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Journal Name:	**Physical Science International Journal**
Manuscript Number:	**2015_PSIJ_16603**
Title of the Manuscript:	**Design of a Novel Shield of Nuclear Medicine with New Alloy**
Type of the Article	**Original Research Article**

General guideline for Peer Review process:

This journal's peer review policy states that **NO** manuscript should be rejected only on the basis of '**lack of Novelty'**, provided the manuscript is scientifically robust and technically sound.
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PART 1: Review Comments

	Reviewer's comment	**Author's comment** *(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)*
Compulsory REVISION comments	**1. Abstract :** Results: The results of the tests were evaluated and determined that the designed shield reduces considerably the received dose by a thousand times. Comments: the results do not reflect on the real outcomes. Elaborate more on the outcomes. **2. Introduction** **Please include aim(s) of the study in the INTRODUCTION section.** **In the introduction section, very minimum references were included in the second paragraph.** As usage of radioactive materials spread, providing a portable effective shield for protection of operating personnel became vital. Gamma radiation is emitted in all directions from its source as an expanding spherical front of energy, with great powers of penetration. High energy gamma radiation will not be wholly blocked by these shields, while lower energy levels can be safely blocked. The most hazardous radiations are gamma rays, x-rays, and neutron particles. If a shield can be effective toward these types of radiation, there would be a negligible hazard from other types. An effective shield should induce sufficient attenuation of the radiation intensity caused by a particular installation to a tolerable level. Lead density, high atomic number, high level of	

	stability, ease of fabrication, high degree of flexibility in application, and its availability has rendered it to an excellent shielding material. High levels of ionizing radiations from radioactive substances are dangerous for living organisms, including human kind. The first people that worked with X-rays and radioactive substances are clearly observed that these substances can cause burns or scarring and there is a possibility of chromosomal mutation and subsequent cancer even at low levels (2). For the whole statement above you only mention 1 reference—please include more than 1 reference(s) In some cases, the easiest way to reduce the amount 46 of radiation exposure to people who are working in this field is putting a shield between the source of radiation and the person. Lead has been always considered as a traditional choice for the radiological protection. It has long been used in radiology departments to protect both workers and patients from any unnecessary exposure to ionizing radiation (3-5). Please be specific which statement reflect on reference 3 likewise 4 and 5. In reviewing the previous using lead as shielding **materil** will redound an effective, light-weight, low-volume attenuation barrier. These factors, combined with its versatility, makes lead an ideal choice for x53	

ray shielding applications.
No reference was included.
In the introduction also No inclusion of the aim(s) of the study.

~~However~~, Over the past years a great deal of concern has been expressed about the toxicity of
lead and the need f~~or~~ of transition from flexible lead protectors to environmentally friendly
nontoxic lead-free shields has been proposed by many scientists (6-9). Please be specific which statement reflect on reference 6 likewise 7,8 and 9.
The sentence above too long.

Recently, Mortazavi and his colleagues in Iran were able to build a lead-free protective with the name Tapron which mainly ~~practical~~ used in diagnostic radiology(10).

Materials and Methods

~~Firstly,~~ Energy threshold ~~that~~ must be controlled and managed was obtained by calculating the
maximum energy emitted from the vials, syringes and radioactive waste in nuclear medicine and
immunology sectors.

Its (Be specific) level in ideal conditions was between 1 to 1000 mCi which is relatively high dose. An alloy (2 mm thickness) of Cadmium (40%), Bismuth (40%), Lead (15%) and Copper (5%) wired with Nichrome (1 mm thickness) (an alloy of nickel and chromium) selected by studying of metals and calculation of the amount of protection to reduce the dose and calculation of

	dose reduction and metals' HVL (Half Value Layer) by Monte Carlo N-Particle Transport Code (MCNP4C) modeling. It should be noted that the presence of copper in the alloy increases its protection to some extent. No need reason in the method elaborate more in the discussion. Moreover, program was calculated once again in a case that there is yet ~~not~~ any protection against mentioned source, in order to compare and illustrate the impact of shield, the output was measured at a distance of 1 meter. In this method and materials please state CLEARLY how the experiments been conducted and also how the results be analysed. **Result** Values prepared by the National Bureau of Standards may be used to determine the required thicknesses for shielding from gamma ray sources in ~~the~~ laboratory. In practice such calculations should be made only under the direction of a qualified expert/ personnel. The alloy of Cadmium, Bismuth, Lead and Copper wired with Nichrome selected and Monte Carlo N-Particle Transport Code (MCNP4C) modeling used for calculation of dose reduction and metals Half Value Layer. **Please do not include method again in the result section.** The presence of copper in the alloy increases its protection to some extent. No need explanation in the result section.	

	The number of studied particles in the simulation was considered 80 million in order to reduce the statistical error. Source energy was defined 662 KeV in the input file and F1 Tali was used in order to calculate the integral of the intensity based on the studied surface The above statement is more elaboration on the methods, please rewrite and state it in the materials and methods section. Discussion When there is a risk of exposure with harmful amounts of radionuclide, personal protective equipment (PPE) should be worn. The type of PPE depends on the quantity, type, and nature of the radiation and health care facility design. For low and medium level work, coveralls, caps, gloves and either special shoes or shoe covers are suggested. For close or contact work with radioactive materials emitting radiation of low penetrating power, shielded clothing such as leather, eye protection or leaded gloves and aprons may be used to increase allowable exposure time. As we try to increase the protection level of shields, the inevitable result is weight increase and flexibility reduction which leads to inability to use shielded attire. Because of the penetrating ability of the radiation used in nuclear medicine, shielding is necessary. The most important role of a protecting shield is preventing rays penetration. Density of shield material has the most important role in preventing penetration of rays. Currently, the dentest available substance is lead. Lead and some of its alloys are generally the most cost-effective	

	shielding materials to protect against the effects of γ- and x-rays. The properties of lead that make it an excellent shielding material are its density, high atomic number, level of stability, ease off abrication, high degree of flexibility in application, and availability lead is more uniform in density in comparison with other aggregate materials. Hence, generally lead products show smooth surfaces that leads to contamination risk reduction and therefore, less radioactive hazard. (11). Lead is heavier than roughly 80 per cent of the periodic table. It could be assumed therefore that shield constructions making use of lead will tend to be heavier than constructions making use of lighter elements. This concept may be true in static shielding structures where weight and volume restrictions are of lesser importance, and concrete and water are often used. In portable shielding systems that low weight and volume are two important factors, selection of lighter materials may adversely affect the protective property of the shield. Recently there has been a great deal of concern expressed about the toxicity of lead and human lead toxicity is well documented (12-14). Lead is a systemic toxicant with no known beneficial biological function and, for several endpoints, no identified threshold of toxicity. The fetus, children, pregnant and elderly are particularly susceptible to some of the toxic effects of Pb (15).	

	Owing to this reality, there is a necessity for transition from conventional lead protectors to environmentally friendly non-toxic lead-free shields. **Too much elaboration on the introduction on the subject matter. I suggest reduce and take the important points to support your findings.** **Please specify the location of the references. I would strongly suggest thatthe references be included at the end of each sentence.** **Need a restructuring and the contents. Write less on the introduction but more on supporting your outcomes.** In this study a specific combination of Cadmium (40%), Bismuth (40%), Lead (15%) and Copper (5%) wired with Nichrome as a novel alloy with a slight amount of lead compared to the traditional lead-based protectors introduced as a possible suitable replacement. Moreover, the carbon based polymeric layer of Cadmium, Bismuth and Lead that is placed in the middle of the two layers of mentioned alloy increases protection several times. In addition, the extra weight of lead aprons results in low back pain and neck pain among radiologists and cardiologists 138 in the long term. ~~Likewise~~, Lead based protectors, protective shields for radioiodine vials in particular, are very heavy and long-term moving of the m results in plenty of adverse physical effects. ~~However,~~ the designed nuclear medicine shield in this study is significantly lighter in comparison with lead based shields as a result of less lead usage and	

	considerable thinner thickness. Compared with lead based protectors, the present new shield is so flexible that can be easily customized into arbitrary shapes. Moreover, this new alloy is environmentally friendly and can be recycled conveniently. Therefore, the designed shield can be considered as an elastic, resistant to erosion, environmentally friendly, lightweight substitute for conventional lead shields. THE WHOLE PARAGRAPH IS JUST STATING ON THE STUDY OUTCOMES WHERE IT SHOULD BE INCLUDED IN THE RESULTS SECTION. Yes you have to state the results BUT need to be support by other studies. **Conclusion:** **This novel shield** (NOT SPECIFIC ENOUGH) with a much less lead produced in this study is considerably safer and offer effective protection in diagnostic energy ranges and may replace the traditional lead-based protectors. The conclusion has to be SPECIFIC. The conclusion MUST reflect the Title. **Used geometry Radiation intensity ± Error== what does it mean** **Does it mean statistical error.**	

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Minor REVISION comments	Some mistakes in using the wrong English vocubulary	
Optional/General comments	This study is good but again the authors do not elaborate on the results too much.	

Reviewer Details:

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