## 1AC—James/Jack

#### Contention one is the status quo

#### Despite feasibility, thorium tech hasn’t caught on in the US

Niiler ’12 Eric Niiler, “Nuclear power entrepreneurs push thorium as a fuel,” Washington Post, 2/20/2012, http://www.washingtonpost.com/national/health-science/nuclear-power-entrepreneurs-push-thorium-as-a-fuel/2011/12/15/gIQALTinPR\_story.html

The proposed fuel is thorium, an abundant silver-gray element named for the Norse god of thunder. It is less radioactive than the uranium that has always powered U.S. plants, and advocates say that not only does it produce less waste, it also is more difficult to turn into nuclear weapons. They’re pushing the idea of adapting plants to use thorium as a fuel or replacing them with a completely new kind of reactor called a liquid-fluoride thorium reactor, or LFTR (pronounced “lifter”). The LFTR would use a mixture of molten chemical salts to cool the reactor and to transfer energy from the fission reaction to a turbine. Proponents say such a system would be more efficient and safer than existing plants, which use pressurized water to cool uranium fuel rods and boiling water or steam to transfer the energy they create. “A molten-salt reactor is not a pressurized reactor,” said John Kutsch, director of the Thorium Energy Alliance, a trade group based in Harvard, Ill. “It doesn’t use water for cooling, so you don’t have the possibility of a hydrogen explosion, as you did in Fukushima.” Kutsch and others say that a thorium-fueled reactor burns hotter than uranium reactors, consuming more of the fuel. “Ninety-nine percent of the thorium is burned up,” he said. “Instead of 10,000 pounds of waste, you would have 300 pounds of waste.” ‘Small boatloads of fanatics’ Although the idea of thorium power has been around for decades — and some countries are planning to build thorium-powered plants — it has not caught on with the companies that design and build nuclear plants in the United States or with the national research labs charged with investigating future energy sources.

#### Budget request triggers perception links

Green Car Congress 12 (Green Car Congress, edited by Mike Millikin, editor and analyst in the IT industry for more than 15 years, "President’s Budget for FY 2013 boosts discretionary funds for DOE, cuts fossil fuel subsidies," Feb 13, [www.greencarcongress.com/2012/02/budget-20120213.html], jam)

The President’s Budget for FY 2013 provides $27.2 billion in discretionary funds for the US Department of Energy (DOE), a 3.2% increase above the 2012 enacted level. The request includes increased funding for clean energy, research and development to spur innovation, and advanced manufacturing. Savings and efficiencies are achieved through eliminating more than $4 billion annually in fossil fuel subsidies; eliminating low-priority and low-performing programs, and by concentrating resources on full utilization of existing facilities and infrastructure. Total outlays for FY 2013 are estimated to be $34,963 billion, compared to the estimated $40,561 billion in outlays for FY 2012. Other key elements in the proposed budget for the DOE include: Increases funding for applied research, development, and demonstration in the Office of Energy Efficiency and Renewable Energy ($2.3 billion). These funds are part of a broad energy strategy that emphasizes priorities in clean energy and advanced manufacturing, through grants, financing assistance, and tax incentives that accelerate fundamental research, technology development, and commercialization. Within EERE, the Budget increases funding by nearly 80% for energy efficiency activities and increases funding for the development of the next generation of advanced vehicles and biofuels. It maintains support for research, development, and demonstration of renewable electricity generation, including: $310 million for the SunShot Initiative; $95 million for wind energy, including off-shore wind technologies; and $65 million for geothermal energy and enhanced geothermal systems. The Budget also provides $770 million for the Office of Nuclear Energy, which includes funding for advanced small modular reactors R&D. Other priority activities include R&D on storage, transportation, and disposal of nuclear waste that supports the implementation of recommendations put forward by the Blue Ribbon Commission on America’s Nuclear Future. The Budget also includes $350 million for the Advanced Research Projects Agency–Energy. $421 million for fossil energy R&D, including $12 million to fund a multi-year research initiative aimed at advancing technology and methods to develop domestic natural gas resources. Specifically, DOE, in collaboration with the Environmental Protection Agency and the US Geological Survey, will focus on understanding and reducing the environmental, health, and safety risks of natural gas and oil production from hydraulic fracturing in shale and other geologic formations. More than doubles research and development on advanced manufacturing processes and advanced industrial materials, enabling companies to cut costs by using less energy while improving product quality. Promotes basic research through $5 billion in funding to the Office of Science. Works through the President’s Better Building Initiative to make non-residential buildings more energy efficient by catalyzing private sector investment. Creates jobs through mandatory funding for HomeStar incentives to consumers to make their homes more energy efficient. Positions the Environmental Management program to meet its legally enforceable cleanup commitments at sites across the country. Continues investments to maintain a nuclear weapons stockpile in support of the planned decrease in deployed US and Russian weapons under the New Strategic Arms Reduction Treaty. Provides funding for securing, disposing of, and detecting nuclear and radiological material worldwide.

#### Advantage one is prolif

#### Nuclear terrorism is inevitable absent fissile material disposal—Bin Laden was only the beginning—expert consensus

Smith 11 (James F., Communications Director, Belfer Center for Science and International Affairs, Jun 6, [www.nti.org/newsroom/news/first-joint-us-russia-assessment/], jam)

Researchers from the United States and Russia today issued a joint assessment of the global threat of nuclear terrorism, warning of a persistent danger that terrorists could obtain or make a nuclear device and use it with catastrophic consequences. The first joint threat assessment by experts from the world’s two major nuclear powers concludes: “If current approaches toward eliminating the threat are not replaced with a sense of urgency and resolve, the question will become not if but when, and on what scale, the first act of nuclear terrorism occurs.” The study recommends measures to tighten security over existing nuclear weapons and the nuclear materials terrorists would need to make a crude nuclear bomb, along with expanded police and intelligence cooperation to interdict nuclear smuggling and stop terrorist nuclear plots. The report also calls for improved protection of nuclear facilities that might be sabotaged, and of radiological materials that might be used in a dirty bomb. The report, titled "The U.S.-Russia Joint Threat Assessment on Nuclear Terrorism," released on Monday, June 6, in Cambridge, Mass., and in Moscow, results from a nearly year-long partnership by nuclear security experts from the Belfer Center for Science and International Affairs at Harvard Kennedy School and The Institute for U.S. and Canadian Studies in Moscow, a leading Russian research center. The lead U.S. and Russian authors are Rolf Mowatt-Larssen, a senior fellow in the Belfer Center and a former director of intelligence and counter-intelligence at the U.S. Department of Energy, and Pavel S. Zolotarev, a retired army general who is deputy director of Moscow’s Institute for U.S. and Canadian Studies, at the Russian Academy of Sciences, and former head of the Information and Analysis Center of the Russian Ministry of Defense. “ If you look at the U.S. and Russia together, we own about 90% of the problem – more of the weapons, less of the nuclear materials. So it’s only right that these two countries share their expertise and look hard at ways to work together to lower the risks,” said Mowatt-Larssen. “The United States and Russia have never produced a document that could be said to represent a common understanding of the nuclear terrorism threat. This can now be used as a basis for driving action in both governments.” Zolotarev said: "Russia and the United States have paid more attention to nuclear weapons and nuclear deterrence, even though neither of our two countries has a political need to rely threat of nuclear terrorism, which constitutes a more real threat than the enormous arsenals of nuclear weapons in both countries. The threat of nuclear terrorism is increasing. Our response should anticipate the dynamics of the threat rather than lag behind it." The researchers’ joint assessment was reviewed and endorsed by a group of retired U.S. and Russian senior military and intelligence officers, led by General Anatoliy S. Kulikov (former Minister of Interior) and General Eugene E. Habiger (former STRATCOM commander). This “Elbe Group” was established in October 2010 to create an informal communication channel on security issues of concern to both the United States and Russia. The Joint Threat Assessment was coordinated by the Kennedy School’s U.S.-Russia Initiative to Prevent Nuclear Terrorism, which is directed by William Tobey, a senior fellow in the BelferCenter and former top official in the National Nuclear Security Administration. The assessment project was supported by the Nuclear Threat Initiative, a non-profit organization in Washington that works to reduce threats from nuclear, chemical and biological weapons. “The joint threat assessment accomplishes something that so far governments have been unable to do: gauge the threat of nuclear terrorism from differing national perspectives, and thereby form the basis for effective action to defeat it,” said Tobey. “This will help to overcome the number one barrier to improved nuclear security--complacency." Key Findings The joint assessment examines potential terrorist pathways to a nuclear attack, among them buying or stealing an existing weapon, or getting highly enriched uranium or plutonium and fashioning a crude nuclear bomb of their own, which the study warns is distressingly plausible. It also concludes that while the killing of Osama bin Laden damages al Qaeda’s capacity to carry out nuclear terrorism, surviving leaders of the group retain nuclear terror ambitions. The joint report documents that al Qaeda has been working for years to acquire the nuclear materials and expertise needed to make a crude nuclear bomb, getting as far as carrying out explosive tests for their nuclear program in the Afghan desert. The report outlines the steps terrorists could follow and envisions how a terrorist nuclear plot might be structured – and how countries should work together to stop it. The study notes that in addition to al Qaeda, terrorists from the North Caucasus region remain committed to carrying out catastrophic attacks, have carried out reconnaissance at nuclear weapon storage sites, have plotted to hijack a nuclear submarine with nuclear weapons on board, have planted radiological materials in Moscow, and have repeatedly threatened to attack nuclear power plants. These groups include factions in Chechnya, Dagestan, Ingushetia and elsewhere. Among the joint assessment’s recommendations: All stocks of nuclear weapons, highly enriched uranium and plutonium must be protected against all plausible terrorist and criminal threats, and the number of locations where these stocks exist must be reduced as much as practicable. Coordinated U.S.-Russian leadership is vital for this international effort because the two countries hold the largest nuclear stockpiles and are most experienced in dealing with nuclear security. This joint effort should promote and support enhanced intelligence and law enforcement by UN, the International Atomic Energy Agency, and international police organizations.

#### We’re overdue for a nuclear attack – it is too easy to steal weapons grade plutonium from reactors

Tirone ‘12 (Jonathan, reporter for Bloomberg News, 3/22/2012, "Missing Nukes Fuel Terror Concern," [www.businessweek.com/news/2012-03-22/missing-nukes-fuel-terror-concern-as-seoul-meeting-draws-obama#p1], jam)

A nuclear-armed terrorist attack on the U.S. port in Long Beach, California, would kill 60,000 people and cost as much as $1 trillion in damage and cleanup, according to a 2006 Rand study commissioned by the Department of Homeland Security. Even a low-level radiological or dirty-bomb attack on Washington, while causing a limited number of deaths, would lead to damages of $100 billion, according to Igor Khripunov, the Soviet Union’s former arms-control envoy to the U.S. He is now at the Athens, Georgia-based Center for International Trade and Security. Because a terrorist needs only about 25 kilograms of highly-enriched uranium or 8 kilograms of plutonium to improvise a bomb, the margin of error for material accounting is small. There are at least 2 million kilograms (4.4 million pounds) of stockpiled weapons-grade nuclear material left over from decommissioned bombs and atomic-fuel plants, according to the International Panel on Fissile Materials, a nonprofit Princeton, New Jersey research institute that tracks nuclear material. That’s enough to make at least 100,000 new nuclear weapons on top of the 20,000 bombs already in weapon-state stockpiles. ‘Poorly Secured’ “The elements of a perfect storm are gathering,” said former Democratic Senator Sam Nunn, founder of the Washington- based Nuclear Threat Initiative, in an e-mail. “There is a large supply of plutonium and highly enriched uranium-weapons- usable nuclear materials spread across hundreds of sites in 32 countries, too much of it poorly secured. There is also greater know-how to build a bomb widely available, and there are terrorist organizations determined to do it.” Greenpeace, the anti-nuclear environmental group, has shown the ease with which intruders could breach security at Electricite de France SA reactors. Activists on Dec. 5 exposed lapses at EDF nuclear reactors near Paris and in southern France, hiding inside one for 14 hours and unfurling a banner reading “Safe Nuclear Doesn’t Exist” on the roof of another. Invading Power Plants Since then, EDF has reviewed existing barriers around reactor sites and added patrols with guard dogs and tasers, said Dominique Miniere, the company’s director of nuclear production. If saboteurs were to penetrate a reactor site and disable the power supply, creating a similar effect as when the tsunami struck the Fukushima Dai-Ichi plant in Japan last year, there would be a danger of the nuclear fuel rods melting and radioactive particles being released into the air. Criminals breached South Africa’s Pelindaba nuclear facility in 2007, overpowering guards who oversaw the country’s stock of bomb-grade material. The U.S. Defense Threat Reduction Agency dismissed staff over nuclear security concerns in May 2008 at a North Dakota base that dispatched nuclear bombs without proper controls. In November 2010, Belgian activists evaded North Atlantic Treaty Organization guards to expose weak security protecting nuclear weapons at a base in Kleine Brogel. Activists spent several hours taking pictures of a bunker containing nuclear warheads before security guards apprehended them. The Global Zero Initiative, whose U.S. arm is headed by former nuclear negotiator Richard Burt, said in a report last month that the greatest nuclear security threat in Russia comes from bases in the country’s west that house tactical nuclear warheads targeting Europe. These bases provide inadequate security against theft or sabotage, according to the report, whose authors included Russian former arms-control negotiators. At the end of the Cold War, the Soviet Union had about 22,000 nuclear weapons in storage in Russia and such satellite states as Armenia, Belarus, Kazakhstan and Ukraine. Allison says there are doubts that all the weapons-usable material was recovered when many warheads were repatriated and dismantled because of the chaos at the time and incomplete records. About 100 grams of highly enriched uranium, lodged inside a nuclear fission chamber, was plucked out of a Rotterdam scrap- metal yard in 2009 by Jewometaal Stainless Processing BV’s radiation-safety chief, Paul de Bruin. The scrap probably came from a decommissioned Soviet nuclear facility, he said. Low Detection Chance The discovery illustrated the ease with which nuclear material can bypass accounting checks and international radiation monitors. The shipment containing the uranium had already been checked for radioactivity. “The inability to accurately account for weapon-usable nuclear material around the world is a major obstacle to eliminating the threat of nuclear terrorism,” said Edwin Lyman, a senior physicist at the Cambridge, Massachusetts-based Union for Concerned Scientists, on March 14. Plutonium can be smuggled from some facilities “without a high probability of detection,” he said. One issue threatening to hobble the security summit is that all nations aren’t invited, wrote Burt, who is also a managing director at Washington’s McLarty Associates. He negotiated nuclear-weapons cuts with the Soviets under President George H.W. Bush. IAEA Role Other countries that weren’t invited include Belarus, home to about 500 pounds of high-enriched uranium that the U.S. wants removed, and Niger, the West African nation falsely accused of supplying uranium to Iraq before the 2003 war over an alleged nuclear-weapons program. Organizers opted to keep participation narrow in 2010 to foster more substantive debate, South Korea’s International Atomic Energy Agency envoy, Cho Hyun, said in a March 15 interview. By excluding some nuclear nations from the proceedings, the summit organizers risk undercutting the role of the Vienna-based IAEA, which verifies nuclear material worldwide. “The summit’s lack of universality affects the ability of the IAEA to take a visible role in nuclear security,” said Cho, who was previously South Korea’s chief negotiator for U.S. nuclear agreements. “The IAEA has been playing an essential role in strengthening international efforts for nuclear security.” Not Yet? The 153-member IAEA, whose powers are granted by consensus, has published guides and helped install detection equipment, in addition to making sure fissile material isn’t diverted for weapons in places like Iran. Lebanon asked the Vienna-based agency in 2008 to help install radiation monitors in Masnaa, along its border with Syria. “Nuclear security is a global issue and it requires a global response,” IAEA spokeswoman Gill Tudor said today in an e-mail, adding that the agency’s security budget will need to grow in order for it to help member states. “The need to improve nuclear security greatly exceeds inflation.” In the absence of binding oversight or an international verification treaty, Harvard’s Allison said he was surprised terrorists haven’t already used nuclear materials in an attack. “There is general agreement in national security circles that” a dirty bomb attack “is long overdue,” he said. “Terrorists have known for a long time that nuclear reactors are potentially vulnerable to attack or sabotage.” Other officials say the threat of nuclear terrorism should be taken seriously without being overplayed in public. “Those of us who are ringing the nuclear terrorism alarm take care to not overstate the odds of such an attack,” former U.S. Energy Department Director of Intelligence Rolf Mowatt- Larssen wrote March 18 in an e-mail. “The population is also suffering from terror-warning fatigue.” “Governments are only now beginning to think about how to raise nuclear security standards worldwide,” Washington-based Arms Control Association President Daryl Kimball said March 14. “Terrorists only need to exploit the weakest link in order to acquire nuclear material that could eventually lead to a detonation that would make the Fukushima disaster pale in comparison.”

#### Nuclear terrorism causes global nuclear exchange

Ayson 10 (Robert, Professor of Strategic Studies and Director of the Centre for Strategic Studies: New Zealand at the Victoria University of Wellington, “After a Terrorist Nuclear Attack: Envisaging Catalytic Effects,” Studies in Conflict & Terrorism, Volume 33, Issue 7, July, informaworld)

A terrorist nuclear attack, and even the use of nuclear weapons in response by the country attacked in the first place, would not necessarily represent the worst of the nuclear worlds imaginable. Indeed, there are reasons to wonder whether nuclear terrorism should ever be regarded as belonging in the category of truly existential threats. A contrast can be drawn here with the global catastrophe that would come from a massive nuclear exchange between two or more of the sovereign states that possess these weapons in significant numbers. Even the worst terrorism that the twenty-first century might bring would fade into insignificance alongside considerations of what a general nuclear war would have wrought in the Cold War period. And it must be admitted that as long as the major nuclear weapons states have hundreds and even thousands of nuclear weapons at their disposal, there is always the possibility of a truly awful nuclear exchange taking place precipitated entirely by state possessors themselves. But these two nuclear worlds—a non-state actor nuclear attack and a catastrophic interstate nuclear exchange—are not necessarily separable. It is just possible that some sort of terrorist attack, and especially an act of nuclear terrorism, could precipitate a chain of events leading to a massive exchange of nuclear weapons between two or more of the states that possess them. In this context, today’s and tomorrow’s terrorist groups might assume the place allotted during the early Cold War years to new state possessors of small nuclear arsenals who were seen as raising the risks of a catalytic nuclear war between the superpowers started by third parties. These risks were considered in the late 1950s and early 1960s as concerns grew about nuclear proliferation, the so-called n+1 problem. t may require a considerable amount of imagination to depict an especially plausible situation where an act of nuclear terrorism could lead to such a massive inter-state nuclear war. For example, in the event of a terrorist nuclear attack on the United States, it might well be wondered just how Russia and/or China could plausibly be brought into the picture, not least because they seem unlikely to be fingered as the most obvious state sponsors or encouragers of terrorist groups. They would seem far too responsible to be involved in supporting that sort of terrorist behavior that could just as easily threaten them as well. Some possibilities, however remote, do suggest themselves. For example, how might the United States react if it was thought or discovered that the fissile material used in the act of nuclear terrorism had come from Russian stocks,40 and if for some reason Moscow denied any responsibility for nuclear laxity? The correct attribution of that nuclear material to a particular country might not be a case of science fiction given the observation by Michael May et al. that while the debris resulting from a nuclear explosion would be “spread over a wide area in tiny fragments, its radioactivity makes it detectable, identifiable and collectable, and a wealth of information can be obtained from its analysis: the efficiency of the explosion, the materials used and, most important … some indication of where the nuclear material came from.”41 Alternatively, if the act of nuclear terrorism came as a complete surprise, and American officials refused to believe that a terrorist group was fully responsible (or responsible at all) suspicion would shift immediately to state possessors. Ruling out Western ally countries like the United Kingdom and France, and probably Israel and India as well, authorities in Washington would be left with a very short list consisting of North Korea, perhaps Iran if its program continues, and possibly Pakistan. But at what stage would Russia and China be definitely ruled out in this high stakes game of nuclear Cluedo? In particular, if the act of nuclear terrorism occurred against a backdrop of existing tension in Washington’s relations with Russia and/or China, and at a time when threats had already been traded between these major powers, would officials and political leaders not be tempted to assume the worst? Of course, the chances of this occurring would only seem to increase if the United States was already involved in some sort of limited armed conflict with Russia and/or China, or if they were confronting each other from a distance in a proxy war, as unlikely as these developments may seem at the present time. The reverse might well apply too: should a nuclear terrorist attack occur in Russia or China during a period of heightened tension or even limited conflict with the United States, could Moscow and Beijing resist the pressures that might rise domestically to consider the United States as a possible perpetrator or encourager of the attack? Washington’s early response to a terrorist nuclear attack on its own soil might also raise the possibility of an unwanted (and nuclear aided) confrontation with Russia and/or China. For example, in the noise and confusion during the immediate aftermath of the terrorist nuclear attack, the U.S. president might be expected to place the country’s armed forces, including its nuclear arsenal, on a higher stage of alert. In such a tense environment, when careful planning runs up against the friction of reality, it is just possible that Moscow and/or China might mistakenly read this as a sign of U.S. intentions to use force (and possibly nuclear force) against them. In that situation, the temptations to preempt such actions might grow, although it must be admitted that any preemption would probably still meet with a devastating response.

#### Thorium reactors can’t produce weapons grade waste – stymies all state and non-state proliferation attempts

Donohue 8/17 (Nathan, George Washington University, Elliott School of International Affairs,

research intern for the Project on Nuclear Issues, Center for Strategic and International Studies, 2012, "Thorium and its Value in Nonproliferation," [csis.org/blog/thorium-and-its-value-nonproliferation], jam)

The Federation of American Scientists (FAS) recently featured an article on their Science Wonk blog entitled “What about thorium?” As the article discussed, thorium is an element, which like uranium, has the ability to be utilized to produce nuclear power. More importantly, thorium fueled reactors are reported to be more proliferation resistant than uranium fueled reactors. However, despite these assertions, thorium has almost universally been ignored in favor of uranium based nuclear power reactors. The purpose of this piece is to conduct a review of thorium and to develop a better understanding of thorium’s nonproliferation benefits as it relates to nuclear power production. As FAS notes, natural thorium is a fertile material, while not itself fissionable, can be converted into a fissile material suitable to sustain a nuclear fission chain reaction. Accordingly, when natural thorium captures neutrons it becomes a new isotope of thorium which then goes through a process of decay where over a period of weeks, the thorium actually turns into uranium in the form of U-233. Unlike natural thorium, this U-233 is a fissile material suitable to sustain a nuclear fission chain reaction. The use of thorium to produce nuclear power is not a new concept. Research into thorium began in the late 1950’s and in 1965, Alvin Weinberg, the head of the Oak Ridge National Laboratory, and his team built a working thorium reactor using a molten salt bath design. Thorium was used to power one of the first commercial nuclear power plants in the U.S. in Shippingport, Pennsylvania in 1977. Nevertheless, research into thorium never found a foothold in the U.S. nuclear power infrastructure. By 1973, thorium research and development was fading to the uranium based focus of the U.S. nuclear industry, which was in the process of developing 41 new nuclear plants, all of which used uranium. The Shippingport facility was one of the last vestiges of thorium research in the U.S. for decades. Recently there has been a renewed focus on thorium based nuclear power, specifically in regards to the benefits related to spent fuel, including research involving the European Commission, India, Canada, Slovakia, the Russian Federation, China, France and the Republic of Korea. The utilization of thorium is purported to have the ability to reduce spent fuel waste by upwards of 50% while at the same time reducing the amount of plutonium within the fuel. To that end, thorium fuel designs are regarded as a better alternative for power production in terms of the plutonium proliferation risk inherent in spent fuel from uranium-fueled reactors. For example, all 104 reactors in the U.S. use uranium fuel. In these reactors, when the uranium in the form of U-238 captures extra neutrons, it goes through a process of decay whereby plutonium in the form of Pu-239 is produced. The spent fuel can then be reprocessed to isolate and remove this plutonium, which can then be used in the core of a nuclear weapon. Roughly 13 kilograms (kg) of reactor grade plutonium is necessary to power a nuclear weapon. In total, these 104 U.S. reactors accumulate roughly 2,000 tons of spent fuel per year. The 2,000 tons of waste produced annually by these nuclear utilities, contains roughly 25,520 kg of plutonium or enough plutonium to build 1,963 nuclear weapons a year. Globally, the total world generation of reactor-grade plutonium in spent fuel is equal to roughly 70 tons annually; more than two times what the U.S. produces. Conversely, there is the thorium seed and blanket design. This reactor concept is based on a design comprised of inner seed rods of uranium which provide neutrons to an outer blanket of thorium-uranium dioxide rods, creating U-233, which in turn powers the nuclear reactor. The important difference with this design is in the nature of the spent fuel. As advocates of thorium such as the U.S. company Lightbridge purport, this process would realize a significant reduction in the “quantity and quality” of plutonium produced within the spent fuel, achieving upwards of an 80% reduction in plutonium. For example, “a thorium-fueled reactor …would produce a total of 92 kilograms of plutonium per gigawatt-year of electricity generated, whereas a conventional water-cooled reactor would result in 232 kilograms.” In addition to a lower percentage of plutonium in the spent fuel, the composition of the plutonium produced is different as well, featuring a higher content of the plutonium isotopes Pu-238, Pu-240, and Pu-242. Weapons-grade plutonium requires roughly 90% plutonium in the form of Pu-239. Plutonium with higher contents of Pu-238 and Pu-240 is inherently unpredictable, and can spontaneously fission, making it “difficult or impossible to compress a bomb core containing several kilograms of plutonium to supercriticality before the bomb [disassembles] with a greatly reduced yield.” This reduces the reliability of a given nuclear weapon, thus making the thorium process less suitable for the development of plutonium for a nuclear weapon. The International Atomic Energy Agency considers plutonium containing more than 81% Pu-238 “not weapons-usable.” Although thorium offers the ability to reduce the plutonium risk inherent in spent fuel, it does not eliminate the need for enriched uranium. Specifically, Lightbridge’s seed and blanket fuel technology would require uranium enriched to less than 20 % in both the seed and blanket fuel rods. Equally significant, the U-233 that is produced in the seed and blanket design poses its own proliferation concern. A nuclear weapon can be constructed with a significant quantity of U-233, which the IAEA defines as 8 kg of U-233, and both the U.S. and India have detonated nuclear devices which utilized U-233. At the same time though, U-233 produced through this design also contains a small amount of the uranium isotope U-232, which emits a powerful, highly penetrating gamma ray. As noted by Ray Sollychin, the Executive Director of the Neopanora Institute-Network of Energy Technologies, this reportedly makes “U233 weapons significantly more difficult to conceal and much more dangerous to handle.” In addition, reactors which use a thorium based seed and blanket design are engineered so that the U-233 which is produced is simultaneously denatured or blended with U-238, further reducing its suitability for a nuclear weapon. Moreover, the blanket is designed to remain within the reactor for upwards of nine to twelve years. This allows for the U-233 that is produced within the blanket to burn “in situ.” Lastly, any attempt to prematurely remove the blanket and separate the U-233 from the U-238, U-234 and U-236 isotopes will also “remove the fissile U-235 from the resulting enriched steam,” once again making it unsuitable for a nuclear weapon. From this brief review of thorium and its properties, it appears clear that from a proliferation standpoint, that thorium fueled reactors provide for a safer nuclear power production process. In fact, it begs the question why thorium was overlooked in the first place. The simple answer is that the U.S. nuclear infrastructure was originally designed to facilitate mass quantities of plutonium for the production of a nuclear weapons arsenal. According to an article by Richard Martin in Wired magazine, “Locked in a struggle with a nuclear- armed Soviet Union, the U.S. government in the 60’s chose to build uranium-fueled reactors — in part because they produce plutonium that can be refined into weapons-grade material.” During the Cold War, maintaining nuclear parity with the Soviets was an overarching goal. Yet, with the end of the Cold War, the focus has shifted from acquiring nuclear weapons to stymying their development by both state and non-state actors. Therefore, the plutonium byproduct of the global nuclear power infrastructure has now become a liability and a proliferation risk. As the IAEA has noted, “for nuclear power to be accepted as a significant contributor of primary energy in the next century, it should be based on a fuel cycle, which is highly proliferation-resistant.” For this reason, further research and development of thorium needs to be explored, not only in terms of seed and blanket technology but other thorium based designs as well, including thorium-based Pebble Bed Reactor, fast reactors (liquid metal cooled and gas cooled); and advanced designs such as Molten Salt Reactor and Accelerator Driven System.

#### Thorium reactors reprocess existing stockpiles and waste ridding us of vulnerable fissile material in the process

Lerner 12 (George, president of Lerner Consulting, a consulting firm, "Can Use LFTRs to Consume Nuclear Waste," Jan 17, [liquidfluoridethoriumreactor.glerner.com/2012-can-use-lftrs-to-consume-nuclear-waste/], jam)

A LFTR can use all three of the available nuclear fuels: uranium-235 (what most reactors use, only 0.72% of naturally occurring uranium), uranium-233 (which is bred in the reactor from thorium-232), or plutonium-239 (bred from uranium-238, 99.28% of natural uranium). LFTRs can consume long-term nuclear waste from other reactors, nuclear weapons, or depleted uranium (any isotope of U, Pu or transuranic elements). Because a LFTR fissions 99%+ of the fuel (whether from Thorium or nuclear waste), it consumes all the uranium and transuranics leaving no long-term radioactive waste. 83% of the waste products are safely stabilized within 10 years. The remaining 17% need to be stored less than 350 years to become completely benign. “LFTR technology can also be used to reprocess and consume the remaining fissile material in spent nuclear fuel stockpiles around the world and to extract and resell many of the other valuable fission byproducts that are currently deemed hazardous waste in their current spent fuel rod form. The U.S. nuclear industry has already allocated $25 billion for storage or reprocessing of spent nuclear fuel and the world currently has over 340,000 tonnes of spent LWR fuel with enough usable fissile material to start one 100 MWe LFTR per day for 93 years. (A 100 MW LFTR requires 100 kg of fissile material (U-233, U-235, or Pu-239) to start the chain reaction). LFTR can also be used to consume existing U-233 stockpiles at ORNL ($500 million allocated for stockpile destruction) and plutonium from weapons stockpiles.” FLiBe Energy FS-MSRs essentially avoid the entire fuel qualification issue in that they are tolerant of any fissile material composition, with their inherent strong negative thermal reactivity feedback providing the control necessary to accommodate a shifting fuel feed stream. Fast Spectrum Molten Salt Reactor Options, Oak Ridge National Laboratory Transuranics (Np, Pu, Am, Cm) are the real reason for “Yucca Mountain” repositories [with PWR/LWR]. All MSR designs can take TRUs from other reactors into the reactor to fission off. TEAC3 Dr. David LeBlanc A 1GW MSR would consume almost 1 ton of “spent” nuclear fuel/year. 340,000 tons of spent nuclear fuel in the world (and more each year). Although costly to extract from fuel rods, 6600 tons of it in MSRs could replace all the coal, oil, natural gas, and uranium the world used in 2007. Since MSRs can be built on assembly lines, build 6600 x 1GW Molten Salt Reactors, have them operate for 30 years and rebuild once, and we eliminate All current spent nuclear fuel stockpiles. Generates 6600 GW electricity for 60 years, and/or use heat from the reactors, water and CO2, to make carbon-neutral car and truck fuel!

#### Plan makes the U.S. a leader in thorium tech – formal mechanisms allow for international adoption

Johnson 6 (Brian, BS Nuclear Engineering from Oregon State U, later received a Ph.D. in Nuclear Science and Engineering from M.I.T., "Thorium for Use in Plutonium Disposition,Proliferation-Resistant Fuels for DevelopingCountries, and Future Reactor Designs," [www.wise-intern.org/journal/2006/Johnson-ANS.pdf], jam)

As it stands, the joint plutonium disposition plans of the United State and Russia have stalled. This is because MOX, the technology chosen to undertake disposition, has taken more time and money than expected. In addition to this, Russia refuses to bear any of the cost of plutonium disposition through the use of MOX. This has opened the door to other options including thorium based fuels. A program in Russia examining thorium-based fuels has made a lot of progress and promises to be an excellent way to dispose of plutonium. The United States cannot directly benefit from this research and should start a program equal in size to the Russian program so that if thorium-based fuels turn out to be a better option for disposition there will be less delay in implementation. The United States outlines a desire in the Global Nuclear Energy Partnership (GNEP) to establish reactors in developing nations to provide potable water, heat for industrial processes, and electricity to growing populations. There are currently no designs that have all of the characteristics desired for reactors to be deployed in developing countries. Thorium-based, proliferation-resistant fuels can provide an evolutionary step until better technologies are developed. The design of this fuel shares a lot of the same technology as thorium-based fuel for plutonium disposition. Because of this, the same program could cover both research objectives with marginal added cost. Molten salt reactors meet all of the goals of next generation fuel cycles. However, the United States is not currently funding research into the technology. Recent research done in France has shown that some of the issues that prohibited development can be resolved. The United States is the only country with operating experience with molten salt reactors. Considering these facts, it makes sense for the United States to fund some research into this promising technology. Thorium could be used to reach several goals in the United States. The technology is not ready for implementation. The United States should fund research into thorium to reach these goals. In doing so, the United States could become a leader in thorium-based technology.

#### Formal mechanisms mean we’ll export SMR technology globally once we use it in the U.S.

Rosner & Goldberg 11 (Robert, William E. Wrather Distinguished Service Professor, Departments of Astronomy and Astrophysics, and Physics, and the College at the U of Chicago, and Stephen, Energy Policy Institute at Chicago, The Harris School of Public Policy Studies, "Small Modular Reactors - Key to Future Nuclear Power Generation in the U.S.," November 2011, [https://epic.sites.uchicago.edu/sites/epic.uchicago.edu/files/uploads/EPICSMRWhitePaperFinalcopy.pdf], jam)

Previous studies have documented the potential for a significant export market for U.S. SMRs, mainly in lesser developed countries that do not have the demand or infrastructure to accommodate GW-scale LWRs. Clearly, the economics of SMR deployment depends not only on the cost of SMR modules, but also on the substantial upgrades in all facets of infrastructure requirements, particularly in the safety and security areas, that would have to be made, and as exemplified by the ongoing efforts in this direction by the United Arab Emirates (and, in particular, by Abu Dhabi). This is a substantial undertaking for these less developed countries. Thus, such applications may be an attractive market opportunity for FOAK SMR plants, even if the cost of such plants may not have yet achieved all of the learning benefits. The Department of Commerce has launched the Civil Nuclear Trade Initiative, which seeks to identify the key trade policy challenges and the most significant commercial opportunities. The Initiative encompasses all aspects of the U.S. nuclear industry, and, as part of this effort, the Department identified 27 countries as “markets of interest” for new nuclear expansion. A recent Commerce Department report identified that “SMRs can be a solution for certain markets that have smaller and less robust electricity grids and limited investment capacity.” Studies performed by Argonne National Laboratory suggest that SMRs would appear to be a feasible power option for countries that have grid capacity of 2,000-3,000 MW. Exports of SMR technology also could play an important role in furthering non-proliferation policy objectives. The design of SMR nuclear fuel management systems, such as encapsulation of the fuel, may have non-proliferation benefits that merit further assessment. Also, the development of an SMR export industry would be step toward a U.S.-centric, bundled reliable fuel services. Exports of FOAK plants help achieve learning without the need for a full array of production incentives required for domestic FOAK deployments. Projected, unsubsidized, electricity market prices will likely be higher in selected foreign markets, particularly when the electricity pricing is based on liquefied natural gas import prices. 49 This situation would enable SMRs to be in a more favorable competitive position. SMR exports would qualify, if needed, for export credit assistance under current U.S. government programs, but this assistance would not require the need for new federal funding.

#### Advantage two is military base islanding

#### *Long-term* grid outages are devastating and highly probable – degrading infrastructure, solar storm, EMP, cyberattack, pandemic, or physical attack

Bartlett et al 12 (Roscoe, Congressman 6th district of Maryland, Rich Andres, Energy Security Chair, National Defense University, Jack Markey, Director, Division of Emergency Management in Frederick County, Maryland, Marshall Hanson, Legislative Director, Reserve Officers Association, R. James Woolsey, Chairman, Foundation for the Defense of Democracies, and Former Director of Central Intelligence, The Honorable Robert McFarlane, former National Security Advisor to President Reagan, Aug 3, [bartlett.house.gov/news/documentsingle.aspx?DocumentID=305763], jam)

Congressman Bartlett noted, “The U.S. electric grid is one of our nation’s 18 critical infrastructures. However, none of the other 17 will function without electricity. America’s grid is vulnerable to widespread blackouts of extended duration. The federal government and the North American Electric Reliability Cor­poration (NERC) agree that there are five separate Low Frequency – High Impact (LFHI) events that could each inflict extended duration grid blackouts, potentially continent-wide including: cyber attack; solar geomagnetic storm electro-magnetic pulse (EMP), coordinated physical attack; nuclear EMP; or a pandemic. In light of these known risks, my legislation encourages communities and organizations to generate at least 20% of their own electricity demand to ensure independent operation of critical infrastructure and vital national security missions and to provide adequate supplies of basic necessities and services. It is critical that we in Congress send the message that it is in the interest of national security that every community and institution, especially our military, reestablish their capabilities to be self-sufficient independent of the grid. We also need to encourage individuals to develop and implement a plan that will provide for themselves and their family sufficient food, water and other emergency supplies necessary to weather an electricity outage when there is no one there to call.” Rich Andres, Energy Security Chair, National Defense University (NDU), said that NDU for the past three years had coordinated workshops in conjunction with other federal government agencies, academics and private sector organizations about the threat to the grid from solar geomagnetic storms. The most recent was Secure Grid 2011 held October 4-5, 2011. “Widespread grid collapse from a solar storm is a serious threat. There are two take aways from these exercises that relate to the legislation introduced today,” said Dr. Andres. “The first is that the federal government does not have the resources to adequately respond to an extended duration grid outage. Local, state, and private sector organizations do have these civil defense capabilities and resources. The second is that what these local organizations lack and that the federal government can provide is threat and risk assessment capabilities.” Jack Markey, Director, Division of Emergency Management in Frederick County, Maryland, reviewed a litany of electricity outages that have affected residents in recent years including the derecho of June 29-30, 2012, the snowmaggeddon blizzard, and hurricanes. He said, “These events illustrate that loss of electricity is not unprecedented, but rather a predictable event. I am pleased by Congressman Bartlett’s introduction of this legislation because it’s important to raise the public’s awareness of threats to the grid in order to garner support for necessary investments and preparation by families, businesses and local community organizations for measures such as generating 20% of their electricity demand.” Mr. Markey also said that his office is actively collaborating with the local utility, First Energy, on measures to improve recovery from electricity outages. Chuck Manto, Lead, National InfraGard Electro Magnetic Pulse Special Interest Group (EMP SIG) and CEO Instant Access Network, LLC, (IAN) explained the history of InfraGard. “InfraGard was initiated in the mid-1990's in Ohio. It was formed to address the reluctance of companies and organizations to share their vulnerabilities out of fear that it would hurt them with competitors or become known to bad guys. Members sign non-disclosure agreements. The FBI performs background checks on prospective members and coordinates information sharing by members nationwide. There are now 50,000 members.” He added, “In the last year and a half, InfraGard established an interest group called EMP SIG. It is focused on an all-hazards approach to mitigate any threat that could cause a nationwide collapse of infrastructure for more than a month. That work is what led to the recommendation of local distributed generation of 20% of electricity and a great deal of interest in renewable sources, such as solar and wind.” Mary Lasky, Business Continuity, Johns Hopkins Applied Physics Lab (JHU-APL) and also chair of Howard County, Maryland's Community Emergency Response Network as well as President of the Maryland Chapter of Contingency Planners, coordinated an exercise at JHU-APL on October 6, 2011 as an adjunct to the NDU Secure Grid 2011. She said that “Americans have become too reliant upon government to take care of them after an emergency. That's just not realistic in the event of a widespread grid outage. Trying to ignite citizen preparation as this bill does is extremely valuable. Generating 20% of electricity locally is important because none of our other critical functions, such as hospitals, work at all or work well without electricity.” Marshall Hanson, Legislative Director, Reserve Officers Association (ROA) said, “I was in the Navy and learned in my training that that the EMP nuclear threat is real. It was intensively studied by the Soviet Union. Nuclear capability is being pursued by Iran. A non-state actor, such as al Qaeda, could inflict a crippling EMP attack if they acquired the capability to launch a crude nuclear weapon from a scud launcher on a tramp steamer. The importance of this new legislation is that it refocuses attention and effort at the community level. That is consistent with the mission and history of the ROA. ROA not only supports this bill but will encourage members to become involved in their community preparations.” A number of distinguished supporters of the bill were unable to attend the news conference but released statements about it. R. James Woolsey, Chairman, Foundation for the Defense of Democracies, and Former Director of Central Intelligence: “Congressman Roscoe Bartlett has been an indefatigable leader to change the dangerous vulnerability at the heart of our civilization's ability to operate: multiple natural and man-made threats to the electric grid. Each could cause extended outages for tens of millions of Americans, our nation’s critical infrastructures and vital national security assets and missions. We could see a repeat of what is now happening in India but with outages lasting months not days. Congressman Bartlett’s new bill sounds this alarm once more with a different tack. It will encourage America’s best in the world hackers, inventors, engineers, first responders and entrepreneurs to help lead the rest of us toward having a much more resilient electric grid. Local communities and organizations that take steps to generate 20% of their electricity load independent of the grid will strengthen our national security by becoming more self-reliant and self-sustaining.” The Honorable Robert McFarlane, former National Security Advisor to President Reagan: "It's human nature to welcome technologies that enhance the quality of our lives while ignoring how our dependence on them poses catastrophic risks. Throughout his life and service in the House of Representatives, Congressman Roscoe Bartlett has been virtually alone in understanding the complex family of natural and man-made risks. He has made it his business to focus on what could go horribly wrong and to propose measures designed to prevent them or to prepare for and cope with the results. He has been the persistent leader of efforts to identify the vulnerabilities of our national electric power grid, as well as the risks we are running by relying on a single fuel -- a fuel that is priced by a foreign cartel -- to power over 90% of all air, sea and land transportation in our country. More importantly, having defined the problems, he has taken the initiative to introduce measures that offer a solution. His leadership in shaping the Open Fuel Standard -- a measure that will enable competition in transportation fuels -- is a landmark measure that will add immeasurably to our national and economic security. It is a measure of his standing on energy issues that he has garnered such solid bipartisan support for his initiatives. Every member of the House knows that Roscoe Bartlett is the go-to man on energy and environmental policies."

#### The military needs to be independent from the civilian grid – blackouts will wreck national command authority, fracture global military operations, collapse deterrence, and escalate to nuclear war – vulnerability independently invites cyber attacks and only small modular reactors can solve

Andres & Breetz 11 (Richard B., Professor of national Security Strategy at the national War College and a Senior fellow and energy and environmental Security and Policy Chair in the Center for Strategic research, institute for national Strategic Studies, at the national Defense University, Hanna L., doctoral candidate in the Department of Political Science at the Massachusetts institute of technology, "Small Nuclear Reactors for Military Installations: Capabilities, Costs, and Technological Implications," February 2011, [www.ndu.edu/press/lib/pdf/StrForum/SF-262.pdf], jam)

Grid Vulnerability. DOD is unable to provide its bases with electricity when the civilian electrical grid is offline for an extended period of time. Currently, domestic military installations receive 99 percent of their electricity from the civilian power grid. As explained in a recent study from the Defense Science Board: DOD’s key problem with electricity is that critical missions, such as national strategic awareness and national command authorities, are almost entirely dependent on the national transmission grid . . . [which] is fragile, vulnerable, near its capacity limit, and outside of DOD control. In most cases, neither the grid nor on-base backup power provides sufficient reliability to ensure continuity of critical national priority functions and oversight of strategic missions in the face of a long term (several months) outage. 7 The grid’s fragility was demonstrated during the 2003 Northeast blackout in which 50 million people in the United States and Canada lost power, some for up to a week, when one Ohio utility failed to properly trim trees. The blackout created cascading disruptions in sewage systems, gas station pumping, cellular communications, border check systems, and so forth, and demonstrated the interdependence of modern infrastructural systems. 8 More recently, awareness has been growing that the grid is also vulnerable to purposive attacks. A report sponsored by the Department of Homeland Security suggests that a coordinated cyberattack on the grid could result in a third of the country losing power for a period of weeks or months. 9 Cyberattacks on critical infrastructure are not well understood. It is not clear, for instance, whether existing terrorist groups might be able to develop the capability to conduct this type of attack. It is likely, however, that some nation-states either have or are working on developing the ability to take down the U.S. grid. In the event of a war with one of these states, it is possible, if not likely, that parts of the civilian grid would cease to function, taking with them military bases located in affected regions. Government and private organizations are currently working to secure the grid against attacks; however, it is not clear that they will be successful. Most military bases currently have backup power that allows them to function for a period of hours or, at most, a few days on their own. If power were not restored after this amount of time, the results could be disastrous. First, military assets taken offline by the crisis would not be available to help with disaster relief. Second, during an extended blackout, global military operations could be seriously compromised; this disruption would be particularly serious if the blackout was induced during major combat operations. During the Cold War, this type of event was far less likely because the United States and Soviet Union shared the common understanding that blinding an opponent with a grid blackout could escalate to nuclear war. America’s current opponents, however, may not share this fear or be deterred by this possibility. In 2008, the Defense Science Board stressed that DOD should mitigate the electrical grid’s vulnerabilities by turning military installations into “islands” of energy self-sufficiency. 10 The department has made efforts to do so by promoting efficiency programs that lower power consumption on bases and by constructing renewable power generation facilities on selected bases. Unfortunately, these programs will not come close to reaching the goal of islanding the vast majority of bases. Even with massive investment in efficiency and renewables, most bases would not be able to function for more than a few days after the civilian grid went offline. Unlike other alternative sources of energy, small reactors have the potential to solve DOD’s vulnerability to grid outages. Most bases have relatively light power demands when compared to civilian towns or cities. Small reactors could easily support bases’ power demands separate from the civilian grid during crises. In some cases, the reactors could be designed to produce enough power not only to supply the base, but also to provide critical services in surrounding towns during long-term outages. Strategically, islanding bases with small reactors has another benefit. One of the main reasons an enemy might be willing to risk reprisals by taking down the U.S. grid during a period of military hostilities would be to affect ongoing military operations. Without the lifeline of intelligence, communication, and logistics provided by U.S. domestic bases, American military operations would be compromised in almost any conceivable contingency. Making bases more resilient to civilian power outages would reduce the incentive for an opponent to attack the grid. An opponent might still attempt to take down the grid for the sake of disrupting civilian systems, but the powerful incentive to do so in order to win an ongoing battle or war would be greatly reduced.

#### Loss of national command authority and cyber attack causes miscalc and extinction

Lawson 9 (Sean - assistant professor in the Department of Communication at the University of Utah, Cross-Domain Response to Cyber Attacks and the Threat of Conflict, 5/13, http://www.seanlawson.net/?p=477)

At a time when it seems impossible to avoid the seemingly growing hysteria over the threat of cyber war,[1] network security expert Marcus Ranum delivered a refreshing talk recently, “The Problem with Cyber War,” that took a critical look at a number of the assumptions underlying contemporary cybersecurity discourse in the United States. He addressed one issue in partiuclar that I would like to riff on here, the issue of conflict escalation–i.e. the possibility that offensive use of cyber attacks could escalate to the use of physical force. As I will show, his concerns are entirely legitimate as current U.S. military cyber doctrine assumes the possibility of what I call “cross-domain responses” to cyberattacks. Backing Your Adversary (Mentally) into a Corner Based on the premise that completely blinding a potential adversary is a good indicator to that adversary that an attack is iminent, Ranum has argued that “The best thing that you could possibly do if you want to start World War III is launch a cyber attack. [...] When people talk about cyber war like it’s a practical thing, what they’re really doing is messing with the OK button for starting World War III. We need to get them to sit the f-k down and shut the f-k up.” [2] He is making a point similar to one that I have made in the past: Taking away an adversary’s ability to make rational decisions could backfire. [3] For example, Gregory Witol cautions that “attacking the decision maker’s ability to perform rational calculations may cause more problems than it hopes to resolveÃ¢â‚Â¦ Removing the capacity for rational action may result in completely unforeseen consequences, including longer and bloodier battles than may otherwise have been.” [4] Ã¯Â»Â¿Cross-Domain Response So, from a theoretical standpoint, I think his concerns are well founded. But the current state of U.S. policy may be cause for even greater concern. It’s not just worrisome that a hypothetical blinding attack via cyberspace could send a signal of imminent attack and therefore trigger an irrational response from the adversary. What is also cause for concern is that current U.S. policy indicates that “kinetic attacks” (i.e. physical use of force) are seen as potentially legitimate responses to cyber attacks. Most worrisome is that current U.S. policy implies that a nuclear response is possible, something that policy makers have not denied in recent press reports. The reason, in part, is that the U.S. defense community has increasingly come to see cyberspace as a “domain of warfare” equivalent to air, land, sea, and space. The definition of cyberspace as its own domain of warfare helps in its own right to blur the online/offline, physical-space/cyberspace boundary. But thinking logically about the potential consequences of this framing leads to some disconcerting conclusions. If cyberspace is a domain of warfare, then it becomes possible to define “cyber attacks” (whatever those may be said to entail) as acts of war. But what happens if the U.S. is attacked in any of the other domains? It retaliates. But it usually does not respond only within the domain in which it was attacked. Rather, responses are typically “cross-domain responses”–i.e. a massive bombing on U.S. soil or vital U.S. interests abroad (e.g. think 9/11 or Pearl Harbor) might lead to air strikes against the attacker. Even more likely given a U.S. military “way of warfare” that emphasizes multidimensional, “joint” operations is a massive conventional (i.e. non-nuclear) response against the attacker in all domains (air, land, sea, space), simultaneously. The possibility of “kinetic action” in response to cyber attack, or as part of offensive U.S. cyber operations, is part of the current (2006) National Military Strategy for Cyberspace Operations [5]: (U) Kinetic Actions. DOD will conduct kinetic missions to preserve freedom of action and strategic advantage in cyberspace. Kinetic actions can be either offensive or defensive and used in conjunction with other mission areas to achieve optimal military effects. Of course, the possibility that a cyber attack on the U.S. could lead to a U.S. nuclear reply constitutes possibly the ultimate in “cross-domain response.” And while this may seem far fetched, it has not been ruled out by U.S. defense policy makers and is, in fact, implied in current U.S. defense policy documents. From the National Military Strategy of the United States (2004): “The term WMD/E relates to a broad range of adversary capabilities that pose potentially devastating impacts. WMD/E includes chemical, biological, radiological, nuclear, and enhanced high explosive weapons as well as other, more asymmetrical ‘weapons’. They may rely more on disruptive impact than destructive kinetic effects. For example, cyber attacks on US commercial information systems or attacks against transportation networks may have a greater economic or psychological effect than a relatively small release of a lethal agent.” [6] The authors of a 2009 National Academies of Science report on cyberwarfare respond to this by saying, “Coupled with the declaratory policy on nuclear weapons described earlier, this statement implies that the United States will regard certain kinds of cyberattacks against the United States as being in the same category as nuclear, biological, and chemical weapons, and thus that a nuclear response to certain kinds of cyberattacks (namely, cyberattacks with devastating impacts) may be possible. It also sets a relevant scale–a cyberattack that has an impact larger than that associated with a relatively small release of a lethal agent is regarded with the same or greater seriousness.” [7]

#### Thorium is the only energy capable of reliably supporting bases

Ackerman 11 (Spencer, senior reporter at Wired, "Latest Pentagon Brainstorm: Nuke-Powered War Bases," Feb 18, [www.wired.com/dangerroom/2011/02/nuke-bases/], jam)

Imagine the snow-capped peaks of mountainous eastern Afghanistan. Wouldn’t it be better topped off with a cooling tower for a nuclear reactor? The Pentagon’s way-out research arm thinks so. It’s all part of a big push to make the military more eco-friendly.

Buried within Darpa’s 2012 budget request under the innocuous name of “Small Rugged Reactor Technologies” is a $10 million proposal to fuel wartime Forward Operating Bases with nuclear power. It springs from an admirable impulse: to reduce the need for troops or contractors to truck down roads littered with bombs to get power onto the base. It’s time, Darpa figures, for a “self-sufficient” FOB. Only one problem. “The only known technology that has potential to address the power needs of the envisioned self-sufficient FOB,” the pitch reads, “is a nuclear-fuel reactor.” Now, bases could mitigate their energy consumption, like the solar-powered Marine company in Helmand Province, but that’s not enough of a game-changer for Darpa. Being self-sufficient is the goal; and that requires going nuclear; and that requires … other things. To fit on a FOB, which can be anywhere from Bagram Air Field’s eight square miles to dusty collections of wooden shacks and concertina wire, the reactor would have to be “well below the scale of the smallest reactors that are being developed for domestic energy production,” Darpa acknowledges. That’s not impossible, says Christine Parthemore, an energy expert at the Center for a New American Security. The Japanese and the South Africans have been working on miniature nuclear power plants for the better part of a decade; Bill Gates has partnered with Toshiba to build mini-nuke sites. (Although it’s not the most auspicious sign that one prominent startup for modular reactors suspended its operations after growing cash-light last month.) Those small sites typically use uranium enriched to about 2 percent. “It would be really, really difficult to divert the fuel” for a bomb “unless you really knew what you were doing,” Parthemore says. But Darpa doesn’t want to take that chance. Only “non-proliferable fuels (i.e., fuels other than enriched uranium or plutonium) and reactor designs that are fundamentally safe will be required of reactors that may be deployed to regions where hostile acts may compromise operations.” Sensible, sure. But it limits your options: outside of uranium or plutonium, thorium is the only remaining source for generating nuclear fuel. The Indians and now the Chinese have experimented with thorium for their nuclear programs, but, alas, “no one has ever successfully found a way” to build a functioning thorium reactor, Parthemore says, “in a safe and economical manner.” For now, Darpa proposes to spend $10 million of your money studying the feasibility of the project. But it’s just one part of the researchers’ new push to green the military. Another $10 million goes to a project called Energy Distribution, which explores bringing down energy consumption on the FOBs. An additional $5 million will look at ways to keep fuel storage from degrading in extreme temperatures. For $50 million, Darpa proposes to build a turbine engine that uses 20 percent less energy. But all of that is mere isotopes compared to the Nuclear FOB. Darpa appears to have thought about it a lot. It says it plans to work with the Department of Energy “to ensure that existing advanced reactor development activities are being exploited and/or accelerated as appropriate, based on the military’s needs.” Still, if it can’t find the right non-proliferable fuel, it suggests that it might look to the “development of novel fuels.” Says a stunned Parthemore, “I have no idea why you’d want to bring that upon the world.”

#### Advantage three is meltdowns

#### Conventional nuclear meltdowns are inevitable and cause extinction – plan solves

Lendman 11 – Research Associate of the Centre for Research on Globalization (Stephen, 03/ 13, “Nuclear Meltdown in Japan,” http://www.thepeoplesvoice.org/TPV3/Voices.php/2011/03/13/nuclear-meltdown-in-japan)

For years, Helen Caldicott warned it's coming. In her 1978 book, "Nuclear Madness," she said: "As a physician, I contend that nuclear technology threatens life on our planet with extinction. If present trends continue, the air we breathe, the food we eat, and the water we drink will soon be contaminated with enough radioactive pollutants to pose a potential health hazard far greater than any plague humanity has ever experienced." More below on the inevitable dangers from commercial nuclear power proliferation, besides added military ones. On March 11, New York Times writer Martin Fackler headlined, "Powerful Quake and Tsunami Devastate Northern Japan," saying: "The 8.9-magnitude earthquake (Japan's strongest ever) set off a devastating tsunami that sent walls of water (six meters high) washing over coastal cities in the north." According to Japan's Meteorological Survey, it was 9.0. The Sendai port city and other areas experienced heavy damage. "Thousands of homes were destroyed, many roads were impassable, trains and buses (stopped) running, and power and cellphones remained down. On Saturday morning, the JR rail company" reported three trains missing. Many passengers are unaccounted for. Striking at 2:46PM Tokyo time, it caused vast destruction, shook city skyscrapers, buckled highways, ignited fires, terrified millions, annihilated areas near Sendai, possibly killed thousands, and caused a nuclear meltdown, its potential catastrophic effects far exceeding quake and tsunami devastation, almost minor by comparison under a worst case scenario. On March 12, Times writer Matthew Wald headlined, "Explosion Seen at Damaged Japan Nuclear Plant," saying: "Japanese officials (ordered evacuations) for people living near two nuclear power plants whose cooling systems broke down," releasing radioactive material, perhaps in far greater amounts than reported. NHK television and Jiji said the 40-year old Fukushima plant's outer structure housing the reactor "appeared to have blown off, which could suggest the containment building had already been breached." Japan's nuclear regulating agency said radioactive levels inside were 1,000 times above normal. Reuters said the 1995 Kobe quake caused $100 billion in damage, up to then the most costly ever natural disaster. This time, from quake and tsunami damage alone, that figure will be dwarfed. Moreover, under a worst case core meltdown, all bets are off as the entire region and beyond will be threatened with permanent contamination, making the most affected areas unsafe to live in. On March 12, Stratfor Global Intelligence issued a "Red Alert: Nuclear Meltdown at Quake-Damaged Japanese Plant," saying: Fukushima Daiichi "nuclear power plant in Okuma, Japan, appears to have caused a reactor meltdown." Stratfor downplayed its seriousness, adding that such an event "does not necessarily mean a nuclear disaster," that already may have happened - the ultimate nightmare short of nuclear winter. According to Stratfor, "(A)s long as the reactor core, which is specifically designed to contain high levels of heat, pressure and radiation, remains intact, the melted fuel can be dealt with. If the (core's) breached but the containment facility built around (it) remains intact, the melted fuel can be....entombed within specialized concrete" as at Chernobyl in 1986. In fact, that disaster killed nearly one million people worldwide from nuclear radiation exposure. In their book titled, "Chernobyl: Consequences of the Catastrophe for People and the Environment," Alexey Yablokov, Vassily Nesterenko and Alexey Nesterenko said: "For the past 23 years, it has been clear that there is a danger greater than nuclear weapons concealed within nuclear power. Emissions from this one reactor exceeded a hundred-fold the radioactive contamination of the bombs dropped on Hiroshima and Nagasaki." "No citizen of any country can be assured that he or she can be protected from radioactive contamination. One nuclear reactor can pollute half the globe. Chernobyl fallout covers the entire Northern Hemisphere." Stratfor explained that if Fukushima's floor cracked, "it is highly likely that the melting fuel will burn through (its) containment system and enter the ground. This has never happened before," at least not reported. If now occurring, "containment goes from being merely dangerous, time consuming and expensive to nearly impossible," making the quake, aftershocks, and tsunamis seem mild by comparison. Potentially, millions of lives will be jeopardized. Japanese officials said Fukushima's reactor container wasn't breached. Stratfor and others said it was, making the potential calamity far worse than reported. Japan's Nuclear and Industrial Safety Agency (NISA) said the explosion at Fukushima's Saiichi No. 1 facility could only have been caused by a core meltdown. In fact, 3 or more reactors are affected or at risk. Events are fluid and developing, but remain very serious. The possibility of an extreme catastrophe can't be discounted. Moreover, independent nuclear safety analyst John Large told Al Jazeera that by venting radioactive steam from the inner reactor to the outer dome, a reaction may have occurred, causing the explosion. "When I look at the size of the explosion," he said, "it is my opinion that there could be a very large leak (because) fuel continues to generate heat." Already, Fukushima way exceeds Three Mile Island that experienced a partial core meltdown in Unit 2. Finally it was brought under control, but coverup and denial concealed full details until much later. According to anti-nuclear activist Harvey Wasserman, Japan's quake fallout may cause nuclear disaster, saying: "This is a very serious situation. If the cooling system fails (apparently it has at two or more plants), the super-heated radioactive fuel rods will melt, and (if so) you could conceivably have an explosion," that, in fact, occurred. As a result, massive radiation releases may follow, impacting the entire region. "It could be, literally, an apocalyptic event. The reactor could blow." If so, Russia, China, Korea and most parts of Western Asia will be affected. Many thousands will die, potentially millions under a worse case scenario, including far outside East Asia. Moreover, at least five reactors are at risk. Already, a 20-mile wide radius was evacuated. What happened in Japan can occur anywhere. Yet Obama's proposed budget includes $36 billion for new reactors, a shocking disregard for global safety. Calling Fukushima an "apocalyptic event," Wasserman said "(t)hese nuclear plants have to be shut," let alone budget billions for new ones. It's unthinkable, he said. If a similar disaster struck California, nuclear fallout would affect all America, Canada, Mexico, Central America, and parts of South America. Nuclear Power: A Technology from Hell Nuclear expert Helen Caldicott agrees, telling this writer by phone that a potential regional catastrophe is unfolding. Over 30 years ago, she warned of its inevitability. Her 2006 book titled, "Nuclear Power is Not the Answer" explained that contrary to government and industry propaganda, even during normal operations, nuclear power generation causes significant discharges of greenhouse gas emissions, as well as hundreds of thousands of curies of deadly radioactive gases and other radioactive elements into the environment every year. Moreover, nuclear plants are atom bomb factories. A 1000 megawatt reactor produces 500 pounds of plutonium annually. Only 10 are needed for a bomb able to devastate a large city, besides causing permanent radiation contamination. Nuclear Power not Cleaner and Greener Just the opposite, in fact. Although a nuclear power plant releases no carbon dioxide (CO2), the primary greenhouse gas, a vast infrastructure is required. Called the nuclear fuel cycle, it uses large amounts of fossil fuels. Each cycle stage exacerbates the problem, starting with the enormous cost of mining and milling uranium, needing fossil fuel to do it. How then to dispose of mill tailings, produced in the extraction process. It requires great amounts of greenhouse emitting fuels to remediate. Moreover, other nuclear cycle steps also use fossil fuels, including converting uranium to hexafluoride gas prior to enrichment, the enrichment process itself, and conversion of enriched uranium hexafluoride gas to fuel pellets. In addition, nuclear power plant construction, dismantling and cleanup at the end of their useful life require large amounts of energy. There's more, including contaminated cooling water, nuclear waste, its handling, transportation and disposal/storage, problems so far unresolved. Moreover, nuclear power costs and risks are so enormous that the industry couldn't exist without billions of government subsidized funding annually. The Unaddressed Human Toll from Normal Operations Affected are uranium miners, industry workers, and potentially everyone living close to nuclear reactors that routinely emit harmful radioactive releases daily, harming human health over time, causing illness and early death. The link between radiation exposure and disease is irrefutable, depending only on the amount of cumulative exposure over time, Caldicott saying: "If a regulatory gene is biochemically altered by radiation exposure, the cell will begin to incubate cancer, during a 'latent period of carcinogenesis,' lasting from two to sixty years." In fact, a single gene mutation can prove fatal. No amount of radiation exposure is safe. Moreover, when combined with about 80,000 commonly used toxic chemicals and contaminated GMO foods and ingredients, it causes 80% of known cancers, putting everyone at risk everywhere. Further, the combined effects of allowable radiation exposure, uranium mining, milling operations, enrichment, and fuel fabrication can be devastating to those exposed. Besides the insoluble waste storage/disposal problem, nuclear accidents happen and catastrophic ones are inevitable. Inevitable Meltdowns Caldicott and other experts agree they're certain in one or more of the hundreds of reactors operating globally, many years after their scheduled shutdown dates unsafely. Combined with human error, imprudently minimizing operating costs, internal sabotage, or the effects of a high-magnitude quake and/or tsunami, an eventual catastrophe is certain. Aging plants alone, like Japan's Fukushima facility, pose unacceptable risks based on their record of near-misses and meltdowns, resulting from human error, old equipment, shoddy maintenance, and poor regulatory oversight. However, under optimum operating conditions, all nuclear plants are unsafe. Like any machine or facility, they're vulnerable to breakdowns, that if serious enough can cause enormous, possibly catastrophic, harm.

#### Al-Qaeda will successfully attack across the globe – causes meltdowns

Kimery 11 – Homeland Security Today's senior reporter and online editor (Anthony, W. Scott Malone, multiple Emmy and Peabody award-winning investigative journalist and former senior editor of NavySEALs.com. He runs the website's counterterrorism newsletter spin-off, “BlackNET Intelligence Channel,” 05/12, “Al Qaeda Could Try to Replicate Fukushima-type Meltdowns,” http://www.hstoday.us/blogs/the-kimery-report/blog/al-qaeda-could-try-to-replicate-fukushima-type-meltdowns/aa96292934d83bb8c9f97fd9d685f32b.html)

A May 5 "intelligence brief" prepared by a Department of Homeland Security (DHS) official at the Pacific Regional Information Clearinghouse (PacClear) in Hawaii, warned Al Qaeda might try to cause the meltdown of certain vulnerable nuclear power plants in the US and Europe by replicating the failure of the electric supply that pumped cooling water to the reactors at the Fukushima Daiichi nuclear power plant in Japan. The plant's primary and backup power supplies were knocked out by the earthquake and tsunami that struck Japan in March, resulting in partial meltdowns of the plant's reactors. Only a week after the intelligence brief was circulated, federal officials dispatched a security alert notifying US power plant operators to raise the level of their security awareness. According to the analysis in the “for official use only” intelligence brief, which was obtained by Homeland Security Today, “the earthquake and tsunami in Japan were ‘acts of nature,’ but a catastrophic nuclear reactor meltdown could potentially be engineered by Al Qaeda” by replicating the cascading loss of electric power that knocked out the Fukushima nuclear power plant’s ability to cool its reactors’ fuel rods, which led to the partial meltdowns of the reactors, causing the worst nuclear disaster since Chernobyl. Even today, highly radioactive fuel rods are fully exposed in the No. 1 reactor at the plant. The six-reactor complex has been bellowing radiation since March 11, and the International Atomic Energy Agency said the "overall situation ... remains very serious." On Thursday, plant operator, Tokyo Electric Power Co., said the amount of water leaking from the No. 1 reactor is more serious than previously believed, meaning it's likely there is severe damage to the reactor. The intelligence brief issued by PacClear, “Recreating Fukushima: A Possible Response to the Killing of Usama Bin Laden - The Nuclear Option,” cautioned that “the death of [O]sama Bin Laden may serve as an impetus to apply lessons learned from Fukushima to attack the United States or another Western country.” Several senior counterterrorism officials told Homeland Security Today that despite the apparent amateurism of some Al Qaeda attacks and plots that were thwarted in recent years, “we still must remain cognizant of the fact that Al Qaeda is capable of sophisticated attacks,” one said, noting in the same breath that the terrorist organization “is now under increased pressure to avenge their leader’s murder at the hands of infidels with something spectacular.” Indeed. Intelligence collected from Bin Laden's compound in Pakistan during the May 2 raid in which he was killed, has disclosed that he continued to urge his lieutenants to focus on carrying out another 9/11-scale attack on US soil that would kill many thousands - or more. The intelligence further showed that the terrorist leader remained obsessed with acquiring, and using, weapons of mass destruction. "I consider Al Qaeda, now being pushed by Anwar Al Awlaki [the leader of Al Qaeda in the Arabian Peninsula, AQAP, and a possible heir to Bin Laden], in the position to begin planning for a new '9/11 style' attack using a weapon of mass destruction ... not to say they will not continue their recruiting of 'lone wolf' types - I do believe the long term goal of Al Qaeda 2.0 to be a spectacular attack to the US infrastructure that would cause significant and permanent damage to a significant portion of the continental US," Homeland Security Today was told by former Army Special Forces Lt. Col. Anthony Shaffer, author of, Operation Dark Heart: Spycraft and Special Ops on the Frontlines of Afghanistan - and the Path to Victory. A successful attack resulting in a reactor meltdown could potentially cause hundreds of thousands of deaths from cancer, at a minimum. The ensuing panic would probably be the most immediate danger. Besides the immense clean-up costs and potential environmental damage, the economic blow to the nuclear power industry would be devastating worldwide. It’s no secret that US authorities have uncovered numerous efforts by Al Qaeda to obtain nuclear weapons and radiological materials over the years. “Although we know from their own statements as well as intelligence and security success in blocking a number of efforts, Al Qaeda has been determined to acquire deliverable weapons of mass destruction [WMD], including nuclear, for a long time,” veteran CIA operations officer and Islamist jihad expert, Clare Lopez, told Homeland Security Today. The new intelligence brief pointed out that “the disaster in Fukushima may have provided the knowledge Al Qaeda needs to carry out such an operation” in lieu of possessing “a prepositioned [nuclear] weapon.” "While the Al Qaeda organization may, or may not, possess either a nuclear device or radiological material," the brief stated, "the pressure on the organization to fulfill that threat is now enormous. If Al Qaeda does possess such a weapon, the danger is obvious. If, however, there is no such device or material in Al Qaeda’s control, then it is likely that Al Qaeda and [Bin Laden’s] supporters may attempt an attack comparable in scale that will at least be perceived as a ‘nuclear’ response to Bin Laden’s death.” “Surely, the determination to strike, and especially now after the killing of [Bin Laden], remains intense,” Lopez said. And “the scenario described [in the PacClear alert] is completely believable,” maintained Charles Faddis, a 20-year career covert CIA operations officer who headed the National Counterterrorism Center’s WMD terrorism unit when he retired several years ago. “All you have to do to cause a meltdown is kill the cooling system. Cutting the power would do that. So would blowing up the pumps or rupturing the right pipes.” Author of, Willful Neglect: The Dangerous Illusion of Homeland Security, which discussed at length the vulnerability of nuclear power plants to terrorist attacks, Faddis stressed to Homeland Security Today that “security at nuclear plants is not adequate, and there are no moves afoot to improve it. Nothing has changed in the last few years.” Faddis also outlined his concerns about the security and vulnerability of US nuclear power facilities in an op-ed he wrote in March 2010. Similarly, US State Department cables leaked to Wikileaks revealed that US officials have been concerned that Japan has not provided adequate security at its nuclear power plants to defend against potential terrorist attacks, Asahi Shimbun reported Tuesday. The intelligence briefing stated that “the disaster in Fukushima may have provided the knowledge Al Qaeda needs to carry out such an operation. The global focus on the disaster in Japan has made the vulnerabilities of our aging nuclear infrastructure painfully apparent. In the past, preparations to defend a nuclear facility mostly focused on protecting the reactor vessel from breach.” The briefing pointed out that “studies commissioned after the 9/11 attacks were mostly concerned with the capability of an airplane strike in effecting such a breach,” but “the March 11th earthquake and tsunami demonstrated that simply turning the power off [with] some reactor designs can result in a catastrophic failure within a matter of hours …” “[I]t is conceivable," the briefing stated, "that Al Qaeda may attempt to recreate this series of failures at another nuclear facility in the West as a way of fulfilling their pledge of a ‘nuclear’ revenge,” which is a reference to Bin Laden’s May 1998 endorsement of the use of nuclear weapons against the US and its allies. In a statement called, "The Nuclear Bomb of Islam," which was issued under the auspices of the "International Islamic Front for Fighting the Jews and Crusaders,” Bin Laden stated "it is the duty of Muslims to prepare as much force as possible to terrorize the enemies of God." Earlier that year, in February, Bin Laden and his number two, Ayman Al Zawahiri, had endorsed a fatwa, published in the Al Quds Al Arabi newspaper, that stated Muslims should kill Americans - including civilians - anywhere in the world where they can be found. Then, towards the end of 2004, Michael Scheuer, the former CIA officer who headed the Agency’s Bin Laden unit from 1996 to 1999, revealed that on May 21, 2003, a prominent Saudi cleric had issued a formal fatwa that authorized Bin Laden and other terrorist leaders to use weapons of mass destruction against the US and its allies. The intelligence brief on a potential Al Qaeda threat to Western nuclear power plants began by pointing out that “statements under interrogation by the imprisoned Khalid Sheikh Mohammed put Al Qaeda on record as threatening to detonate a nuclear weapon presently hidden in a Western country if [O]sama Bin Laden were to be captured or killed.”

#### Only a fraction of reactors need to meltdown to cause extinction from agricultural collapse

IB Times 9/14 (International Business Times, Mike Adams – author and journalist, Solar Flare Could Unleash Nuclear Holocaust Across Planet Earth, Forcing Hundreds of Nuclear Power Plants Into Total Meltdowns, <http://au.ibtimes.com/articles/213249/20110914/solar-flare-could-unleash-nuclear-holocaust-across-planet-earth-forcing-hundreds-of-nuclear-power-pl.htm>, AV)
 But here's the real issue: There are 700 nuclear power facilities in the world, remember? Let's suppose that in the aftermath of a massive solar flare, the nations of the world are somehow able to control half of those facilities and nurse them into cold shutdown status. That still leaves roughly 350 nuclear facilities at risk. Now let's suppose half of those are somehow luckily offline and not even functioning when the solar flare hits, so they need no special attention. This is a very optimistic assumption, but that still leaves 175 nuclear power plants where all attempts fail. Let's be outrageously optimistic and suppose that a third of those somehow don't go into a total meltdown by some miracle of God, or some bizarre twist in the laws of physics. So we're still left with 115 nuclear power plants that "go Chernobyl." Fukushima was one power plant. Imagine the devastation of 100+ nuclear power plants, all going into meltdown all at once across the planet. It's not the loss of electricity that's the real problem; it's the global tidal wave of invisible radiation that blankets the planet, permeates the topsoil, irradiates everything that breathes and delivers the final crushing blow to human civilization as we know it today. Because if you have 100 simultaneous global nuclear meltdowns, the tidal wave of radiation will make farming nearly impossible for years. That means no food production for several years in a row. And that, in turn, means a near-total collapse of the human population on our planet. How many people can survive an entire year with no food from the farms? Not one in a hundred people. Even beyond that, how many people can essentially live underground and be safe enough from the radiation that they can have viable children and repopulate the planet? It's a very, very small fraction of the total population. Solar flares far more likely to hit nuclear power plants than tidal waves or earthquakes What's the chance of all this actually happening? A report by the Oak Ridge National Laboratory said that "...over the standard 40-year license term of nuclear power plants, solar flare activity enables a 33 percent chance of long-term power loss, a risk that significantly outweighs that of major earthquakes and tsunamis." ([http://www.IBTimes.com/articles/194](http://www.ibtimes.com/articles/194)...) The world's reliance on nuclear power, you see, has doomed us to destroy our own civilization. Of course, this is all preventable if we would only dismantle and shut down ALL nuclear power plants on the planet. But what are the chances of that happening? Zero, of course. There are too many commercial and political interests invested in nuclear power. So the power plants will stay, and we will therefore be vulnerable to a solar flare which could strike us at any time and unleash a global nuclear holocaust. Planet Earth has been struck by solar flares before, of course, but all the big hits in recorded human history took place long before the age of modern electronics, so the impacts were minimal. Today, society cannot function without electronics. Nor can nuclear facility coolant pumps. Once you realize that, you begin to understand the true danger in which humanity has placed itself by relying on nuclear power. By relying on nuclear power, we are risking everything. And we're doing it blindly, with no real acknowledgement of the dangers of running 700+ nuclear facilities in a constant state of "near meltdown" while foolishly relying on the steady flow of electricity to keep the fuel rods cool. If Fukushima, all by itself, could unleash a tidal wave of deadly radiation all by itself, imagine a world where hundreds of nuclear facilities go into a total meltdown simultaneously.

#### Meltdowns are *impossible* with LFTRs – passive design and chemically inert liquid salt

Lerner 12 (George, president of Lerner Consulting, a consulting firm, "Can Use LFTRs to Consume Nuclear Waste," Jan 17, [liquidfluoridethoriumreactor.glerner.com/2012-can-use-lftrs-to-consume-nuclear-waste/], jam)

If the reactor overheats, a frozen plug melts and the fuel quickly drains out of the core into tanks where nuclear reaction is physically impossible. Radiation is contained by materials that remain solid at temperatures much higher than inside the reactor, with passive air cooling. (In solid-fueled reactors, you have to override everything that normally happens in the core and bring in coolant.) Fuel draining to the storage tanks could be triggered by seismic alert, chemical or temperature sensors, power outage, or the operators. [The 1989 Loma Prieta earthquake about 60 miles from Oakland, CA, reached Oakland about 30 seconds later. Japan has a seismic alert network, industrial plants shut down, elevators open at the nearest floor, trains stop, etc. California is building one.] “LFTR designs have a freeze plug at the bottom of the core—a plug of salt, cooled by a fan to keep it at a temperature below the freezing point of the salt. If temperature rises beyond a critical point, the plug melts, and the liquid fuel in the core is immediately evacuated, pouring into a subcritical geometry in a catch basin. This formidable safety tactic is only possible if the fuel is a liquid.” Hargraves, American Scientist, July 2010 “A passive core drain system activated by a melt plug enables draining the radioactive inventory into geometrically subcritical drain tanks that are passively thermally coupled to the environment.” Fast Spectrum Molten Salt Reactor Options, Oak Ridge National Laboratory, July 2011 “One of the current requirements of the Nuclear Regulatory Commission (NRC) for certification of a new nuclear plant design is that in the event of a complete electricity outage, the reactor remain at least stable for several days if it is not automatically deactivated. As it happens, the freeze-plug safety feature is as old as Alvin Weinberg’s 1965 Molten Salt Reactor Experiment design, yet it meets the NRC’s requirement; at ORNL, the [engineers] would routinely shut down the reactor by simply cutting the power to the freeze-plug cooling system. This setup is the ultimate in safe poweroutage response. Power isn’t needed to shut down the reactor, for example by manipulating control elements. Instead power is needed to prevent the shutdown of the reactor.” Hargraves, American Scientist, July 2010 Inherent Safety: Low Pressure LFTRs operate at atmospheric pressure. No high pressure to contain, no risk of pressure containment explosively failing. In a LFTR, there is no coolant boiling away. “A signature safety feature of the LFTR design is that the coolant — liquid fluoride salt — is not under pressure. The fluoride salt does not boil below 1400 degrees Celsius. Neutral pressure reduces the cost and the scale of LFTR plant construction by reducing the scale of the containment requirements, because it obviates the need to contain a pressure explosion. Disruption in a transport line would result in a leak, not an explosion, which would be captured in a noncritical configuration in a catch basin, where it would passively cool and harden.” Hargraves, American Scientist Volume 98, July 2010 “Only a low pressure vessel is needed as the salts run near atmospheric pressure as opposed to the thick walled vessels needed for LWR or PBMR. No water or sodium means no possible steam explosion or hydrogen production within the containment. In designs without graphite moderator, there is not even combustible material present.” D. LeBlanc / Nuclear Engineering and Design 240 (2010) p.1644-1656 “The containment walls are only required to contain a low-pressure internal environment and endure when subjected to external seismic and impact stressors. Halide salts are chemically inert, so they do not have exothermic reactions with the environment (oxygen, water) as would hot sodium or hot zirconium. With a greater than 500°C margin to boiling, the halide salts also do not have a credible route to pressurizing containment as would a water-cooled reactor. FS-MSRs also do not have any hydrogenous material within containment; thus they cannot generate hydrogen.” Fast Spectrum Molten Salt Reactor Options, Oak Ridge National Laboratory, July 2011 Inherent Safety: Containing Radioactive Material Radioactive cesium and iodine that were released in Fukushima-Daiichi would not be released in a LFTR accident. Cesium fluoride, strontium bi-fluoride are very stable salts. “Fluoride combines ionically with almost any transmutation product. This is an MSFR’s first level of containment. It is especially good at containing biologically active ‘salt loving’ wastes such as Cesium 137. The salts do not burn, explode or degrade in air or water, and the fluoride salts of the radioactive actinides and fission products are generally not soluble in water or air.” Wikipedia There are much less fissile materials (compared with LWR) in the fuel salt at any time, as continuous refueling enables operating with just enough to sustain reactivity. About half of the total fissile material is in the reactor core, the rest in the heat transfer and chemical processing loops. Thorium is one of the least radioactive materials, so (unless the LFTR is for waste burning, at a high security storage site) there is no hazardous fuel storage. Gasseous fission byproducts are easily and continuously removed from the reactor and safely stored. There is far less radioactive gas (that could leak in an accident) than in a LWR, and it isn’t pressurized. Inherent Safety: Self-Regulating The temperature in the reactor is self-regulating. The liquid fuel naturally expands if it gets hotter, slowing nuclear reaction, and contracts if it gets cooler (strong negative temperature coefficient of reactivity). [The nuclear reaction in the poorly-designed Chernobyl reactor got Hotter and Stronger as coolant boiled away.] Remove less heat (making less electricity), and the reactor throttles down. Remove more heat (making more electricity) and the reactor throttles up. “Most MSR designs have very strong negative temperature and void coefficients which act instantly, aiding safety and allowing automatic load following operation.” D. LeBlanc / Nuclear Engineering and Design 240 (2010) 1644-1656 Gasseous fission products are easily removed from the molten salt, making the reactor much more stable. (Xenon gas in LWR absorbs neutrons so readily it affects fission rate, so restarting the LWR must be done very carefully.) “Removing the most significant neutron poison xenon-135 made the reactor safer and easier to restart. In solid-fuel reactors, on restart the 135Xe in the fuel absorbs neutrons, followed by a sudden jump in reactivity as the 135Xe is burned out. Conventional reactors may have to wait hours until xenon-135 decays after shutting down and not immediately restarting.” Wikipedia – Molten Salt Reactor Experiment “The MSRE confirmed expectations and predictions. For example, it was demonstrated that: the fuel salt was immune to radiation damage, the graphite was not attacked by the fuel salt, and the corrosion of Hastelloy-N was negligible. Noble gases were stripped from the fuel salt by a spray system, reducing the 135Xe poisoning by a factor of about 6. The bulk of the fission product elements remained stable in the salt. Additions of uranium and plutonium to the salt during operation were quick and uneventful, and recovery of uranium by fluorination was efficient.” Wikipedia – Molten Salt Reactor Experiment Inherent Safety: Stable Chemistry “FS-MSRs have a negative salt void coefficient (expanded fuel is pushed out of the core) and a negative thermal reactivity feedback that avoids a set of major design constraints in solid-fuel fast reactors. A passive core drain system activated by a melt plug enables draining the radioactive inventory into geometrically subcritical drain tanks that are passively thermally coupled to the environment. FS-MSRs have a low operating pressure even at high temperatures; and FS-MSR salts are chemically inert, thermodynamically lacking the energetic reactions with environmental materials seen in other reactor types (hot zirconium and sodium with water). FS-MSRs do involve more intensive manipulation of highly radioactive materials than other reactor classes and thus small spills and contamination accidents appear to be more likely with this reactor class.” Fast Spectrum Molten Salt Reactor Options, Oak Ridge Nat’l Lab 2011

#### Text: The Department of Defense should substantially increase market-fixed production cost incentives for domestic deployment of thorium small modular nuclear reactors.

#### Contention two is solvency

#### DoD can authorize thorium SMRs independent of the NRC – also spurs widespread commercialization

Hunt 11 (Gary L, 30 years experience in the energy, software and information technology industries, Tech&Creative Labs, "Is there a Small Modular Nuke in our Distributed Energy Future?," May 31, [www.tclabz.com/2011/05/31/is-there-a-small-modular-nuke-in-our-distributed-energy-future/], jam)

What the US military needs according to Colonel Roege is clean, modular, transportable energy sources for forward operating bases, the lift to get them there and move them around, and a fast-track path to development and commercialization to supply them anywhere in the world. This Army Colonel said the US military already has a solution in mind based upon the experience of the US Navy. That solution is small scale, modular nuclear power plants like the ones used on aircraft carriers and submarines. Only the new version would be likely smaller, more portable and safer by design with passive safety systems. The Colonel says the military does not believe the NRC will license such a modular design anytime soon enough to meet the military need so he is recommending that the Department of Defense use its authority to license such technology for military purposes since doing so does not require NRC approval. Once proven and deployed, these military applications should speed the path to small modular nuclear units in civilian applications. GO ARMY! Speeding the development of transportable, small scale, safe microgrid solutions based upon small modular nuclear plants could transform the power system not just for the US military but for civilian applications as well. By substituting the economies of scale from modular design for the economy of scale from building large sized nuclear plants as was done in the first generation nukes, the hope is that nuclear energy will find a larger market share place in our clean energy economy. It may not be the fuel cell alchemy the military would love to have, but it is technology the military knows made better, safer and, they hope, cheaper by modern design and manufacturing methods. WHY THIS IS A DER BIG DEAL Transforming our energy future with clean, sustainable, low emission choices is the goal of much of our energy strategy today. In a distributed energy future we need more choices with greater efficiency than currently available from wind and solar. Small modular nuclear reactors meet that need and give both our military and potentially, a wide range of civilian applications the best available technology with the capability to displace coal and replace the first generation nuclear units as they retire.

#### The military can enter into purchase power agreements for SMRs – this market pull makes nuclear economically competitive

Rosner & Goldberg 11 (Robert, William E. Wrather Distinguished Service Professor, Departments of Astronomy and Astrophysics, and Physics, and the College at the U of Chicago, and Stephen, Energy Policy Institute at Chicago, The Harris School of Public Policy Studies, "Small Modular Reactors - Key to Future Nuclear Power Generation in the U.S.," November 2011, [https://epic.sites.uchicago.edu/sites/epic.uchicago.edu/files/uploads/EPICSMRWhitePaperFinalcopy.pdf], jam)

Similar to other important energy technologies, such as energy storage and renewables, “market pull” activities coupled with the traditional “technology push” activities would significantly increase the likelihood of timely and successful commercialization. Market transformation incentives serve two important objectives. They facilitate demand for the off-take of SMR plants, thus reducing market risk and helping to attract private investment without high risk premiums. In addition, if such market transformation opportunities could be targeted to higher price electricity markets or higher value electricity applications, they would significantly reduce the cost of any companion production incentives. There are three special market opportunities that may provide the additional market pull needed to successfully commercialize SMRs: the federal government, international applications, and the need for replacement of existing coal generation plants. 6.2.1 Purchase Power Agreements with Federal Agency Facilities Federal facilities could be the initial customer for the output of the LEAD or FOAK SMR plants. The federal government is the largest single consumer of electricity in the U.S., but its use of electricity is widely dispersed geographically and highly fragmented institutionally (i.e., many suppliers and customers). Current federal electricity procurement policies do not encourage aggregation of demand, nor do they allow for agencies to enter into long-term contracts that are “bankable” by suppliers. President Obama has sought to place federal agencies in the vanguard of efforts to adopt clean energy technologies and reduce greenhouse gas emissions. Executive Order 13514, issued on October 5, 2009, calls for reductions in greenhouse gases by all federal agencies, with DOE establishing a target of a 28% reduction by 2020, including greenhouse gases associated with purchased electricity. SMRs provide one potential option to meet the President’s Executive Order. One or more federal agency facilities that can be cost effectively connected to an SMR plant could agree to contract to purchase the bulk of the power output from a privately developed and financed LEAD plant. 46 A LEAD plant, even without the benefits of learning, could offer electricity to federal facilities at prices competitive with the unsubsidized significant cost of other clean energy technologies. Table 4 shows that the LCOE estimates for the LEAD and FOAK-1plants are in the range of the unsubsidized national LCOE estimates for other clean electricity generation technologies (based on the current state of maturity of the other technologies). All of these technologies should experience additional learning improvements over time. However, as presented earlier in the learning model analysis, the study team anticipates significantly greater learning improvements in SMR technology that would improve the competitive position of SMRs over time. Additional competitive market opportunities can be identified on a region-specific, technology-specific basis. For example, the Southeast U.S. has limited wind resources. While the region has abundant biomass resources, the estimated unsubsidized cost of biomass electricity is in the range of $90-130 per MWh (9-13¢/kWh), making LEAD and FOAK plants very competitive (prior to consideration of subsidies). 47 Competitive pricing is an important, but not the sole, element to successful SMR deployment. A bankable contractual arrangement also is required, and this provides an important opportunity for federal facilities to enter into the necessary purchase power arrangements. However, to provide a “bankable” arrangement to enable the SMR project sponsor to obtain private sector financing, the federal agency purchase agreement may need to provide a guaranteed payment for aggregate output, regardless of actual generation output. 48 Another challenge is to establish a mechanism to aggregate demand among federal electricity consumers if no single federal facility customer has a large enough demand for the output of an SMR module. The study team believes that high-level federal leadership, such as that exemplified in E.O. 13514, can surmount these challenges and provide critical initial markets for SMR plants.

#### All existing reactors can run on thorium

Cox 11 (Patrick, two decades of experience in software, public policy, medical economics and biotechnology, editor of the Breakthrough Technology Alert and Technology Profits Confidential, studied at Boise State University and has written for USA Today, Wall Street Journal, Los Angeles Times and Reason Magazine, Sep 12, [dailyresourcehunter.com/investing-thorium-interview-patrick-cox/], jam)

Rodricks: Patrick Cox, another question about thorium. If it’s so great, how come — well, you said it’s a regulatory issue why it’s not in more nuclear power plants. But could you put thorium in 104 U.S. nuclear power plants and make them all safer? I mean, could you transition to that? Cox: Yes. As a matter of fact, one company that is the leader in this technology, they’re consulting with the Gulf states, with French, Russian, and probably will end up consulting with the Indians and the Chinese, as well. There are many different strategies for getting thorium into this fuel stream. Some of them are as simple as dropping a different fuel rod into the existing light water reactors, which would somewhat improve safety, though in the long run — I think the thing we should realize is these reactors in Japan were 40 years old. I mean, you don’t drive a car that’s 40 years old. They had made some serious mistakes. On expert points out that the backup systems on these reactors were all on one circuit, which is absurd. It’s mind-boggling that people who are known for their technical competence had done something that stupid. I mean, the problem of what we really need to do in terms of safety is to move to the next generation of nuclear reactors, which are going to be an order of the magnitude safer than what we have now operating in Japan, in the United States.

#### Transition takes 30 months

Sorensen 11 (Kirk, studying thorium technology since 2000 and has been a public advocate for its use and development since 2006, masters’ degree in aerospace engineering from the Georgia Institute of Technology and is studying nuclear engineering at the University of Tennessee under Dr. Laurence Miller, May 28, [www.financialsense.com/financial-sense-newshour/big-picture/2011/05/28/03/kirk-sorensen/thorium-could-be-our-energy-silver-bullet], jam)

Jim: (32:00) Let me throw another idea, and I've often had this conversation, with the late Matt Simmons, who was a big believer in peak oil, and was kind of looking for that silver bullet. And that is, could it take a crisis? I know in the midst of a crisis, World War II, you know, we discovered nuclear power and also weapon grade uranium in the Manhattan project where we basically produced a bomb in a short period of time. So if we were faced with a severe energy crisis, global warming, or just shortages of fuel, could we turn this into a Manhattan project and turn thorium? In other words, how quickly can we turn the table and really start to get this thing running? Kirk: (32:47) If we were talking Manhattan project, and that’s where you're taking the smartest people out of society. You’re putting them in a place and they work on it six days a week, 18 hours a day, we could probably have one of these reactors up and running within 18 months. And we could be to a production level within a year or so after that. I mean, it would be a lot like World War II. Imagine the factories turning out B-29 bombers, you know, it would be like that. Jim: (33:11) Wow. Kirk: (33:11) Now Manhattan style projects, that’s a severe disruption though, to the flow society. That is a heavy governmental hand reaching and deciding how to allocate resources. And that’s really not what I would hope would happened. What I would hope would happen would be a much more market-driven approach where a fair and clear regulatory environment allows businesses and investors to make wise decisions, with a high certainty that if they fulfill the obligations laid out, and the regulations, they will be able to build and operate the machines they have designed. In that scenario, which I would call more the skunk works approach, having worked at Lockheed when I was younger, I think we could have this ready in four or five years. With abundant private financing and a clear and realistic regulatory environment. That's not really the world we live in right now. Now that may change, but that's not how it is right now. Right now we have a regulatory challenge and we are looking for ways to move the technology forward under situations that have a stronger need for the technology. For instance, the military's need for base islanding, and so, in that scenario that does stretch out the time. But I guess maybe I’m getting past your original question, which was could we do this in a Manhattan style project, and the answer is absolutely yes. And it would go quite quickly.

#### LFTRs are super cheap and get cheaper

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In terms of cost, the ideal would be to compete successfully against coal without subsidies or market-modifying legislation. It may well be possible. Capital costs are generally higher for conventional nuclear versus fossil-fuel plants, whereas fuel costs are lower. Capital costs are outsized for nuclear plants because the construction, including the containment building, must meet very high standards; the facilities include elaborate, redundant safety systems; and included in capital costs are levies for the cost of decommissioning and removing the plants when they are ultimately taken out of service. The much-consulted MIT study The Future of Nuclear Power, originally published in 2003 and updated in 2009, shows the capital costs of coal plants at $2.30 per watt versus $4 for light-water nuclear. A principal reason why the capital costs of LFTR plants could depart from this ratio is that the LFTR operates at atmospheric pressure and contains no pressurized water. With no water to flash to steam in the event of a pressure breach, a LFTR can use a much more close-fitting containment structure. Other expensive high-pressure coolant-injection systems can also be deleted. One concept for the smaller LFTR containment structure is a hardened concrete facility below ground level, with a robust concrete cap at ground level to resist aircraft impact and any other foreseeable assaults. Other factors contribute to a favorable cost structure, such as simpler fuel handling, smaller components, markedly lower fuel costs and significantly higher energy efficiency. LFTRs are high-temperature reactors, operating at around 800 degrees Celsius, which is thermodynamically favorable for conversion of thermal to electrical energy—a conversion efficiency of 45 percent is likely, versus 33 percent typical of coal and older nuclear plants. The high heat also opens the door for other remunerative uses for the thermal energy, such as hydrogen production, which is greatly facilitated by high temperature, as well as driving other industrial chemical processes with excess process heat. Depending on the siting of a LFTR plant, it could even supply heat for homes and offices. Thorium must also compete economically with energy-efficiency initiatives and renewables. A mature decision process requires that we consider whether renewables and efficiency can realistically answer the rapidly growing energy needs of China, India and the other tiers of the developing world as cheap fossil fuels beckon—at terrible environmental cost. Part of the cost calculation for transitioning to thorium must include its role in the expansion of prosperity in the world, which will be linked inexorably to greater energy demands. We have a pecuniary interest in avoiding the enviromental blowback of a massive upsurge in fossil-fuel consumption in the developing world. The value of providing an alternative to that scenario is hard to monetize, but the consequences of not doing so are impossible to hide from. Perhaps the most compelling idea on the drawing board for pushing thorium-based power into the mainstream is mass production to drive rapid deployment in the U.S. and export elsewhere. Business economists observe that commercialization of any technology leads to lower costs as the number of units increases and the experience curve delivers benefits in work specialization, refined production processes, product standardization and efficient product redesign. Given the diminished scale of LFTRs, it seems reasonable to project that reactors of 100 megawatts can be factory produced for a cost of around $200 million. Boeing, producing one $200 million airplane per day, could be a model for LFTR production. Modular construction is an important trend in current manufacturing of traditional nuclear plants. The market-leading Westinghouse AP1000 advanced pressurized-water reactor can be built in 36 months from the first pouring of concrete, in part because of its modular construction. The largest module of the AP1000 is a 700-metricton unit that arrives at the construction site with rooms completely wired, pipefitted and painted. Quality benefits from modular construction because inspection can consist of a set of protocols executed by specialists operating in a dedicated environment. One potential role for mass-produced LFTR plants could be replacing the power generation components of existing fossil-fuel fired plants, while integrating with the existing electrical-distribution infrastructure already wired to those sites. The savings from adapting existing infrastructure could be very large indeed.