

# Transcript of Episode 17, “The Little-Known History of Radiological Weapons”

*Originally released on June 22, 2021*

[Note: This is a rough transcript of the audio recording, based on digital transcription and human review.]

[00:00:00] One, two, three go.

**Morgan Kaplan:** [00:00:18] Hello, and welcome to *International Security* “Off the Page.” On today's episode, we are talking about the rise and demise of radiological weapons programs in the United States and the Soviet Union in the 1940s and 1950s. We'll also discuss what this previously underexplored history means for the pursuit of radiological weapons by state actors today.

I'm Morgan Kaplan, the Executive Editor of *International Security*. And we'll be speaking with Sarah Bidgood, the co-author of a recent *IS* article with Samuel Meyer and William Potter titled, “Death Dust: The Little-Known Story of U.S. and Soviet Pursuit of Radiological Weapons.” And a little later, we'll go off the page with Usha Sahay, who is a Senior Editor at *Politico* [00:01:00] Magazine, where she focuses on foreign affairs and global issues.

**Benn Craig:** [00:01:08] [Belfercenter.org/offthepage](https://www.belfercenter.org/offthepage) is where you can find past episodes as well as supplemental reading materials. It is also where you can subscribe to Off the Page on your favorite podcast platform.

**Morgan Kaplan:** [00:01:17] Sarah Bidgood is the Director of the Eurasia Nonproliferation Program at the James Martin Center for Nonproliferation Studies at the Middlebury Institute of International Studies at Monterey.

Joining us now we have Sarah Bidgood, one of the co-authors of a recent *IS* article called, “Death Dust: The Little-Known Story of U.S. and Soviet Pursuit of Radiological Weapons.”

Sarah, welcome to the show.

**Sarah Bidgood:** Thanks Morgan.

**Morgan Kaplan:** So Sarah, tell us a little bit about what are radiological weapons and how are they different from nuclear weapons?

**Sarah Bidgood:** [00:01:51] Yeah, that's a great question and a good one to start us out with. So in our study, we're defining radiological weapons as ones that are basically designed to [00:02:00] distribute radioactive material in the absence of a nuclear detonation. So that is sort of the fundamental difference between radiological weapons and nuclear weapons.

And these weapons can take a lot of different forms, which we kind of describe in our study. So in the Soviet case, for instance, we have cluster munitions and we have warheads, but the

uniting feature is that they all make use of fission products or irradiated isotopes. And what makes our study a little bit unusual is that we're focused on state level radiological weapons.

So the ways that governments pursued and attempted to develop radiological weapons. And most of the time we hear about radiological weapons in the context of sort of non-state actors and terrorists and 'dirty bombs.' But the definition remains consistent whether you're talking about government level programs or terrorists or non-state actors.

**Morgan Kaplan:** [00:02:51] So tell us about this little-known story. In the, in the article, you talk about two distinct programs, but they're kind of happening at the same time in the United States [00:03:00] and the Soviet Union. We'd love to hear a little bit more about what those programs looked like, how they started, how they progressed.

**Sarah Bidgood:** [00:03:06] Exactly Morgan. So we focus specifically on these two cases, one in the United States and one in the Soviet Union that have both similarities and differences. So both of them begin sort of in the early 1940s and progress in the United States case up until about 1954. And in the Soviet case, up until about 1958.

On the United States side, you know, there was testing of radiological weapons. You had early institutional advocates who are really interested in kind of pushing this concept forward. You have bureaucratic entities that see a sort of new *raison d'être* for themselves that stems from the pursuit and development of radiological weapons. So they're very enthusiastic about it.

And then eventually, you see, sort of falling away of interest in radiological weapons that really precipitates the demise of that program. We see a similar kind of contour in the Soviet case as well. So again, in the early [00:04:00] 1940s, you have technocrats who are interested in pushing for radiological weapons who see the potential for the use of radiological weapons in a military context.

You see the perceived threat posed by the United States where Soviet intelligence begins to reveal that the US is pursuing radiological weapons and actors on the Soviet side think maybe we should do the same thing. You see consolidation of kind of interest in resources being devoted to the development of radiological weapons, whether that means perfecting the radiological material that would be used in the weapons themselves or the testing of the weapons.

And then the same thing sort of happens towards the end of the 1950s. You just see a diminishing of interest, a diminishing of a willingness to devote resources to this program and the eventual petering out of the Soviet pursuit of radiological weapons.

**Morgan Kaplan:** [00:04:49] So, what are those factors that led to the rise and decline of radiological weapons programs? What did you find when you were going through this, this history?

**Sarah Bidgood:** [00:04:57] Yeah, so we found some really [00:05:00] interesting things and of course, you know, certain aspects of this history are unique to either the United States or

the Soviet Union, so it's not always the simplest thing to kind of draw uniform conclusions about, about the two programs.

But we did find some, some fundamental commonalities that I think are pretty interesting. The first one of these is that, at least initially, both the United States and the Soviet Union pursued radiological weapons alongside nuclear and chemical weapons.

But interestingly enough, as soon as they had sort of developed very robust nuclear capabilities or thermonuclear capabilities, their interest in radiological weapons kind of wore off, they stopped being so interested in the pursuit of, of radiological weapons. And we think that this is because their military utility as compared with other weapons became sort of diminished.

It became clear that radiological weapons were really not so useful when you already have a nuclear weapons or a chemical weapons capability.

The other commonality that we found across both of these programs is that it [00:06:00] turns out it's kind of difficult to develop radiological weapons. So they might seem sort of like a poor man's nuclear weapon, at least initially, or like the threshold for developing them is, is lower than the pursuit of nuclear weapons for instance, but they come with their own set of technical challenges. And so those were some of the things that we were able to identify by sort of tracing the rise and demise of these two programs.

We also discovered in the course of our research that institutional advocates, so people who were interested in radiological weapons, played a really important role in, in driving their pursuit. And at least in the Soviet case, as soon as those advocates sort of left the scene, either because they passed away or they retired, or what have you, interest in radiological weapons diminished.

So the importance of these individuals in driving the initial exploration of radiological weapons and sustaining those programs was really important. And correspondingly the absence of those institutional advocates seems to play an important role in explaining [00:07:00] why radiological weapons programs ended.

And then we also found that security considerations actually mattered quite a bit. So for instance, the United States, at least from what we are able to see from the documentary record, was totally unaware of the Soviet pursuit of radiological weapons, even though it was happening at basically the same time that the United States was pursuing radiological weapons.

So it's interesting to think about, you know, if the United States had been aware that the USSR was doing this, how might that have changed the perceived utility of radiological weapons? You know, we don't know. We see the same thing happening on the Soviet side as well. So, the Soviet Union actually had really great intelligence on the kind of contours of the American program.

I think they probably overestimated the extent to which the US was interested in radiologic weapons, but still. And we see the same thing happen once the US program stopped, the

Soviet radiological weapons program stopped too. So that suggests to us that these external drivers, these kinds of considerations related to security and perceived threats played an [00:08:00] important role in driving these, these programs.

So the bottom line here that kind of came across in our research, is that a lot more countries than we typically think about, might've thought about, might've considered, might've even pursued radiological weapons, even though they didn't end up actually incorporating these weapons into their arsenals.

And it's therefore significant that there is no international mechanism at this point that discourages the development or the use of these weapons.

**Morgan Kaplan:** [00:08:26] That's fascinating. So what is the current state of affairs in terms of radiological weapons in the world? Are there any countries that have these programs, any non-state actors that we're particularly afraid of may have these, or is it the case that radiological weapons are still sitting on the wayside?

**Sarah Bidgood:** [00:08:42] Yeah, that's a really good question. And I think part of what came across for us in this study is the fact that these are very secretive programs. It's a little bit difficult to see from the outside, whether countries are pursuing these programs in part, because they make use of the same facilities and the same infrastructure, as you [00:09:00] might see in the development of nuclear weapons or chemical weapons. So it's a very opaque, developmental process here.

But I think if we can drive some lessons from history, it's that a lot of countries have considered the pursuit of radiological weapons. And why would we necessarily think that in the future, they wouldn't do the same thing?

So I think you can make the argument, for example, that even in a country like Russia, where the Soviet Union did pursue radiological weapons and had a pretty robust radiological weapons program up through about the end of 1958 or so, even today, you see things like the Poseidon nuclear powered torpedo, which many analysts and observers believe may carry a what's called a salted nuclear warhead. So a warhead that is encased in cobalt that increases the radioactive fallout from the detonation of that warhead.

That's not precisely a radiological weapon in the same way that the Soviet Union explored radiological weapons in the past, but it's certainly reminiscent of some of those types of weapons systems.

[00:10:00] And so it really raises the prospect that there could be countries in the future that consider and think about, and potentially even pursue the development of radiological weapons moving forward.

**Morgan Kaplan:** [00:10:09] So what's so fascinating is like you said, these programs are so secretive and in a lot of ways, prior to your article, we didn't know so much about these programs. So I think one question, you know, our listeners may have is where does the data come from? I know you've done some deep archival work. What are the documents you're working with? Where did they come from? How did this history become revealed?

**Sarah Bidgood:** [00:10:30] The answer kind of differs depending on which case you're looking at.

So on the United States side, for instance, there was a very significant effort in the 1990s, under the Clinton administration to declassify the records relating to the United States pursuit of radiological weapons. So we have, as researchers, really great documents to look at on that side, we have a really robust kind of primary source record that we can use to draw conclusions from and understand these push and pull factors that are responsible for the rise and [00:11:00] demise of that program.

Unsurprisingly, perhaps for folks who conduct research on the Soviet Union, things look a little bit different on the Russian side. But we were still able to find a lot of really interesting information, in particular, from a database that Rose Adam actually maintains on the history of the Soviet nuclear weapons program.

So once we sort of knew what keywords to look for and what different concepts to look for, we were able to derive some really interesting information from that archival record that I don't think other people have really looked at in quite the same way that we did prior to this article.

**Morgan Kaplan:** [00:11:34] Fantastic. Well, Sarah, I only have one more question for you and that is, are you ready?

**Sarah Bidgood:** [00:11:40] Am I ready for what, Morgan?

**Morgan Kaplan:** [00:11:42] To go off the page.

**Benn Craig:** [00:11:49] If you enjoy listening to Off the Page, you'll enjoy reading our quarterly journal *International Security*, which is edited and sponsored by the Belfer Center at Harvard Kennedy School and published by the MIT Press. [00:12:00] To learn more about the journal, please check out [Belfer center.org/is](https://www.belfercenter.org/is).

**Morgan Kaplan:** [00:12:04] Usha Sahay is a Senior Editor at Politico Magazine, where she focuses on foreign affairs and global issues. She is also the host of "A Most Terrible Weapon," a podcast from *War on the Rocks* about the first years of the nuclear age. And she was previously Managing Editor of *War on the Rocks*. Usha, welcome to the show.

**Usha Sahay:** [00:12:24] Thank you so much for having me, Morgan.

**Morgan Kaplan:** [00:12:27] We thought we'd start the conversation by trying to hear your impressions of this article 'Death Dust.'

**Usha Sahay:** [00:12:31] First of all, my compliments to the authors, this is a really interesting article on something that as far as my research has told me is really under-studied in the literature on the history of WMDs. So I think this is a really great contribution to that conversation.

In terms of my impressions of this article, I think that it really rang true to me in terms of the way that it highlights something that I don't think a lot of people understand about the way

that the United States and other powerful countries [00:13:00] think about military choices and think about which weapons they want to have at their disposal.

And that is that it is rarely if ever solely informed by which threats they face out in the world and what weapons they think will be needed to address those threats. So often it is a combination of that sort of external threat conversation, as well as very internal, very political, often, very messy series of conversations inside the government, inside the military in many agencies and an individual back and forth about, you know, who's going to get which slice of the budget, whether a certain weapon is going to fulfill, you know, certain budgetary or operational goals and there's tons of back and forth, there's tons of debates.

And I think most people tend to think about our military posture and our nuclear arsenal as something that is sort of a straightforward product of the things that we need to do with it out in the world and in the security environment.

But I think as this article shows, it is about so many more factors than that, for better or worse. And I really appreciate [00:14:00] the way in which this article brought that dynamic to life in the case of this particular set of really interesting weapons.

**Sarah Bidgood:** [00:14:05] I'm so glad that we started out on this note because I think that, that's one of the things that really came through for me in researching and writing this article with my co authors is that it's not just these security considerations that Usha sort of laid out. It's also bureaucratic politics and interest in seizing a larger part of the sort of budgetary pie, thinking about the ways to create a new *raison d'être* for you organizationally, if perhaps another weapon system has diminished the sort of salience of your mission set.

So there are all of these things going on in this study. And I think because of the comparative nature of it, we see that there are differences within different governments and different state systems as well. So these sort of discrepancies between the Soviet system and the American system are some of the things that really come through for me in the research and in the article, and some of the things that I found most interesting as an author.

**Morgan Kaplan:** [00:14:59] We refer to it as the [00:15:00] "little-known story," because it truly is little-known. I'm wondering, what do you think is the reason why it is so unknown? And I'm wondering, Usha, I also in your own kind of research that you've looked into, I mean, did radiological weapons ever pop up, did it ever kind of rear its head in your discussions or in your analysis?

**Usha Sahay:** [00:15:18] It is totally little known and, you know, I think probably on the rough hierarchy of the ways in which these different categories of weapons are covered, certainly nuclear weapons take kind of the lion's share of the attention. And then you'll see discussions of certainly biological weapons, and there's some really interesting studies about that.

Chemical weapons kind of get their own sort of category because they are probably something that continues to be the most relevant today. And then down there you have radiological weapons and, you know, frankly, Sarah, I think you and your co-authors were

really smart to pull out the kind of fiction and science fiction component here, because this really is something that is in our imagination because of fiction and storytelling, more so than any sort of serious look at the history.

So I would fully agree with that [00:16:00] characterization. And as someone who's researched this era pretty closely myself, I agree that it is not something that you read about a lot at all.

**Sarah Bidgood:** [00:16:05] I couldn't agree more. I think that, you know, there are reasons why this history is particularly unknown or under-examined.

Some of them are exactly the ones that you, that you laid out that, nuclear weapons tend to sort of dominate the conversation. We talk about chemical weapons separately, but sometimes in the same category of weapons of mass destruction. And part of the reason why I think the history of state-level radiological weapons has remained so under examined is because of the way that the discourse around radiological weapons changed in the post 9/11 space.

So we tend to think about these as sort of the purview of non-state actors, of terrorists. We think about radiological weapons in the context of dirty bombs and how those might be used by non-state actors.

But there is this interesting rich history of the state-level pursuit of these weapons that we highlight in the article. And part of the reason why we don't [00:17:00] know much about this is because they were so secretive. So I think there are a lot of different reasons to explain why that history is so under examined, but there's a real utility in digging into it because I think it informs our thinking about the potential for these weapons to be developed by other state actors in the future.

**Usha Sahay:** [00:17:16] I just want to jump in quickly with sort of a follow up. I mean, I guess we should say, although we're, I think characterizing this as something that has been largely lost to history and is worth reviving, I suppose there is, you know, the point that you guys make in the article, which is that this pursuit was largely abandoned.

Particularly on, well, it really on both sides because the weapons were deemed to be militarily ineffective. And so I'd just be curious, given that we're now kind of talking about these different categories of weapons of mass destruction and sort of how much attention and salience they've had over the years. Can you talk, Sarah, a little bit about kind of this question of effectiveness and why there was this seeming ineffectiveness on the radiological side that maybe wasn't the case with the other categories?

**Sarah Bidgood:** [00:17:56] So I think there are a couple of factors that are at play that came out for us in doing this [00:18:00] research.

First and foremost, there is this research and this theoretical literature that speculates that when you have chemical, biological, and radiological weapons, all under development at the same time, as soon as a nuclear weapons capability is achieved, these other weapon systems

kind of fall back in terms of their salience, they take a backseat, they get put on the back burner, whatever analogy you want to use.

And even though that literature doesn't treat radiological weapons or doesn't address radiological weapons because of the unknown elements of this history that we were just talking about. I think it's worth looking at that in, in this particular frame.

And that's something we do do in the article. We consider whether the development of, for example, the Soviet thermonuclear capability in 1953 could help us understand why radiological weapons were sort of put on the back burner. At the same time, there's also another literature that talks about the preference for kinetic weapons in military strategy and in nuclear force posture in particular.

And it's [00:19:00] worth considering whether there is a preference among military strategists. And R&D for weapons that resemble traditional bombs and bullets and radiological weapons, don't do that, that's not the effect that they're intended to have. So how does that kind of normative consideration change the perceived utility of radiological weapons in ways that explain why they are unknown, why they didn't achieve the same salience as for example, chemical or nuclear weapons?

**Morgan Kaplan:** [00:19:26] I'd love to pick up though on this point about the normative considerations, the discussion of ethics and norms around the proliferation and the use of nuclear weapons is a massive debate. But what about the normative discussion of radiological weapons?

Is it different in any way from how we think about nuclear weapons or even chemical weapons? What's the kind of normative debates that exist, and historically when these programs were active, what were the discussions on these moments of issues?

**Sarah Bidgood:** [00:19:55] Well, it's interesting that you should ask that because I think there was a very robust [00:20:00] conversation around the ethics and military utility of nuclear weapons, for example, in that sort of post-war period.

And we don't really see quite as rich a discussion around radiological weapons. There was kind of a debate that you see play out among the proponents and the opponents of radiological weapons, particularly in the United States where you can see some people saying, "these are insidious weapons, they have many of the same characteristics of chemical weapons, and therefore these are not really things that we should sort of be considering and making use of in our military strategy and force development."

But then you have the proponents saying, "well, in fact, maybe they're actually not as bad as they seem," because for example, if you were going to use a radiological weapon for sort of area denial, you could warn the people who were in the area that you were trying to clear out that this was coming and they could get out in time.

And so they wouldn't be affected by the ionizing radiation that would result from the use of a radiological weapon. So you do see a kind of effort to [00:21:00] understand the normative considerations around radiological weapons, but I don't think that it ever, in part, because



these weapons were never actually deployed or incorporated into a military arsenal to our knowledge. You don't see the same richness of that debate really playing out because you never sort of got to a conversation about how would we use these. How should we use these? How, how should we incorporate these into our strategy?

**Usha Sahay:** [00:21:22] That's a really interesting framing. And certainly the fact that we never kind of got to that point, I think goes a long way to explain why we didn't see maybe more of, more of a fulsome conversation in that way. That being said, I thought it was so fascinating to read in your article about the role of scientists as really being kind of a factor that pushed this idea forward.

And, you know, certainly you saw some of that during the Manhattan Project, which is sort of the nuclear analog here, I suppose, on the American side. But, you know, because my research looked at kind of the post-Hiroshima and -Nagasaki period of nuclear policy in the US government, I largely found that now that these nuclear weapons had been used and had sort of [00:22:00] come into force as a real thing, you saw scientists being very concerned about nuclear weapons and kind of raising these normative concerns, and in particular, Robert Oppenheimer of course becomes this kind of almost tragic figure who in some ways sort of feels a lot of regret for what he's helped to bring into the world.

And I thought it was so fascinating to see kind of a rewind on, on that dynamic in your article, Sarah, because here is Oppenheimer, by all indications being fairly interested in and even enthusiastic about the potential for radiological weapons was really interesting to kind of see and think about what the role of the scientific community is, and kind of transpose that onto different stages of weapons development.

And maybe there's an idea emerging that, you know, at these early phases, scientists are more excited about the possibility of military use of these technologies. And maybe as we saw with nuclear weapons, but not with radiological weapons, once the train moves forward a little bit and they start to see kind of the full impact, maybe that enthusiasm becomes a little more complex.

**Sarah Bidgood:** [00:22:52] I think that's such an important observation Usha, because you're exactly right. I mean, the roles of these scientists were so critical [00:23:00] in driving the development and the sort of initial interest in radiological weapons in the United States. And we don't actually see that happening on the Soviet side.

So I think in addition to the point that you're making about how scientists shape the normative discourse around the use and the utility of radiological weapons and other weapons. We also see that they play a really important role in driving the literal process of innovation. So sort of stirring up excitement about the potential utility of certain weapon systems, kind of consolidating support for that, ensuring that there is enthusiasm among, you know, higher level decision makers about the potential ways to use these weapons, and a value of pursuing their development.

Of course, we don't really see that same thing happening on the Soviet side because of these differences that we alluded to previously in the ways that weapons innovation happens in

the two countries, but certainly in the case of the United States, to your point, I mean, that was something that we saw come through in tracing the contours of the rise and demise of that program.

**Usha Sahay:** [00:23:58] I would actually love to ask [00:24:00] you a little bit more about the Soviet side of your research. And I know that you guys had a lot less to work with on that side than on the American side.

But one thing that I am fascinated by is the idea or the extent to which the WMD development process in the Soviet Union kind of is a microcosm of or tells us something about the sort of broader authoritarian society that, that the Soviet Union was at the time. And so I'd just be curious, what insights do you guys have about just kind of the way that the Soviet political and military system worked?

**Sarah Bidgood:** [00:24:30] That's a great question. And it's one I can talk about endlessly. So I'll try to sort of limit my remarks to the scope of, of the paper. But you know, one of the things that sort of came through for me is that, unlike in the American system, until you have very high level interest in the development and pursuit of a certain class of weapons, it's just not going to happen on the Soviet side.

So in the United States, as we mentioned, there's this ability to kind of innovate at low levels and consolidate support among the bureaucracy and [00:25:00] decision makers for the ideas and the innovations that you as a lower level person, or as a technocrat are putting forward.

On the Soviet side, we see an early attempt on the part of some scientists to try to say, hey, you know, there are many effects of fission, one of them is explosive, but one of them is this poisoning effect, and maybe that's something that would be of interest to do, you know, the Soviet defense infrastructure. And they were completely shut down. So that happened in 1941, we really don't see the kind of offensive research on radiological weapons in the Soviet Union kick and divorce until about 1948 through 1950. And it was only driven by an understanding that the United States was also pursuing these same weapons.

So this kind of role of external threats in driving the innovation process. And by the same token, because high-level decision makers were so important in driving and sustaining the radiological weapons program in the Soviet Union, when they [00:26:00] exit the scene momentum and interest in radiological weapons also kind of falls off the plate.

So you see both the incredible importance of high-level decision-makers in driving Soviet innovation that comes through in our study of the radiological weapons program. But then you see how that can be a double-edged sword as well when those people exit the scene.

**Morgan Kaplan:** [00:26:20] Well so, speaking of the drivers of radiological weapons and the drivers of innovation, is there any driving going on now for radiological weapons?

**Sarah Bidgood:** [00:26:28] Well, that's a great question. And I think part of, sort of looping back around to the beginning part of our conversation, these are very secretive programs and we wouldn't necessarily know, I think whether countries were engaged in the pursuit of

these weapons currently. But you know, my colleagues, Jeffrey Lewis and Bill Potter have speculated that there might've been interest on the part of North Korea, for example, before they really developed a full-fledged nuclear weapons capability in potentially developing radiological weapons.

And I think for me, that really speaks to kind of the validity of this idea of [00:27:00] the substitution effect that we talk about in the article where countries do tend to kind of engage in the pursuit of multiple types of weapons of mass destruction before nuclear weapons pull out in front and then we see a back burning of these other programs.

But I think the thing for me that is perhaps the most important takeaway here is that it still wouldn't be a good thing for a country to go down the road of pursuing or expressing interest in radiological weapons.

I mean, just because it has not traditionally ended up in a full-fledged deployment of radiological weapons or an incorporation of those weapons into a country's nuclear arsenal, it doesn't mean that we want countries to explore that path because there could be a less sanguine outcome the next time that happens.

**Usha Sahay:** [00:27:40] Sarah, I have a question about kind of this idea you're bringing up about what you call the substitution effect and this idea that it's actually in a lot of ways, harder for a country to pursue a radiological weapons program than a nuclear program. And if they have to choose, they choose the latter. I'm so interested in that, because I think that again, maybe pop culture plays a role here, we all kind of traditionally believe the opposite, right? [00:28:00]

That, like building a full-fledged nuclear program, is something that only a super power can do. Whereas a radiological weapon can be as simple as like some green slime in a can, or something, right? So can you talk a little bit about why this sort of technical barrier exists and maybe sort of this counterintuitive idea that having a traditional nuclear program is easier in some ways.

**Sarah Bidgood:** [00:28:17] It's important to note at the outset too, that, you know, it is really hard to develop a nuclear weapon. And I, and I don't think radiological weapons are necessarily harder. I think what came through for us in the article is that there are technical challenges that are unique to the development of radiological weapons, that I'm not sure that the original kind of progenitors of this idea necessarily would have foreseen, especially when they were compared with the challenges of developing a nuclear program.

And some of the ones that really stand out are technical challenges. So for one thing, it's just really hard to sort of get the radiological material that is used in these different formats of weapons. On the Soviet side, it was, you know, warheads, cluster, munitions, that sort of thing, to, to disperse in the way that you want [00:29:00] to.

So the weapons' effects demonstrated that these mechanisms that the Soviets and the Americans were developing were just not that effective in terms of dispersing radiological materials. So that's one thing, another thing that kind of comes up in the article and that

came through for us in the research is that there are real humanitarian, I guess, for a lack of a better word, challenges to developing and pursuing these weapons.

On the Soviet side, in particular, we know a lot about the ways that the testing of radiological weapons was actually really damaging for the personnel who were involved in that process. And I'm not sure that that necessarily would have been apparent to Soviet or American decision makers who were just embarking on a radiological weapons program in tandem with a nuclear program.

And then the other thing is there are these, I guess, resource challenges as well. So on the American side, for example, American decision makers came to the realization that tantalum 182 was the isotope that they wanted to use in their radiological [00:30:00] weapons. But only one reactor in the United States at the time, you know, at the, at the Hanford pile was capable of irradiating tantalum so that you could get tantalum 182, and that presented serious sort of supply chain issues that I don't think any of the early kind of technocratic and scientific proponents of the radiological weapons program in the US could have anticipated.

So just as there are drivers behind the program, there are also these kinds of unexpected inhibitors. And I think that that plays a real role in favoring, perhaps a nuclear capability over a radiological capability.

**Morgan Kaplan:** [00:30:36] Well, this has been a fascinating conversation.

Now, Usha, we have a special tradition when we end every podcast episode, which is, we like to ask our special guests what advice you'd have for junior scholars, policy makers, practitioners, service members, given all the success you've had in your career.

**Usha Sahay:** [00:30:59] I [00:31:00] think that my biggest piece of advice for people starting out in this field is write every day. I think that whether you are going to become a podcaster or you're going to become an academic or, you know, however you choose to convey your ideas and in whichever sort of subfield you end up in, being able to communicate is more important than ever these days as information sort of proliferates and there's just more and more things for people to sort through for people who are trying to get their head around a topic. And so I think that if you can become someone who really is deliberate about being a clear and effective communicator that can really set you apart, regardless of what, in particular you are studying.

And I think the way to do that is make writing a part of your routine, whether you're writing in your journal or writing a draft of something that you want to polish up or whatever the case is, just having that habit in the same way that you would train for a race is something that I certainly find really difficult, but I think it really pays off in terms of becoming an analyst and a communicator.

**Morgan Kaplan:** [00:31:53] Fantastic. Well, thank you so much, Sarah. Thank you, Usha, for joining the show today.

**Sarah Bidgood:** Thanks, Morgan. Thanks, Usha.

**Usha Sahay:** [00:31:57] Thank you both. Great [00:32:00] to be here.

**Julie Balise:** Off the Page is a production of *International Security*, a quarterly journal edited and sponsored by the Belfer Center at Harvard Kennedy School and published by the MIT Press. Our program is produced and edited by Morgan Kaplan, the Executive Editor of *International Security*, the Associate Producer and Technical Director is Benn Craig, digital communications by me, Julie Balise, production support by Carly Demetre.

Thanks to our intern Elizabeth V. Silva for additional assistance and a special thanks to Hilan Kaplan for composing our theme music.

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