NUCLEAR, RADIATION BUILDINGS AND ITS PEACEFUL UTILIZATION IN SUSTAINBLE DEVELOPMENT

By

Abd ElRady Mohamed Hussein Jumaa

A Thesis Submitted to the

Faculty of Engineering at Cairo University

In Practical Fulfillment of the Requirement for the Degree Of

DOCTOR OF PHILOSOPHY IN

ARCHITECTUREAL ENGINEERING

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Under the Supervision of

Prof.Dr.Tarek Abdel-latifAboul-Atta

Head of Architecture Department

(previously)Cairo University

Prof.Dr. Bahaa Bakri

Prof .Environmental Design and planning

(May he rest in Peace)

Prof.Dr. KaramAmin Ali Ssharshar

Head of the Radiation engineering department- previously

Atomic Energy Authority

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Approved by the Examining Committee

1- Prof. Dr, Tarek Abdel-Latif Aboul-Atta	**Thesis Main Advisor**
2- Prof. Dr, Karam Amin Ali Sharshar	**Advisor**
Atomic Energy Authority	
3- Prof. Dr, Ahmed Ahmed Faqry	**Internal Examiner**
4- Prof. Dr, Mohamed Mahmoud El-Fawal	**External Examiner**
Nuclear Regulatory Authority	

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Engineer: **Abdel-Radi Mohamed Hussein**

Date of Birth: **20/1/1952**

Nationality: **Egyptian**

E-mail **Mahammed.law@gmail.com**

Phone **: 01227223585**

Address: **23 Hagag Abdel Rheum Street -Imbaba - Giza**

Registration Date: **1/10/2010**

Awarding Date: **2017**

Degree: **Doctor of Philosophy**

Department: **Architectural Engineering**

Supervisors: **Prof. Dr. Tarek Abdel-latif Aboul-Atta Thesis Main Advisor**
Prof .Dr. Bahaa Bakri (May he rest in Peace)

Prof. Dr: Karam Amin Ali Sharshar Advisor (Atomic Energy)

Examiners:

Prof .Dr, Mohamed Mahmoud El-Fawal External Examiner

Nuclear Regulatory Authority

Prof .Dr, Ahmed Ahmed Feqry Internal Examiner

Prof. Dr, Tarek Abdel-Latif Aboul-Atta Thesis Main Advisor

Prof .Dr, Karam Amin Ali Sharshar Advisor (Atomic Energy)

Title of Thesis NUCLEAR, RADIATION BUILDINGS AND ITS PEACEFUL UTLIZATION IN SUSTAINABLE DEVELOPMENT

Key Words:-radiation, peaceful, utilization, Development, Architecture.

ABSTRACT: **The research aims at identifying the peaceful applications of nuclear radiation and its possible utilization on building materials, to improve its mechanical properties, the creation of new materials or testing their capability to endure nuclear radiation. In the first part the research studies the concept of nuclear radiation and its advantages and disadvantages. It also studies, in this part the criteria of planning and design of nuclear building and the ways to choose the appropriate building materials. The third chapter in this part, discusses the peaceful applications of gamma rays on buildings materials**

In the second part (applied), the researcher has undertaken several experiments on one of the mostly used building materials "the polycarbonate panels "which was subjected to different doses of gamma rays. The relationship between the doses change and the properties of the building material was studied from the transmittance of light and heat points of view. The research reached a mechanism to test the materials resistance to radiation based on the results of the applied tests. .

الخلاصة

تهدف الرسالة إلى التعرف على التطبيقات السلمية للإشعاع النووي وإمكانية استخدامها على مواد البناء لتحسين خواصها الميكانيكية أو استنباط مواد جديد أو اختبار مدى تحمل مواد البناء للإشعاع.

فى الجزء الأول يدرس البحث مفاهيم الإشعاع النووي وميزاته وعيوبه ، ويدرس فى هذا الجزء أيضا معايير تخطيط وتصميم المنشات النووية وكيفية اختيار مواد البناء ، اما الفصل الثالث من هذا الجزء يناقش التطبيقات السلمية لأشعة جاما على مواد البناء .

وتطرق هذا العمل لمضمون التطبيقات السلمية لأشعة جاما كمرحلة من مراحل التطور التكنولوجي والانتاجى والمعيشي للمجتمعات ترصد انعكاساتها على العمارة والعمران المصاحب لها وبما يتطلب أن تكون ضمن إطار اعتبارات التنمية المستدامة التي يدعم دورها بتحقيق التوازن بين متطلباتها والتوصل إلى آلية المدخل المتكامل الذي يراعى كيفية العمل على معايشة تكنولوجيا الإشعاع وما تحتاجه البلدان النامية ومنها مصر مع ما تعانيه من تواضع قدراتها الإدارية والتنموية ويهتم هذا العمل في إطاره الفكري بدراسة أهمية أشعة جاما وعلاقتها بمواد البناء حيث أسهمت أشعة جاما في التطور السريع لتكنولوجيا المواد بما يناسب تطور التكنولوجيا الحديثة.

أما الجزء الثاني (التطبيقي) فقد قام الباحث بعمل مجموعه اختبارات على احد مواد البناء الشائعة وهى ألواح البولي كربونيت لتعريضها لجرعات مختلفة من أشعة جاما ودراسة العلاقة بين التغير فى الجرعات وخواص هذه المادة من ناحية نفاذية الضوء والحرارة .

.وتم في هذه الدراسة إمكانية التقييم البيئي لوحدات التصنيع الجامى التي أصبحت داخل الكتل السكنية لمعالجة الإخطار والآثار السلبية عند أختيار نوع نظام التشغيل وجد أن تصميم الوحدات الإشعاعية على المستوى الرأسي أفضل من المستوى الافقى في معالجة الإخطار والآثار السلبية من المصدر، نتيجة لأنها مؤمنة ذاتيا،ولا تتعرض الفراغات المجاورة للوحدة للمخاطر، والآثار السلبية كما في الوحدات الأفقية.

أهمية التقييم البيئي للمبنى لتقليل تكلفة التشغيل والبناء وتوفير الطاقة والتشغيل الأمن بيئيا وان المبنى الذي يحتوى على الفناء يتميز من الناحية الاقتصادية والبيئية لتكامل أنظمة الطاقة داخل المبنى والفصل بين مناطق العمل لسهولة الحركة للأفراد والمعدات والمنتج وتوافر أنظمة ومخارج الطوارئ.

ويقوم الطرح الرئيسي لهذا العمل على مجموعة من الملاحظات والتجارب العملية على منتج البولي كربونيت وهو أحد مواد البناء والتي أدت إلى علاقة مشتركة بين تكنولوجيا الإشعاع والتنمية المستدامة من حيث الحفاظ على البيئة ومواردها لما لهذا المنتج من خواص تساهم في تكامل أنظمة الطاقة داخل المباني حيث أثبتت نتائج التجربة أن هناك علاقة سلبية بين منتج البولي كرب ونيت وأشعة جاما .

وقد تم التوصل إلى آلية لاختيار المواد المقاومة للإشعاع بناء على نتائج الجزء التطبيقي

Abstract

The research aims at identifying that peaceful applications of nuclear radiation and its possible utilization on building materials, to improve its mechanical properties, the creation of new materials or testing their capability to endure nuclear radiation.

In the first part the research studies the concept of nuclear radiation and its advantages and disadvantages. It also studies, in this part the criteria of planning and design of nuclear building and the ways to choose the appropriate building materials.The third chapter in this part, discusses the peaceful applications of gamma rays on buildings materials

Work aims to familiarize the reader some peaceful applications of gamma radiation that serve the National Development and check the concept of sustainable development on the one side and works on the other side to get rid of some harmful effects on the environment, and access to a mechanism to provide criteria for the use technology of resistant materials for radiation in Egypt, and the advantage from developments of radiation technology in treatment of resistant materials for radiation in buildings in Egypt, and identify on chose criteria of material resistance for radiation, where that radiation technology are safety record is superior to any other technology

In this study, the possibility of an environmental assessment of the gamma manufacturing facilities both when choosing the type of operating system, The selection of vertical radiation units is better in treatment the hazards and negative effects of the source, as it is self-contained, and the spaces adjacent to the radiation unit are not exposed to hazards, and the negative effects as in horizontal

In the second part (applied), the researcher has undertaken several experiments on one of the mostly used building materials "the polycarbonate panels "which was subjected to different doses of gamma rays. The relationship between the doses change and the properties of the building material was studied from the transmittance of light and heat points of view .

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The research reached a mechanism to test the materials resistance to radiation based on the results of the applied tests .

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