewage water.

EM treated water is used for irrigation except drink water and hand-wash water.

Toilets are easy to clean since EM recycled water helps in reducing molds and helps to easy remove of other matters.

It is also used in watering plants helping their healthy growth.

Since EM treated water helps to prevent rusting, it is also used to cleanup cars and windows.

The carpets of the first and second floors are washed with EM treated water and after drying in shade they are mold-free and removed malodors as well as tick or other harmful insects.

View of the library

Internet corner

Parking lot for mobile library car and staff

Book room for the mobile library

6. EM Construction at T-House

Design & Management: Environment Creative Institute Inc.

Completed: December 2003

Total floor area: 180.56m^2

An environment-friendly house and a space to enhance family's health

- EM Technology was utilized in soil land, paint adhesive agents, flooring materials, and concrete in order to prevent sick building syndrome.
- The woody part of flooring and the short pillar standing between a beam and roof ridge were treated with EM materials to protect from insects and ants.
- Natural materials and bees wax were used for flooring.

Energy and resource saving

Rainwater collection tank ($24m^2$) was placed in the basement under the garden and is reused for watering plants, flashing toilet and washing clothes and a car.

A sustainable building with a higher degree of durability

- EM materials were mixed in concrete in order to suppress the corrosion of steel beams with the anti-oxidation effect of EM so that it reduces the neutralization of concrete and expects the long-term durability.
- Skeleton and infill structure: the separation of building systems and decisions according to a subsystems approach distinguishing skeleton or base building from infill.
- Titanium oxide was mixed in the paint to coat the outer wall for antifouling effect.

6-1. Examination of EM Concrete at T-House in March 2012 (9-year-old building)

Building Durability: 546 years

1. Testing for compressive strength of drilled cores of concrete: Average strength of the six sample cubes was 43.9N/mm2
2. Carbonation depth measurement test of concrete: Average depth of the six sample cubes was 3.2mm

<RESULT>

Compressive strength was 1.83 times higher than the designed strength of 24.0/mm2

Equation for depth of carbonation: $\mathbf{y = b\sqrt{t}}$

y: the depth of carbonation (mm)

b: the coefficient of carbonation (mm/√year)

t: the time of carbonation (year)

b= 3.2 / √9 =1.07

It estimated 786 years that the carbonation reaches to the concrete cover of 30mm.

To take safety measures, the concrete cover was set to 25mm and estimated the durability of 546 years.

7. EM Construction at Y-House (Uruma city) in 2008

Design & Management: Environment Creative Institute Inc.

<Objectives>

- Newly-built house utilized with EM Technology
- A house roofed with traditional red tile and a durable building for future generations
- Building a house making use of the environmental climate in Okinawa
- Energy saving: summarize a house by changing the direction, plant trees and recycle rainwater
- Making to last for 200 to 300 years
- Utilization of EM Technology – a house with the use of the natural materials and EM materials in concrete, paint, wallpapers adhesive agent and so on

Durability of the house: Reinforced concrete (thick paste / slump:12cm / water-cement ratio: below 48%)

<Remarkable point> to widen the concrete section has made it easier to cast concrete with the thick paste.

Rainwater on the roof is collected in a tank in the basement for reuse as toilet water, to water plants

Shisa (guardian lion dog) stand on the top of roof

8. EM Construction Sites

8-1. Hokuno Kaikan (Nago city)

Owner: Hokubu Norin High School Alumni Association

Completed: May 24, 2008

Land area: 1,725.23m^2

Building area: 355m^2

Total floor area: 314m^2

Structure: Reinforced concrete, 1floor

Construction cost: JPY 28,351,680

Applications:

- Activated EM・1 (AEM or EMAS) was applied (sprayed on the land and washed the formwork) for 4 times – 280 Liter (diluted 100-fold)
- AEM was applied into fresh concrete (321m^3) for 3 ways: i)footing bean; ii)slab; iii)beam
    - EM・X Ceramics powder: 171.2kg
    - AEM: 535 Liter
    - EM・3: 16 Liter
    - EM・X GOLD: 5.4 Liter

Cost of EM Materials: The total cost was JPY 300,760.

8-2. N-House (Nago city)

Designing: AMS Architectural Company

Builder: Tsunami Gumi Co., Ltd.

Completed: August 27, 2009

Land area: 229m^2

Total floor area: 108.76m^2

Structure: Reinforced concrete block, 1 floor

Construction cost: JPY 16,016,000

Applications:

- land soil,
- concrete,
- paint,
- wallpaper,
- wood building materials

Types of EM products used:

- EM super cera – sosei C: 68.6kg
- AEM: 275.95 Liter
- EM・X GOLD: 2.438 Liter
- EM・3: 5.154 Liter

Construction cost: JPY 134,722

8-3. Analysis result of chemical level in the air at N-House

Analysis of formaldehyde and acetaldehyde for EM house

Formaldehyde, acetaldehyde, and volatile organic compound (VOCs) that are famous for the cause of sick building syndrome were measured.

Completion of N-House: August 27, 2009

The Date of First Analysis:

17th through 18th of September 2009 (the 21st day from the completion of N-House)

The Date of Second Analysis:

4th through 5th of November 2009 (the 69th day from the completion of N-House)

Method of Analysis:　Passive Method

Figure 1 [First Analysis]　　Unit：（converted to 25 ° C） μg/ m^3

	Formaldehyde	Acetaldehyde	Toluene	Xylene	Ethyl benzene	Styrene	Paradichloro-benzene
Living room	71	43	4.2	< 14	< 7.0	< 9.5	< 7.9
Indicator Value	100	48	260	870	3800	220	240
Limit of quantification	0.42	0.27	4.1	14	7.0	9.5	7.9

Figure 2 [Second Analysis]　　Unit：（converted to 25 ° C） μg/ m^3

	Formaldehyde	Acetaldehyde	Toluene	Xylene	Ethyl benzene	Styrene	Paradichloro-benzene
Living room	41	41	—	—	—	—	—
Indicator Value	100	48	260	870	3800	220	240
Limit of quantification	0.42	0.27	—	—	—	—	—

<RESULT>

The values of formaldehyde, acetaldehyde and VOCs were lower than each indicator value.

EM was applied before the second analysis: the mixture of EM・W(2%), EM・2(2%) , EM・1(4%) and water was sprayed for one week.

The value of formaldehyde was reduced by 42.2% between the first analysis (71μg/m^3) and the second analysis (41μg/m^3).

9. **EM Application at Meio University**

Background:

* 1994 Establishment of Meio University (Faculty of International Studies)
* 2001 Establishment of Graduate School
* 2005 Establishment of Faculty of Human Health (Department of Sports and Health Sciences)
* 2007 Establishment of Department of Nursing in the Faculty of Human Health
* 2010 Officially established as a public university

In 1994, Meio University was established as a private managed university in Okinawa, with the public funds by Okinawa prefecture as well as the northern 12 towns and villages.

However, in 2010 Meio University was reborn as a public university and espoused its founding spirits of "peace, freedom and progress".

International Institute for EM Technology was established in April 2007 as a functional public-opened facility. EM Research Organization cooperates to organize lectures on EM Technology in general education curriculum for one semester.

As for the public activity, the main role of the institute is to provide EM information and distribute Activated EM・1 in Nago city which is supported by city council to disseminate EM Technology and facilitate the home gardening while contributing to beautifying the city.

EM workshop is organized in several communities in northern towns and villages, and the demand of EM is increasing these days.

Entrance of the campus

EM Workshop for the public

Explanation of basics on how to activate EM・1

EM workshop in practice

Young “Kawatsu” cherry blossom tree

EMRO staff and volunteers take care of the campus’ plants on a regular basis (February 2013)

Cherry blossom in bloom

* 200 “Kawatsu” and Himalayan cherry blossom have been donated by Prof. Higa and have been maintained for 5 years now. The first blooming was last year in January 2012.

10. Examples of EM Diatomite for Houses

10-1. K-House (Nago city)

Application:

- EM Diatomite
- Soil treatment
- Paint
- Wallpapers
- Wood building materials

2nd floor, paint color-Shirohana

Applying EM diatomite inside the pieces of furniture

10-2. Café (Ginowan city) in 2010

Application:

- EM Diatomite

10-3. Two-family House (Kadena town) in April 2012

Application:

- EM Diatomite

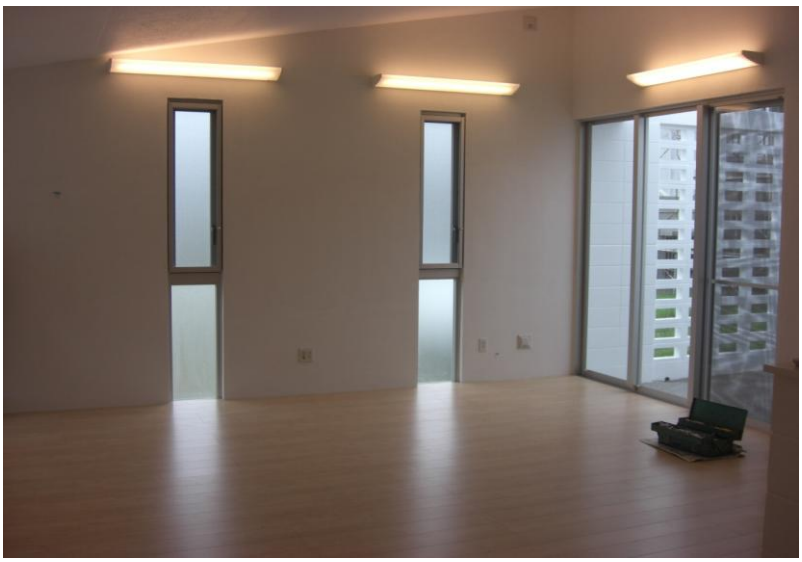
Kitchen & Dining room

Stairs

10-4. M-House (Naha city) in November 2011

Application:

- EM Diatomite



10-5. Japanese Restaurant (Nago city) in May 2012

Application:

- EM Diatomite

10-6. Renovating the Old House (Motobu town) in December 2011

Application:

- EM Diatomite

EM Diatomite was used in dining room.

EM Diatomite was pained in pattern.