I, Crystal M Collado, hereby submit this original work as part of the requirements for the degree of Master of Architecture in Architecture.

It is entitled:
The Chernobyl Intervention: An Architectural Response to an Anthropologically Contaminated Site

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Committee member: Elizabeth Riorden, M.Arch.
The Chernobyl Intervention:  
An Architectural Response to an Anthropologically Contaminated Site

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by

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ABSTRACT

This is an architectural intervention for the Chernobyl Exclusion Zone. The focus of this dissertation is a theoretical framework that generates an architectural model in response to an anthropologically contaminated site as they become the catalyst for new patterns of culture and settlement. Extreme conditions of the investigated site are not ideal for habitation due to high levels of radiation, but the site offers a powerful history that inspired theoretical exploration and forward thinking strategies. The Chernobyl Intervention emerged through the analytical investigation of Chernobyl at multiple scales – macro, meso, micro, nano. The end result is a masterplan that visually narrates change over time in response to the integration of architectural elements, topographical elements and rewilding strategies. This is a narrative into the envisioned future of Chernobyl.
ACKNOWLEDGEMENTS

This dissertation is dedicated to my mother, Karla. The completion of this thesis would not have been possible without your love and encouragement.

I sincerely thank my friends and family for being patient with me over the years, especially when I’ve been so distant.

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Many thanks to Udo Greinacher, Liz Riorden and Barry Kew for the insights you have shared through the adaptation of this thesis.

And last, but not least, thank you to my little inspirations for their endless love.

Personal Pictures Taken by the Author
I do not see a delegation
for the four-footed
I see no seat for the eagles

we forget and we consider
ourselves superior.

but we are after all
a mere part of Creation

and we must consider
to understand where we are

and we stand somewhere between
the mountain and the ant.

somewhere and only there
as part and parcel
of the Creation

- Chief Oren Lyons
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“One reason we are in so much trouble is that our modern culture is paradoxically behind the times, still assessing the world the way it did in the nineteenth or even eighteenth centuries as a place of inexhaustible resources, where man is at the pinnacle of creation, separate from and more important than anything around him.”

- David Suzuk
1.1 Problem Statement

1.2 Monitoring at Multiple Scales

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   Intercontinental
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   Proposed Architectural Elements

1.7 Conclusion
1.1 PROBLEM STATEMENT

The urgent need to respond to the ecological issues Earth has endured is overdue. Constant neglect of Earth and its resources causes permanent damage that no form of technology can repair. Landscapes face the impending future of becoming anthropologically contaminated sites caused by forestry, mining, agriculture and urban sprawl; an extreme example being the Chernobyl Exclusion Zone.

On April 26, 1986, a reactor of the Chernobyl Nuclear Power Plant located in Ukraine exploded causing radioactive material to blanket over 77,000 square miles across Europe and Eurasia.¹ Due to the restrictions and health risks of permanently inhabiting the area, the thirty kilometer Exclusion Zone around the Chernobyl power plant has been deserted for thirty years causing social, economic and environmental consequences.² Although the Exclusion Zone is figuratively disconnected from the rest of the world, this site continues to have negative effects on neighboring countries. This resulted in consistent monitoring, from a local to a global scale.

February - Vital Sklyar, Minister of Power and Electrification of Ukraine, in reference to the nuclear reactors in Ukraine, is quoted in Soviet Life magazine as saying:

"The odds of a meltdown are one in 10,000 years. The plants have safe and reliable controls that are protected from any breakdown with three safety systems."

March - Construction of the Chernobyl Nuclear Power Plant begins (CNPP).

1970

1979

Pripyat officially proclaimed as a city.

April - The Chernobyl Atomic Power Station reaches its first 10 billion kilowatt-hours of electrical output.

1986

20 April - Saturday
01:23:45 - Explosion.

The reactor reaches 120 times its full power. All the radioactive fuel disintegrates, and pressure from all of the excess steam which was supposed to go to the turbines broke every one of the pressure tubes leading to an explosion.

21 April - Sunday
01:29:45 - The 1000 ton lid above the fuel elements is lifted by the first explosion. The release of radiation starts. Air reaches the reactor and the oxygen results in a graphic fire.

04:26:03 - Fire alarm activated.

04:35 - Firemen fight fires on roof of turbine hall.

25 April - The test begins.

27 April - 14:00
Evacuation of Pripyat begins. Residents were given two hours to gather their belongings. The evacuation of Pripyat's 35,000 residents took 3.5 hours, using 1,200 buses from Kiev. Residents remember that everyone was in a hurry, but nobody was panicking. The residents of Pripyat were asked to carry with them only what was required for two or three days, some food, a change of underwear, and their identity papers. Dosimeters are confiscated.

28 April - Monday
2:02 - Moscow TV news announce that an accident has occurred at the Chernobyl Nuclear Power Plant.

29 April - Tuesday
The first real information in the western world.

2 May
The wind has changed direction and is now blowing in the direction of Kiev.

A week after the Chernobyl tragedy the children's playgrounds in the town of Pripyat were closed due to the levels of radiation.

20:00
Soviet deputy energy minister Abram Malinovskii wrote a secret message to the Soviet Communist Party detailing an explosion in the upper part of the reactor. He stated there was no need for the evacuation of the nearby town of Pripyat.
10 May
According to the IAEA the fire is extinguished, but the temperature in the reactor is still rather high. Meanwhile a Ukrainian government official states reactor is still burning and fire fighters are continuously trying to put the fire out.

11 December
A concrete roof ("sarcofagus") is completed over the fourth reactor. It is built to protect the environment from radiation for at least 30 years. 300,000 tons of concrete and 6,000 tons of metal constructions were utilized.

February - Ukraine’s Emergencies Ministry officially began licensing tourist trips. More than 10,000 tourists visit Chernobyl and its surroundings each year. Forbes magazine even names the dead zone one of the world’s most exotic tourist destinations.

18 September
Galsjo Forest elk hunters fill a quarry in Northern Sweden with carcasses contaminated with radioactivity.

1988
Norway increases the limit for cesium in reindeer meat for consumption to 6000 Bq/kg. This is extremely high. Sweden also increases their limit to 1500 Bq/kg from 3000 Bq/kg in May 1987. Most countries have a limit of 600 Bq/kg. And even this figure is heavily criticized. But due to this limit much of the reindeer meat can be sold in Scandinavian countries.

19 January
Pripyat is re-opened to tourists. The dispute is resolved. But the cost of entry is raised $150.

17 September - The project contract for the New Safe Confinement (shelter over reactor 4) is finally signed, with French consortium Novarka constructing the 150 by 257 meter arch structure. Construction costs are estimated at 432 million euros with a project time of five years.

19 March
Ukraine’s Emergencies Ministry has been left to operate trips as well as making an unhealthy profit. With every tourist to the zone paying around a US$140 for entry the Ministry has a turnover of millions dollars every year.

1.2 MONITORING AT MULTIPLE SCALES

GLOBAL

According to the UN, the world population is estimated to reach 11.2 billion people by 2100 and with that comes an increase in contaminated land. Ecosystems are degrading and climate change is accelerating due to continued increase in the consumption and devastation of natural resources.

INTERCONTINENTAL

The Group on Earth Observations (GEO) is building a system called the Global Earth Observation System of Systems (GEOSS). GEOSS is used to gather environmental data through observation, information and processing systems. The collected information is accessible for a wide range of users, including public organizations. The purpose of this tool is to facilitate the sharing of information and data collection on environmental conditions all over the world to strengthen the monitoring of Earth. The result is a single database that provides up-to-date environmental data to promote knowledge of Earth’s natural processes and to improve predictive capabilities of environmental impacts.

CONTINENTAL

Networks of organizations all over Europe, such as ECNC and Rewilding Europe, made it their mission to rewild Europe and promote biodiversity. There is a growing interest in wilderness, wildlife and rewilding due to climate change and an increase in land abandonment.

In addition, due to the aftermath of the Chernobyl Nuclear Accident, the European Commission (EC) utilizes a monitoring system called the Radioactivity Environmental Monitoring (REM) database. Authorities routinely document measured levels of radioactive contamination within the environment such as food, air and water. The result is real-time monitoring data collected from thirty seven countries around Europe by the EURDEP system, which is then available to national and international authorities.

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NATIONAL

Under the operation of the State Environment Monitoring System (SEMS), there are eight ministries and agencies that monitor the environmental conditions of Ukraine: the State Land Committee, the State Water Management Committee, The State Housing and Municipal Services Committee, Food and Forestry Policy, the Ministry of Agriculture, the Ministry of Health, the Ministry of Emergencies and the Ministry of Environment.  

Stationary sites are utilized to monitor air pollution, water bodies, groundwater, soil, food sources, snow cover and precipitation in 53 Ukrainian towns and cities. Due to limited funding, biodiversity is only monitored over species that are of industrial interest such as fish, game and trees. Data is submitted to the Information and Analytical Centre of the Ministry of Environment and made available in ecological data banks.  

REGIONAL

The International Radioecology Laboratory of Chernobyl Centre for Nuclear Safety, Radioactive Wastes and Radioecology is located within the Kiev Oblast region in Slavutych. The facility monitors the concentration of radionuclide and the effect of radiation on biota within the 30 kilometer Exclusion Zone encircling the Chernobyl Nuclear Power Plant.  

LOCAL

The local economy of Chernobyl and Pripyat were highly dependent on agriculture prior to the disaster. Most of the surrounding area was rural with large collective farms. The effects of the Chernobyl accident impacted the local and national economy as land was removed from production. A major challenge of this site is to boost the local economy when land is still unsafe for use.  

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8 Ibid.
1.3 DELIMITATIONS

This dissertation is in response to the overdue need to rethink the way people design and build. Indeed, there is exploration in the roles of architectural landscaping, bioremediation and technology, but for the purpose of this dissertation the focus is on the progressive design of the architectural intervention. It attempts to consider the possibility of an architectural intervention that can influence a symbiotic relationship between the natural and built environment. This proposal includes a large scale rehabilitation program at an area of approximately 100 acres. Due to the scope of this dissertation, it is important to note that all aspects of research are not addressed to the same level of detail. Related aspects, outside of the realm of architecture, are partially addressed.

1.4 RESEARCH METHODOLOGY

The research methodology is a collection of information and data by means of literature reviews, precedent studies, film documentaries, photographic analysis, physical models and digital models. The adaptive research processes provide the basis for design decisions and inform the resultant architectural intervention of a theoretical proposal.

Due to the author’s inability to visit the Chernobyl Exclusion Zone for documentation and analysis, the author made site visits to the local Fernald Preserve, located in Hamilton, Ohio. The Fernald Preserve faced a less extreme event, but is comparable enough to gain a better understanding of environmental remediation in response to an anthropologically contaminated site (Reference 3.4 Precedent: Fernald Nature Preserve).

The context of the Chernobyl Exclusion Zone is analyzed from a micro to macro scale through the analysis of literature reviews, a collection of scientific data from journals and databases, as well as the analysis of images and film documentaries. Research is collected to better understand the succession of the site from the time the towns of Chernobyl and Pripyat were established, to the time of the nuclear disaster and up to the present conditions of the Chernobyl Exclusion Zone. This analysis is used narrate the future of Chernobyl through design.
1.5 SITE SELECTION

After World War II, people feared the threat of a nuclear war between the United States and Russia, yet there was the promise of using that same nuclear power technology to provide safe, clean energy. At the time, this technology was futuristic and seemed like an ideal solution. Air pollution was not produced, power plant construction created jobs and it made a few people very wealthy.

Nuclear plants were sold to countries like China, India and Russia with the false promise of nuclear power being cheap, both in economical and environmental terms. In fact, building and running a nuclear plant can be costly as it requires high maintenance, waste storage, and there are constant problems with safety and production. The public’s support of nuclear technology was deterred when there was a sudden burden of waste problems within communities and nuclear reactor accidents occurred in locations such as Three Mile Island, Hanford Nuclear Reactor and Chernobyl.12

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12 ibid.
ZONE CLOSURE + LIMITATIONS

According to the International Atomic Energy Agency (IAEA), the nuclear disaster of Chernobyl released four hundred times more radioactive material compared to the atomic bomb dropped on Hiroshima, Japan during World War II.\(^\text{13}\)

The Exclusion Zone is an irregularly shaped area, about the size of South Carolina. The Zone is roughly split in half at the border of Ukraine and Belarus.\(^\text{14}\) There are two zones that make up the overall Exclusion Zone. The central Zone, called the 15 kilometer Zone, contains the highest concentration of radiation.\(^\text{15}\)

Encircling the 15 kilometer Zone is the 30 kilometer Zone; although this Zone has a lower concentration of radiation compared to the 15 kilometer Zone, it still affects the health of its inhabitants. Access to the Exclusion Zone is still limited and there are various strictly controlled check points along the perimeter of the 15 and 30 kilometer Zones.\(^\text{16}\) It is inevitable that the land is permanently damaged by an invisible threat.

According to World Nuclear News, in 2010 the Belarus government announced a 2.2 billion dollar masterplan to resettle people between 2011 and 2020 back into the contaminated areas caused by the Chernobyl accident. The focus of resettlement is in the Mogilev and Gomel regions. Rehabilitative, restorative and socio-economic development measures are planned to present an attractive site for habitation, while also providing incentives for the residents.\(^\text{17}\)

This process requires the removal of 5,600 contaminated or damaged buildings, the excavation of contaminated articles previously buried by the government and the reduction of the fire hazard that threatens the overgrown areas.\(^\text{18}\) Presently, there is not yet evidence of a detailed resettlement plan, nor is there evidence of it being put into effect.


16 Ibid.


18 Ibid.
1.6 MASTERPLAN BRIEF

CONCERNING FACTORS

Multiple phases are implemented to assist in the rewilding of the Exclusion Zone. The master plan is an architectural intervention that hosts a variety of programs. The intervention, in response to anthropologically contaminated sites, acts as an instrument to detect, monitor and alleviate the impact of environmental change.

The intervention responds to the following concerns:

*Environmental degradation*

The purpose of the architectural intervention is to contribute gained knowledge of experimental methods that integrate architecture with the environment at multiple scales. Architectural structures must go beyond the point of integration; it must have the ability to sustain itself and positively contribute to environmental conditions.

*Safety and well-being of the people of Chernobyl*

The safety and well-being of the residents and visitors of Chernobyl are of major concern. The implementation of safe housing for both residents and visitors are crucial for the local economy. Understanding how to mediate the diversity of people, flora and fauna can influence and contribute to the well-being of all living organisms.

*Availability of Resources*

A significant portion of the design must be based on its context; climate, local hydrology, vegetation, topography, biodiversity and culture. The first attempt is to re-use existing infrastructure. The following option is to build on degraded land while preserving as much of the site possible. It is also important to minimize ecological disturbance and restore the site to the fullest extent.
PROPOSED ARCHITECTURAL ELEMENTS

The selected site is located south of the town of Pripyat and north of the town of Chernobyl. It is situated at a point along on the west side of the Chernobyl tour path. A theoretical model comprised of architectural and topographical elements (Reference 2.5 Meso Analysis: Topographical Elements) contribute to the rehabilitation of the anthropologically contaminated site of the Exclusion Zone. Using the identified site as the basis, the theoretical model includes the following architectural elements:

Core Facility

The Ecological Observatory is the central node of the masterplan. This facility provides temporary living accommodations for visitors, laboratories for scientist and provides access to a database of collected research. For the safety of the residents and visitors of Chernobyl, living accommodations are located outside of the 15 kilometer Zone; at a far enough distance from the Red Forest for a timely evacuation if a forest fire were to occur, but close enough to experience the ecological benefits of the intervention. The purpose is to create a tangible link between architecture and environmental awareness.

Research Pods

Research pods provide researchers and scientist with basic research accommodations. The research pods are mobile and have the ability to collect samples, document data, and return that data back to the core site. Pods allow for the collection of data beyond the parameters of the core facility in addition to allowing the following abilities: to observe, monitor, contribute to and protect ecosystems and biodiversity.

Observation Stations

Unstaffed stations, equipped with camera systems, are implemented in and around the Exclusion Zone. These stations relay real-time data to the core facility. They are static and do not require the physical presence of people.

Housing

Housing is provided for the permanent residents of Chernobyl. Housing is situated within close proximity to the core facility for the purpose of sharing resources and services.
1.6 CONCLUSION

This architectural intervention goes beyond the paradigm of sustainability. The proposed theoretical model addresses concerning factors and creates a synergy between people and the natural environment through the accommodation of all living systems. The architectural intervention involves the consideration of available resources, implements self sustained and contributing architectural and topographical elements, as well as restores anthropologically contaminated.

The proposed architectural elements provide the following:

**Observation and Information**

Mobile and static research facilities in the surrounding area allow for observation in the field. Data collected will be available to regional and global networks.

Observation decks provide viewpoints as they are directed towards the Nuclear Power Plant, the town of Pripyat and Chernobyl, the Russian Woodpecker, the Red Forest, the Pripyat (Pripet) River and the surrounding landscape.

Visitors are exposed to a visual narrative through the organization and integration of architectural and topographical elements. The visual and interactive experiences narrate the effects of environmental conditions and human intervention.

**Spaces for Safe Habitation**

Safe living accommodations are available for the visitors and residents of Chernobyl. Access is monitored and controlled for the safety and well-being of all inhabitants. The air circulation of closed and open spaces is constantly monitored within the masterplan.

**Futuristic Influence**

This proposal is a theoretical intervention for, but should not be limited to, the Exclusion Zone of Chernobyl. This dissertation explores a theoretical framework for an architectural response to an anthropologically contaminated site. The hope is that this theoretical framework will inspire future exploration, experimentation and application.

Upcoming chapters explore the following questions:

- *After the implementation of this architectural intervention, what does the future hold for Chernobyl?*

- *How can human intervention speed up the process of rewilding and rehabilitate the landscape?*

- *How will the positive and negative factors of the site influence the design proposal?*

- *In what ways can the proposed architectural intervention influence the future of this site and other anthropologically contaminated sites, as well as the future of Regenerative Architecture?*
Figure 6

Figure 7
CHAPTER 2: SITE ANALYSIS

“Together, all species make up one immense web of interconnections that binds all beings to each other and to the physical components of the planet. The disappearance of a species tears the web a little, but that web is highly elastic. When one strand is rent the whole network changes configuration, but so long as there are many remaining strands to hold it together, it retains its integrity.”

- David Suzuki
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   Fauna
2.8 Conclusion
2.1 INTRODUCTION

As Jason McLennan argues, it is necessary for degradation to occur before people can react to it. It is not until then that people have a conscious reaction to the consequences of unsustainable practices.\(^\text{19}\) Generally, those reactions are caused due to concerns for personal health. Human intervention leads to the relentless alteration and exploitation of natural landscapes and conscious reactions are in desperate need for anthropologically contaminated sites like the Chernobyl Exclusion Zone.

The site is analyzed at four scales – macro, meso, micro and nano. The information gathered through literature studies and online data are translated into maps and data graphs to better understand the selected site and design parameters. Land use, geology, climate and geography at various scales are also analyzed through a series of drawings and physical models to better understand the natural processes of the site. This chapter presents the analytical investigation of the local environment through the understanding of place, culture, natural patterns, environmental factors and site restrictions to generate an appropriate design response.

2.2 SITE HISTORY

The selected site is located between the towns of Pripyat and Chernobyl, both within the Chernobyl Exclusion Zone. The town of Chernobyl was founded in 1193 and the town of Pripyat was founded in 1970 for the purpose of exploiting the Chernobyl Nuclear Power Plant. Both towns are situated within the Ivankiv Raion of northern Kiev Oblast, Ukraine, bordering Belarus. The town of Chernobyl is approximately 90 kilometers northwest of Kiev and the town of Pripyat is approximately 20 kilometers northwest of the town of Chernobyl. Along the northeast side of both towns is the Pripyat (Pripet) River.20

High concentrations of radiation still contaminate the Chernobyl Exclusion Zone. Depending upon different factors such as wind patterns, radiation levels change daily as air pockets of radioactive contaminants are blown around.21 This is specifically problematic because radiation can be harmful to any living thing depending on the length of exposure and the dose received; it can damage molecules such as protein and DNA. Radioactive isotope $^{137}$Cesium is specifically problematic because of its natural ability to spread due to its high water solubility and its half-life of thirty years. $^{131}$Iodine and $^{137}$Cesium are responsible for most of the radiation exposure received by people and the elements that prevent people from re-inhabiting the Exclusion Zone.22

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2.3 CLIMATIC STUDY

According to the Academy of Science of Ukraine, the following climatic features are outlined.\(^{(23)}\)

- **Climate**: moderate continental, mild
- **Rainy Season**: May to June at 87 to 100mm
- **Average Annual Rainfall**: 600mm
- **Thunderstorms**: Frequent in Spring
- **Snowy Season**: January to March with a variance of 4 to 16 inches of snow cover
- **Average Snow Days**: 52 to 116 days
- **Average Annual Air Humidity**: 77 percent
- **Wind Direction**: mainly from the west and northwest
- **Wind Velocity Average**: 10 to 11.2 mph

TEMPERATURE

According to the Academy of Sciences of Ukraine, the average annual temperature of the site is 44.06 degrees Fahrenheit. The absolute minimum temperature is -32.8 degrees Fahrenheit between the months of January and February and the maximum temperature is 96.8 degrees between the months of July and August. January is the coldest month at an average of 19.76 degree Fahrenheit. Winter in the region has frequent thaws, unstable snow cover, snowstorms and precipitation in the form of sleet and freezing rain.\(^{(24)}\)

Spring sets in March with active temperature rise, frequent thunderstorms and high humidity. Significant heat and cold fluctuations also cause rapid drying of the soil. Summer begins mid-May and continues to mid-September.\(^{(25)}\) The design implements passive design strategies that respond to local climate and site conditions. Strategies such as cross ventilation, thermal mass and sunspaces are explored. Due to colder temperatures, it is important to optimize heat gain and minimize heat loss during the colder months.


\(^{(25)}\) Ibid.
RAINFALL + SNOW

Maximum values of precipitation are reached between May and June at 87 to 100mm and a minimal value between January and February at 25 to 30mm. The design harvests rainwater, to be stored in a water bladder, and use a gravity fed system. Collected rainwater is used for irrigation and potable use, once water purification is undergone using appropriate methods.

WIND

Wind speeds average 10 to 11.2 mph. The predominant wind direction is from the west and northwest with the highest wind speeds exceeding 22.3 mph in February. Human intervention alters the topography of the landscape to steer northwest wind away from the Ecological Observatory in an attempt to redirect radioactive air pockets. Wind turbines generally require a minimal wind speed of 7mph in order for it to function. West winds are funneled into an air drawn system, through a filtration wall system and into the building to cool the building during summer months. Strategies for proper air ventilation include ventilation louvers, operable windows, roof vents, and building form to re-direct breezes during the cold months. Although comfort is important, inhabitants also adjust to a wider temperature range.

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27 Ibid.
2.4 MACRO ANALYSIS

TOPOGRAPHY

The region has a flat relief with a maximum height of 200 meters above sea level. The topography exerts considerable runoff and consists of lowlands, swamps and reservoirs. The Pripyat River is the largest body of water intersecting the Chernobyl Exclusion Zone with spring floods and discharges into the Kiev Reservoir. The river flows northwest to southeast, through the plains of the Chernobyl Exclusion Zone and into the Black Sea. The topography consists of the built towns of Chernobyl and Pripyat, secluded abandoned farmhouses, graveyards of contaminated objects too large to bury, shallow man-made mounds that cap small contaminated objects, as well as the overgrown Red Forest and open grasslands.

GEOGRAPHIC STUDY

There are three agro-climatic zones in Ukraine: forest-steppe, plane-polissya and prairie (steppe). The forest-steppe zone accounts for 19% of the area of Ukraine and is characterized by lowlands and is least arable. The Chernobyl Exclusion Zone is located in a physicogeographic region comprised of mixed forests. The soil cover is primarily sod-podzol and peat-bog soils, which has low natural fertility. Forest covers about 70 percent of the region; about 63% of the forest consists of coniferous species, primarily pine, and the remaining are deciduous species such as birch, oak and alder.

FOREST FIRE

Trees that died due to the large amounts of radiation and the thirty years of accumulated fallen leaf litter are not decomposing as they normally should. Wildfires in the exclusion zone broke out in 2002, 2008, 2010, 2015 and 2016; these fires redistributed an estimated 8 percent of the original amount of radioactive material back into the air. The accumulation of leaf litter and dead trees are potential fuel for more wildfires as well as a radioactive forest fire, putting all lives at risk.

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32 Ibid.
2.5 MESO ANALYSIS

CONNECTION TO SURROUNDING LANDSCAPE

Due to the relatively flat topography, this allows expansive views out over the landscape. The design proposal creates visual connections with the surrounding landscape, both built and natural, to better understand the history and narrative of the site.

SUPERIMPOSED ELEMENTS

Five topographical elements defined by Kevin Lynch in The image of the City, are superimposed to generate a reading of the landscape and the site at a meso scale. The five elements identified by Lynch are as follows:33

Path:
A means for people to move along in order to observe.

Edge:
Boundary that visually breaks and defines adjacent areas.

Node:
A focal point that people can enter; it can be used to orient visitors.

Landmark:
A focal point within the landscape that cannot be entered, but can also orient visitors.

District:
Larger area with identifying characteristics mentally recognized by the observer.

2.6 MICRO ANALYSIS

BUILT ENVIRONMENT

Majorities of the existing infrastructure have been demolished, have collapsed or are in danger of collapse. Unfortunately, the existing infrastructure in Chernobyl and Pripyat are not safe for habitation due to the structural instability as well as the accumulation of radioactive dust that coat the interior and exterior of each structure. Although it is preferred to incorporate locally sourced material, it will not be feasible for this specific proposal due to the extent of contamination.

Figure 34
2.7 NANO ANALYSIS

EXCLUSION ZONE USERS

Residents

Due to the explosion of the power plant in 1986, the people of Chernobyl, Pripyat and other surrounding towns were evacuated and resettled. An estimated 300 of those resettled inhabitants moved back into the Exclusion Zone shortly after the disaster.\textsuperscript{34} Although it is illegal to live within the Exclusion Zone, the residents, all elderly and seventy percent being women, refuse to leave their homeland.\textsuperscript{35} The Ukrainian authorities turn a blind eye while the Ukraine Emergencies Ministry provides humanitarian assistance to these residents.\textsuperscript{36}

\textsuperscript{35} Chernobyl 30 Years After. Directed by WDR. Produced by Quarks and Company. Performed by Ranga Yogeshwar. ARD Mediathek, 2016.
\textsuperscript{36} Moller, Anders Pape, and Timothy Mousseau, interview by Author. Correspondence via email (October - December 2016).
Scientist and Researchers

Scientist and researchers, like Dr. Timothy Mousseau and Dr. Anders Pape Moller, have conducted years of research within the Exclusion Zone. Presently, visiting researchers and scientist do not have living accommodations on site. At times, abandoned houses are rented to conduct their research and/or store their equipment. Therefore, these visitors are in need of an on-site research facility to conduct their research and are in need of living accommodations for the varied periods of time they stay in the area.

Tourist

According to Philip Stone, six percent of Ukraine’s national budget is devoted to Chernobyl related programs and there is a desire to return the land to productive use. Prior to 2011, before tour licensing was offered by the Ukrainian authorities, thousands of people went on illegal Chernobyl tours. Since then, the number of tours to Chernobyl increases each year due to an increased interest in “ruin porn” or “dark tourism” in popular culture. Chernobyl and Pripyat have an increasing number of photo galleries and blogs online created by tourist. Some of the most photographed areas include Pripyat’s amusement park, graffiti, and abandoned schools.

There are a couple of hotels located in close proximity to the Exclusion Zone to accommodate tourist. Visits include strictly guided tours, protective clothing, radiation badges and signed disclaimers relinquishing any claim against ill health. Security checks and body scanners are utilized to check levels of radiation. Each tourist is also given a personal dosimeter to measure radiation levels.

Tourists wander through Pripyat, deserted villages that offer a look into Soviet rural life and meet with the residents. They also have the opportunity to get fairly close to the power plant, but certain levels of clearance are required to enter the power plant.

37 Moller, Anders Pape, and Timothy Mousseau, interview by Author. Correspondence via email (October - December 2016).


39 Ibid.

40 Ibid.
REWILDING

Rewilding was coined by Dave Foreman in the 1970s in response to the degradation of natural processes and an increasing rate of many species extinction.\(^{41}\)

Rewilding, defined by Rewilding Europe:

“…ensures natural processes and wild species to play a much more prominent role in the land- and seascapes, meaning that after initial support, nature is allowed to take more care of itself. Rewilding helps landscapes become wilder, whilst also providing opportunities for modern society to reconnect with such wilder places for the benefit of all life.” (Rewilding Europe 2015)

Rewilding plays a major role in the development of this proposal. There is still a lack of biodiversity in the region. Flora and fauna are critical to the regeneration of the site and have the potential to adapt and thrive despite the environmental conditions. Rewilding strategies are incorporated in the landscape and become integrated with the architectural elements in order to increase biodiversity. Rewilding strategies in the masterplan include a habitat corridor, wetlands, deposit of healthy microorganisms, and reforestation.

FLORA

The podzol soil of the region is a leached, low organic, sandy and acidic.\(^{42}\) This type of soil in combination with radioactive contaminants makes it difficult for plants and trees to grow and thrive as they normally would. Phytoremediation, a method that uses plants to absorb contaminants from soil and water, is integrated with the rewilding process to mitigate the impact of the radioactive contaminants.

In addition, a composition of seeds for a variety of trees and plants created for the purpose of rewilding the site. A land restoration method called Imprinting, the process of creating indentations of rolling patterns into the soil to better capture and store water, is integrated with the distribution of the seed composition around the Exclusion Zone. Seeds of specific species of plants and trees were selected – specifically species that attract and provide a source of food for a variety of wildlife, insects and birds. The selection of plant species will also be important to the aesthetic of the intervention as it transforms the appearance of the building and the site during different seasons.


FAUNA

According to recent reports, flora and fauna have flourished in the past 30 years. Although wildlife continues to flourish, the effects of the radioactive material hold major consequences. An example of affected fauna includes the fifty percent decrease in the number of bird species in the area. Research shows that an abundance of birds in the area develop change in their color patterns, experience asymmetry in their bodies, contract tumors, develop eye cataracts, and show signs of depression.

The explosion has spread $^{134}$Caesium, $^{131}$Iodine, $^{90}$Strontium and $^{137}$Cesium; these isotopes have accumulated in the food chain affecting inhabitants in other countries. An example of this can be seen in the increase of the safe level of radiation in food allowed to be consumed in Scandinavia. The migratory reindeer within the Norwegian regions graze on fungus and lichen, which is prone to quickly absorbing radioactive contaminants. This caused high concentrations of radiation levels in the reindeer, which reached radiation levels too high for human consumption. Scientist and other professionals constantly test and monitor the radiation levels of reindeer. Some reindeer are vaccinated and released while others are slaughtered to minimize the spread of radiation.

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43 Moller, Anders Pape, and Timothy Mousseau, interview by Author. Correspondence via email (October - December 2016).
2.9 CONCLUSION

Literature studies of collected journals and reports show that the radioactive contamination, due to the fallout of the Chernobyl Nuclear Power Plant, has had an adverse effect on the region. Radioactive contamination will continue to have a negative impact on ecosystems, on various species of flora and fauna, and on the human population that inhabit the site.

This chapter presents the analytical investigation of the place, culture, natural patterns, environmental factors and site restrictions at multiple scales – macro, meso, micro, and nano – to generate an appropriate design response.

The intervention aims to regenerate the site and increase biodiversity through the integrated processes of rewilding, phytoremediation, land imprinting, and the distribution of a designed seed composite.

Architectural elements are integrated within their context and have a climatic response with the purpose of being self sustained. In the subsequent chapters the following components are investigated: synergy spaces, passive strategies, responsive technologies, materiality and form.
CHAPTER 3: THEORETICAL DISCOURSE

“Old habits, as they say, die hard. It is for this reason that changes in philosophy tend to occur in generational timeframes rather than individual...”

- Jason McLennan
3.1 Introduction

3.2 Nature as the Context
   Precedent: The Eden Project

3.3 Nature as a Mentor
   Precedent: Naturhus

3.4 Nature as a Partner
   Precedent: Fernald Nature Preserve
   Precedent: Fernald Visitors Center

3.5 Conclusion
3.1 INTRODUCTION

Literature studies have presented principles of models proposed in Permaculture, Biomimetic Design and Regenerative Design which all have a similar point of departure. That point of departure being that nature should be used as context, mentor and partner.
3.2 NATURE AS THE CONTEXT

The concept of permaculture was developed by Bill Mollison and David Holmgren in the 1970s as a response to the decline of resources and energy. This concept has twelve principles:

**Observe and Interact:**
Analyze and interact with the context of the project to facilitate the design process.

**Use and Value Renewable Resources and Services:**
Explore effective options to allow “off the grid” designs through the use of geothermal energy, solar energy, biomass, hydro and wind power, etc. Renewable materials can sometimes be used as an alternative for modern building materials.

**Design Details from Patterns:**
Follow proven patterns that are available from previous experiences, whether observed in nature or in society, and use common sense.

**Use Edges and Value the Marginal:**
The most popular technique is not always the best solution. Consider all variables on site to develop the project and the key points of the design.

**Use and Value Diversity:**
Each project should be designed in response to its context. Even controlling orientation and the choice of strategies used to take advantage of the natural elements will offer diversity to each project.

**Use Small and Slow Solutions:**
The larger a building is, the more resources required for maintenance. Use design to minimize maintenance requirements through choice of material, size and configuration.

**Catch and Store Energy:**
Capture, store and use resources such as sunlight, rainwater and wind through passive strategies.

**Produce No Waste:**
Use the abundance of resources that are already available and avoid wasting material. Consider the use of standard dimensions of materials to avoid waste, consider minimizing the square footage per household, or removing features that increase the use of resources, such as trim and moldings.

**Obtain a Yield:**
Use the opportunity to develop potential benefits that will greatly influence the context.

**Apply Self-Regulation and Accept Feedback:**
When planning for the present, also plan for the future. Consider what happens when there is a change in user, change in program, or what happens when the product is at the end of its use.

**Creatively Use and Respond to Change:**
Imagine the future. Raised buildings and theoretical ideas influence the following generations of designers. This will determine what will or will not continue to be used, from process to building construction. It’s best to attempt to eliminate those that have a negative impact on society and the environment in order to have a positive impact on the future.

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Integrate Rather than Segregate:

Share strategies, ideas and techniques by collaborating with others to reach a better result.

PRECEDENT: THE EDEN PROJECT

Inspired by the geodesic system made famous by Buckminster Fuller, the Eden Project consists of two Biome buildings designed by Grimshaw Architects and located within a clay pit in Cornwall, UK. When the Biomes were designed, the clay pit was still in operation and the Biomes had to be constructed on uneven and shifting sands. Each Biome houses a microclimate – one being a Rainforest Biome and the other being a Mediterranean Biome. Each Biome consists of several connected domes and is joined by the core building. The concept of the geodesic system allowed for maximum surface area, strength and less weight.\(^{47}\)

Each dome has a hex-tri-hex space frame made up of two layers; the inner layer is a system of hexagons and triangles bolted together while the outer layer is comprised of hexagons. According to the Eden program, the steel work weighs slightly more than the air contained by the Biomes. The structures are attached to ground anchors, as well as tied to the foundation to prevent uplift. Each hexagon and pentagon is made of ethylene tetrafluoroethylene copolymer (ETFE), which operates as transparent windows. Each window has three layers of ETFE that is inflated to create a pillow. For the warmth and comfort of the plants inside the Biomes, the inflated ETFE acts as a thermal blanket. ETFE is very light as it weighs less than 1% of the equivalent area of glass. ETFE can transmit UV light, it requires minimal maintenance and it has a life span of at least 25 years.\(^{48}\)

In the core building itself, recycled building material was utilized; tile floors were originally Heineken bottles, entrance mats were made from recycled truck tires, the café floor was made of reclaimed wood and recycled newspaper was used for insulation. Since cement is a carbon-intensive process, the amount of cement used for the core was minimized. For the 10% of cement that was needed, Portland cement was used; recycled aggregate, from the local China Clay industry waste, accommodated the remaining 90% of the concrete.\(^{49}\)

The structures were designed to need as few construction products as possible since construction material can result in a high concentration of carbon emissions through the manufacturing process or transportation. A portion of the building is topped with a green roof to keep the building warmer in the winter and cooler in the summer. In addition, a combination of harvested rain and ground water is used to irrigate the plants and for low-flush toilets; two-thirds of the water is provided from the collected rainwater. Rather than installing renewable energy technology, with the exception of minimal energy produced by photovoltaic panels and a wind turbine, energy is primarily provided with active systems while making the effort to lower energy consumption through self-monitoring.\(^{50}\)


\(^{48}\) Ibid.

\(^{49}\) Ibid.

\(^{50}\) Ibid.
3.3 NATURE AS A MENTOR

People are no different from other habitat builders. Habitats like coral reefs or beaver dams are a platform for the way people can design. Janine Benyus, co-founder of Biomimicry and author of *Biomimicry: Innovation Inspired by Nature*, proposes to use nature as a mentor. She suggests that nature can be used as a model to inspire design and its process.

Benyus proposes that in a biomimetic world we would conform to the following laws of nature:

*Nature...*

“Runs on sunlight, uses only the energy it needs, fits form to function, recycles everything, rewards cooperation, banks on diversity, demands local expertise, curbs excesses from within, and taps the power of limits.” (Benyus 1997)

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**PRECEDENT: NATURHUS**

Naturhus (Nature House), designed by Bengt Warne, is located in a secluded area outside of Stockholm Sweden. The 1500 square foot house, made of wood, is located within a 3200 square foot greenhouse. The main entry and the chimney are the only elements not built within the greenhouse structure. A porch extends out from the second floor and up to the façade of the greenhouse. A section of the greenhouse façade is connected with the porch via a sliding glass door, which opens the space up to nature. The roof utilizes security glass to minimize the chance of breakage and a 4mm glass façade encloses growing fruits and vegetables. Ventilation windows at the roof allow hot air to escape; these open automatically depending on the interior temperature.\(^52\)

Although there is an active heating system for the house, the period of heating is shortened due to the greenhouse effect which allows for minimal insulation. It is a house almost dependent on the sun. It doesn’t require much sun exposure, but if there is no sun the interior temperature is almost the same as the exterior temperature. Even during winter temperatures the space is warmed by residual heat from the bedrock stored below the house.\(^53\)

Naturhus has its own water and sewage system located in the cellar and there is a tank underground for rainwater collection. According to the owners of Naturhus, the collected rainwater is utilized for all household needs and watering plants and excess water is directed to a pond outside of the greenhouse. There are 2 separate filtration systems; neither systems use chemicals, only a natural process. Starting with a urine-separating toilet, black water goes through a centrifuge cistern, growing beds, and garden ponds in order to filter the water from the remains of the compost. Compost from black water can be used to grow plants, flowers and trees while compost from gardens and the kitchen are used for fruits and vegetables that are consumed. A separate tank filters the grey water to be used for the shower, dishwasher, toilet, etc.\(^54\)


\(^{53}\) Ibid.

\(^{54}\) Ibid.
3.4 NATURE AS A PARTNER

The principles of Regenerative Design proposed by Lyle are similar to the biomimetic principles offered by Benyus and the permaculture principles of Holmgren. Regenerative Design, geared towards architectural landscape, was coined by John Tillman Lyle in the 1970s to encourage the application of strategies that restore landscapes, rehabilitate living systems and enhance biodiversity.\(^\text{55}\)

Regenerative Design, defined by Regenesis Group:\(^\text{56}\)

“A system of technologies and strategies, based on an understanding of the inner working of ecosystems that generates designs to regenerate rather than deplete underlying life support systems and resources within socio-ecological wholes.” (Melby 2002)


**PRECEDENT: FERNALD NATURE PRESERVE**

The Fernald Preserve, a former uranium processing facility, is located in Hamilton, Ohio. Through the use of original land surveys and the post excavation topographies the preserve underwent multiple phases of cleanup and environmental remediation. Prior to remediation of the site, radioactive material stored on site contaminated the groundwater and soil. Extraction wells are implemented to clean up the uranium plume in the groundwater.\(^5^7\)

Waste was shipped to Texas and Utah to be stored. The remaining contaminated soil is stored in on-site engineered disposal cells and disposal facility. Mitigation wetlands were constructed and donor soil was introduced to expedite site vegetation.\(^5^8\) The contaminated site included an integrated landscape management program that restored 77% of native and adaptive plants that do not require irrigation.\(^5^9\)

Remediation and continued monitoring of the site has returned natural plants, microorganisms and consumer communities to the site. The Fernald Preserve is now open to the public providing parks, wetlands, ponds, prairies and upland forests. Ecological restoration transformed the site into a haven for wildlife, including over 170 species of birds.\(^6^0\)

\(^{57}\) Homer, John, interview by Author. *Fernald Preserve Site Visit* (October 2016).

\(^{58}\) Division of Environmental Response and Revitalization. *Ohio Environmental Protection Agency.*


\(^{59}\) glaserworks. *Fernald Visitors Center and Nature Preserve.*


\(^{60}\) Homer, John, interview by Author. *Fernald Preserve Site Visit* (October 2016).
PRECEDE NT: FERNALD VISITORS CENTER

The Fernald Visitors Center is a design-build project located within the Fernald Preserve. The project was designed by an architecture firm called glaserworks in collaboration a faculty team from the University of Cincinnati. The Visitors Center is an existing steel warehouse on site that was renovated to house a few programs: offices, community meeting rooms, and an exhibition space. The primary purpose of this Center is to provide information about the remediation process and the context of the site. One of the major goals for the designers was to provide a healthy environment for the visitors and staff, from ventilation to the choice of materials used.

The Visitors Center utilizes environmental building practices and accomplishes energy efficiency through multiple strategies. Efficient strategies featured include high-efficiency electrical water and plumbing systems, low-emitting building materials, a bio-wetland that processes the building’s wastewater, a geothermal based heat pump system, and window placement to optimize sunlight during all seasons. On site is a fourteen foot deep lake which provides heating and cooling to the Visitors Center through the use of a ground source heat-pump system. Low flow/flush urinals, toilets and lavatories reduce water use efficiency by 41% and 100% of the wastewater is treated by a bio-treatment constructed wetland system. High efficiency windows, high efficiency HVAC equipment and reduced lighting power densities result in energy efficiency and reduce pollution.

Materials used during building construction, as well as materials in the exhibits, are categorized by the designers as being sustainable. About forty-three percent of the materials are locally sourced and twenty-three percent are made of recycled material content. To conserve efforts, sustainable practice included the following: 51% of wood used is made of recycled content, 75% of construction waste was diverted from landfills, and 91% of an existing storage building is used.

Overall, the project provided sustainable practices for the site, but the problem is hidden, not resolved. The major concern with this remediation and cleanup process is that the contaminated soil is shipped elsewhere and a portion is still stored on site. There is a lack of evidence to show that there was an attempt to remove contaminants from the soil through other methods such as phytoremediation.

62 Homer, John, interview by Author. Fernald Preserve Site Visit (October 2016).
63 Ibid.
64 Ibid.
3.5 CONCLUSION

This dissertation merges and restructures the principles of the following models: Regenerative Design, Biomimetic Design and Permaculture design to be applied specifically to architecture.

The derived methodology of the overall organization and applied strategies of the masterplan is based on the following premises:

- A visual narrative through the organization, design and integration of architectural and topographical elements to narrate the historical significance of the site and the future of Chernobyl.

- Humans are part of nature and should use nature as context, as a mentor and as a partner to develop a flourishing system for all living organisms.

- Develop a theoretical framework for architectural intervention and rewilding in anthropologically contaminated sites.
The following principles are restructured based on the principles of Holgrem, Benyus and Lyle:

**Landscape Integration**

Analyze the site in its entirety - such as its restrictions, climate, and topography. The site is also analyzed at macro, meso, micro and nano scale to better understand the impact it has at all levels. Use already disturbed land and use methods of remediation.

**Responsive to Available Resources**

The design will maximize the use of renewable resources available to its fullest potential and explore materiality. Use resources that are adaptable, compostable, recyclable and renewable.

**Place and Culture**

This is the basis for developing a narrative. Understand historical significance, geological history, existing culture, existing infrastructure, and local resources. Take advantage of existing infrastructure when possible. Enhance life and accommodate for all cultures.

**Adaptability and Flexibility**

The building consists of flexible spaces that offer more than one program. Minimize private space to what is necessary and maximize on indoor/outdoor public spaces for social interaction. The building will respond to the safety, well-being and comfort of all of its inhabitants. This may also require adaptability on the part of the inhabitants.

**Synergies and Micro-Climates**

The building has microclimates incorporated into a larger system. At the meso level, the building supports biodiversity and acts as an incubator for regenerating the region’s ecology. At a nano level, the building houses synergetic spaces between people and nature to increase shared resources.
CHAPTER 4: DESIGN CONCEPT

“Flowers are marvels of adaptation, growing in various shapes, sizes, and forms. Some lie dormant through the harshest of winters only to emerge each spring once the ground has thawed. Others stay rooted all year round, opening and closing as necessary to respond to changing conditions in the environment such as the availability of sunlight. Like buildings, flowers are literally and figuratively rooted in place, able to draw resources only from the square inches of earth and sky that they inhabit. The flower must receive all of its energy from the sun, all of its water needs from the sky, all of its nutrients from the soil. Flowers are also ecosystems, supporting and sheltering microorganisms and insects just as our buildings support and shelter us. Equally important, flowers are beautiful and can provide the inspiration needed for architecture to be truly successful.”

- Jason McLennan
4.1 Parti Diagram
4.2 Initial Masterplan Sketch
4.3 Masterplan Design Development
   Forming the Site
   Topographical Elements
   Analytical Masterplan Diagrams
4. 1 PARTI DIAGRAM

Figure 137
4.2 INITIAL MASTERPLAN SKETCH

Figure 138
4.3 MASTERPLAN DESIGN DEVELOPMENT

FORMING THE SITE

Figure 139
TOPOGRAPHICAL ELEMENTS

Figure 140
ANALYTICAL MASTERPLAN DIAGRAMS

Figure 141

Figure 142

Figure 143

Figure 144
“In many ways, the environmental crisis is a design crisis. It is a consequence of how things are made, buildings are constructed, and landscapes are used. Design manifests culture, and culture rests firmly on the foundation of what we believe to be true about the world.”

- Sym Van Der Ryn
5.1 Introduction
   Users
5.2 Design Brief
5.3 Topographical Elements
5.4 Design Criteria
5.5 Program
   Ecological Observatory
   Research Pods
   Observatory Stations
   Greenhouse Residences
5.1 INTRODUCTION

The purpose of this chapter is to state the design criteria of this thesis proposal. The architectural intervention acts as a visual translation to create awareness regarding environmental change through narrative. This is accomplished through the design process and design proposal that responds to the analysis of the site and will contribute to the environment at a macro, meso, micro and nano scale. The aspiration is the integration of the architectural and topographical elements that respond to and restore an anthropologically contaminated site to its fullest potential. The building is an integrated organism rather than a static, nonresponsive structure.

5.2 DESIGN BRIEF

The reasons for placing the proposed district in the Chernobyl Exclusion Zone are as follows:

**Awareness of environmental impact at multiple scales: Macro, Meso, Micro, Nano**

To develop a landscape rehabilitation plan and use this site as a model to rewild and restore anthropologically contaminated sites, even in the most extreme cases.

**Integration with the landscape and interaction between all living and built systems**

This site is an experimental playground for researchers, scientist, rewilding experts and other organizations with an interest in anthropologically contaminated sites. Multiple opportunities of synergetic spaces are implemented.

**Narrative through elements**

Architectural and topographical elements are the tangible link between man, nature and environment to visually translate the narrative of the site’s past, present and future. Architectural and topographical elements respond to environmental factors and continue to adapt to changing factors after implementation.

**Invest in economic opportunities**

Capitalize on the growing interest of dark tourism, eco tourism and research.
5.3 TOPOGRAPHICAL ELEMENTS

District

Multiple phases of enhancement, mitigation and re-vegetation are implemented to alter the topography of the site. The district is 100 acres and emerges from the site. The layout of the district developed from three superimposed circle. There is a combination of architectural elements, hardscape, softscape and waterscape within the district to attract people, flora and fauna.

Edge

The tourist cross the district edge and enter the site from the east side of the district, adjacent to the Chernobyl tour path accessed via bus. Scientist and researchers enter from the north-west side of the district edge and the residents reside within the district boundary on the north-east side.

Paths

Paths and landmarks within the district accommodate all users. Paths radiate outward from the Ecological Observatory. The specific selection of trees and plants that line the paths attract free roaming wildlife, but also act as a buffer from radioactive air pockets. Paths extend out from the building platforms to viewing decks directed towards significant sites around the Exclusion Zone, as well as provide views of the expansive landscape.

Nodes

The main node is the Ecological Observatory. Entry points into the Ecological Observatory are separated and controlled for each user group. Within the building, private spaces for each user group are connected by public platforms. All users returning from the field are required to enter decontamination entry points prior to entering public spaces within the Ecological Observatory. The Mobile Research Pods act as supporting nodes for the Ecological Observatory. Mobile Research Pods remain out in the field and are only accessible to scientist and researchers.

Landmarks

Observatory Stations are static elements in and around the exclusion zone. These elements do not require the presence of people to function, but the sculptural forms of these stations exert points of wayfinding.

Narrative

Tourist experience:

The past of Chernobyl by visiting abandoned towns and engaging with the residents,

the present of Chernobyl by interacting within the district,

and the future by experiencing the rewilding of the surrounding area.
5.4 DESIGN CRITERIA

Investigation of history, context, environmental factors and restructuring of related theoretical models established the following design criteria:

<table>
<thead>
<tr>
<th>No.</th>
<th>DESIGN CRITERIA</th>
<th>CRITERIA CONFLICT</th>
<th>IMPLEMENTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Place and Narrative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cultural Heritage</td>
<td>The remaining residents are elderly and live in poor conditions with no electricity or potable water.</td>
<td>Incorporate cultural patterns into the design. Provide housing for the residents. Housing implements passive design strategies.</td>
</tr>
<tr>
<td>1</td>
<td>Existing Infrastructure</td>
<td>Structural stability of existing infrastructure compromised due to decay. Most existing infrastructures are unsafe without safety gear due to layers of dust mixed with radioactive material.</td>
<td>Existing infrastructure to remain for the purpose of memory of place and continue as a tourist attraction. Safety gear required when out in the field. Entry into decontamination areas prior to entering the building is required.</td>
</tr>
<tr>
<td>1</td>
<td>Historical Significance</td>
<td>Nuclear disaster disrupted life and continues to have a major impact on the environment.</td>
<td>Create a unique visitor experience. Trigger an emotional response through narrative to illustrate the need for action.</td>
</tr>
<tr>
<td>2</td>
<td>Landscape Integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Establish Connections to the Site</td>
<td>Exclusion Zone figuratively disconnected from the rest of the world, but continues to have a negative impact.</td>
<td>Organization and design of the proposal to have an impact at macro, meso, micro and nano scales.</td>
</tr>
<tr>
<td>2</td>
<td>Circulation</td>
<td>Ease of access for the different users: scientist and researchers, the elderly residents and large tour groups.</td>
<td>Minimize stairs; slightly sloped or level pathways. Designated access points per user group.</td>
</tr>
</tbody>
</table>
### 3 Synergies and Micro-Climates

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Strategies/Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Macro Scale</strong></td>
<td>Radioactive contaminants have contaminated flora and fauna; including migratory animals. The contaminated Pripyat River flows into the Black Sea.</td>
<td>Implement regenerative design strategies to decrease contamination of food chains and water sources. Experimentation of phytoremediation to absorb contaminants.</td>
</tr>
<tr>
<td><strong>Meso Scale</strong></td>
<td>Lack of bacteria and micro organisms has led to the build-up of leaf litter and dead trees from the past 30 years, which can potentially trigger a radioactive forest fire.</td>
<td>Mobile and static stations act as an incubator for the regions ecology. Biodiversity enhanced by implementing habitat corridors, wetlands, water pathways, etc.</td>
</tr>
<tr>
<td><strong>Micro Scale</strong></td>
<td>New buildings can have a negative impact on the site if material choice and methods are not properly considered before and after the life of the building.</td>
<td>Hybrid building structure to incorporate natural and artificial systems. Building must be responsive to the landscape, climate and context. Selection of recycled material, passive design strategies, and a limited number of materials.</td>
</tr>
<tr>
<td><strong>Nano Scale</strong></td>
<td>Lack of housing for visitors and residents. Lack of facilities for research. Decrease in biodiversity.</td>
<td>Shared spaces for people, flora and fauna. Generate microclimates and encourage shared resources. Living spaces for visitors and residents. Research facilities and laboratories for researchers and scientist.</td>
</tr>
</tbody>
</table>

### 4 Responsive to Available Resources, Application of Passive Design Principles

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Strategies/Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross Ventilation</td>
<td>No access to the grid for active systems. Active systems negatively impact the environment.</td>
<td>Building form and stack effect increase and evenly distribute air. Walls run parallel to breeze. Use of fans.</td>
</tr>
<tr>
<td>Orientation</td>
<td>Heat loss on the northern façade. High temperature on the west during summer months.</td>
<td>Orient North-South. Sunspace on Southern façade.</td>
</tr>
<tr>
<td>Winds</td>
<td>Wind loads. Possibility of radioactive air pockets reaching the site. Mild, temperate climate.</td>
<td>Responsive louver system. Multi-façade filtration system. Wind power and energy storage.</td>
</tr>
<tr>
<td>Rainwater and Groundwater Harvesting</td>
<td>Groundwater may be contaminated. Possibility of rainwater being contaminated if not collected properly.</td>
<td>Rainwater carefully collected and treated for potable use. Rainwater bladder storage.</td>
</tr>
</tbody>
</table>

### 5 Adaptability and Flexibility

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Strategies/Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible Spaces and Program</td>
<td>General lack of interaction. Fixed layout does not allow for various program uses.</td>
<td>Maximize indoor/outdoor spaces. Minimize private space. Public spaces have an open layout to accommodate multiple programs.</td>
</tr>
<tr>
<td>End of Life of Building</td>
<td>Most building materials go into landfills, negating the initial purpose.</td>
<td>Selection of recycled material. Selection of material that can be recycled after use.</td>
</tr>
</tbody>
</table>
5.5 PROGRAM

Architectural elements include the following: Ecological Observatory, Lab Shaft, Research Pods, Observatory Stations and private Greenhouse Residences.

ECOLOGICAL OBSERVATORY

The Ecological Observatory houses a variety of programs with open, flexible spaces which include the following: shared dining hall, gallery spaces, kitchen, admin offices, information desk, decontamination areas, hotel rooms and observation decks.

LAB SHAFT

The Lab Shaft houses open, semi-private and closed private laboratories.

RESEARCH PODS

Research Pods are inhabited only by scientist and researchers out in the field. They are the machines crucial to rewilding the Exclusion Zone through the process of a land remediation method called Imprinting. The pods roam the Exclusion Zone to collect samples, analyze data and monitor as they reforest the site.
OBSERVATORY STATIONS
Observatory Stations are observational tools. These elements house and protect a visual recording device to relay real-time data to the Ecological Observatory and Research Pods. These stations do not require the presence of people to function, but act as a wayfinding tool.

GREENHOUSE RESIDENCES
Permanent housing for the current residents of Chernobyl is available in close proximity to the Ecological Observatory. Each residence is enclosed within a greenhouse. The residents culturally eat what they grow; the greenhouse houses raised planting beds with safe soil to allow residents to grow their own food. The greenhouse minimizes the amount of energy needed to heat up the house through heat gain and passive design strategies. Residents have the opportunity to earn an income by interacting with visitors and sharing stories. Residents also utilize the facilities and resources available within the planned district.
CHAPTER 6: INVESTIGATION

“Every great movement must experience three stages: ridicule, discussion, adoption.”

- John Stuart Mill
6.1 Ecological Observatory
   Initial Design
   Water Collection Strategies
   Materiality

6.2 Research Pod
   Design Development

6.3 Greenhouse Residences
   Design Development
6.1 ECOLOGICAL OBSERVATORY

INITIAL SKETCH

Figure 149
Figure 150
WATER COLLECTION STRATEGIES

Figure 151
Figure 152
Figure 153

- Aluminum Frame
- Aluminum Panels coated with Titanium Dioxide
- Open Air Cutouts
- Aluminum Frame
- ETFE Panel
6.2 RESEARCH POD

DESIGN DEVELOPMENT

Figure 155
6.3 GREENHOUSE RESIDENCE

DESIGN DEVELOPMENT

Figure 156
CHAPTER 7: CONCLUSION
“We are or have become a kind of natural disaster.”

- Jeremy Caradonna
A LETTER TO THE PAST

April 26, 2046

Today marks the 60th year anniversary of the Chernobyl Nuclear Disaster and the consequences still scar the environment.

Although the Chernobyl Intervention has not shown significant impacts on the environment, it does continue to respond to the climate and sustain itself. The rainwater collection and treatment systems are still in use and are expected to be technologically improved in the next 10 years due to an increasing need for potable water. Radioactive contaminants have seeped into the groundwater and have begun to make its way into the limited fresh water supply. Consuming locally grown food is still problematic; food and other necessity products are still trucked in. So much for reducing negative environmental impact...

At the time of construction, the use of new materials and experimental strategies were costly and minor changes were made to reduce cost, but the Ecological Observatory continues to generate income as it accommodates thousands of tourists a year. Shortly after breaking ground, other shareholders invested in the construction of hotels in the area. Developers were hired because investors were interested in generating income and had no interest in a self sustained, ecologically friendly building. The Ecological Observatory attracts more tourists compared to other hotels because it allows tourists to encounter multiple experiences and become part of a narrative. Architectural elements such as the Research Pods and the Observatory Stations are still resourceful tools for researchers and scientist, like myself.

In addition, Ukrainian and Belarus governments developed plans to resettle residents back into the Exclusion Zone using the Greenhouse Residences as a model. These settlements are to be located outside of the 15km Zone as that Zone is still hot with radioactive air pockets. Both governments are currently in the process of moving the first set of families into the Greenhouse Residences where the Chernobyl residents resided. The last resident of Chernobyl, Tatiana, passed away eight years ago leaving the last of the occupied Greenhouse Residences vacant.

Although rewilding and integration strategies, similar to the strategies implemented in the Chernobyl Intervention, have been successful in smaller anthropologically contaminated sites, it is not enough for the Exclusion Zone due to the vastness and severity of site. Collected research concludes the rehabilitation of a site contaminated with radiation is extremely difficult, if not impossible. After thorough investigation and intervention, the most viable solution for Chernobyl is rehabilitation through natural processes. Although flora does not completely absorb all contaminants, it has proven to slow the spread of the radioactive contaminants.

We are or have become a kind of natural disaster.

- Jeremy Caradonna
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